Exploring the impact of schools on the quality of diet and physical activity in their students: A mixed methods study in Irish post-primary schools

Sarah Browne, B.Sc.

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School of Nursing and Human Sciences
Dublin City University

Supervisors:
Dr. Mary Rose Sweeney
Prof. Anthony Staines
Dr. Carol Barron

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Sarah Browne

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Abbreviations

BMI	Body Mass Index
BMR	Basal Metabolic Rate
CSO	Central Statistics Office
CSPPA	Children's Sport Participation and Physical Activity (Study)
DCU	Dublin City University
DCYA	Department of Children and Youth Affairs
DEIS	Delivering Equality of Opportunity in Schools
DES	Department of Education and Skills
DoHC	Department of Health and Children
DSP	Department of Social Protection
EEE	Estimated Energy Expenditure
EEI	Estimated Energy Intake
EU	European Union
GAA	Gaelic Athletic Association
GUI	Growing Up in Ireland (Study)
HBSC	Health Behaviours of School Aged Children (Study)
HELENA	Healthy Lifestyle in Europe by Nutrition in Adolescence (Study)
HSE	Health Service Executive
IOTF	International Obesity Task Force
LNED	Low-nutrient, energy dense
MET	Metabolic Equivalent
MMR	Mixed Methods Research
MVPA	Moderate to vigorous physical activity
NCCA	National Council for Curriculum and Assessment
NOTF	National Obesity Task Force
NTFS	National Teen Food Survey
PE	Physical Education
REC	Research Ethics Committee
SAGO	Special Action Group on Obesity
SC	Social Class
SD	Standard Deviation
SES	Socio-economic Status
SHE	Schools for Health in Europe (Network)
SPHE	Social Personal and Health Education
TY	Transition Year
UK	United Kingdom
UNCRC	United National Convention on the Rights of the Child
US	United States
WC	Waist circumference
WHO	World Health Organisation

"Taste…invites us by pleasure to repair the losses which result from the use of life"

JA Brillat-Savarin, The Physiology of Taste (1825)

ABSTRACT

Exploring the impact of schools on the quality of dietary and physical activity in their students: A mixed methods study in Irish post-primary schools

By Sarah Browne

Schools have the potential to positively impact on population health. Food and physical activity practices at Irish post-primary schools are not currently subject to national policy. The aim of this study was to carry out a cross-sectional study with students and staff from Irish post-primary schools (male, female, mixed gender, urban, rural, disadvantaged) to explore the effect of the school setting on the dietary and physical activity behaviours of students.

A mixed methods approach was used, incorporating participatory methods with students where possible. Peer-led focus groups and visual techniques were conducted. Principals and teachers were interviewed. Quantitative measures with students included anthropometry, fitness testing, and 4-day food and activity diaries.

A total of 393 students from fourth-year classes (15-17 year olds) took part. Overweight and obesity prevalence in the sample was 20%, with higher abdominal obesity observed among girls. Self-reported physical activity level was the strongest predictor of fitness. 55.4% of girls and 44.8% of boys reported low physical activity levels. Significant differences in energy and nutrient intakes were observed between home prepared, and school and externally purchased lunches, with the latter two sources being less healthy than home. Factors influencing unhealthy food choice during school included independent school food operators, an open lunch time campus, close proximity to shops, price, taste, convenience, marketing, and peer norms. Gender differences in school physical activity cultures were observed, with boys having more access to social supports and facilities for activity outside of PE compared to girls. The physical environments of the schools, as depicted by students through photos indicated that school buildings, facilities and grounds are inadequate to support current healthy eating and physical activity recommendations for young people. Students demonstrated their agency to become involved in research about health promotion issues within their schools.

These findings have implications for policy makers as they highlight multi-level factors that could be addressed by local and national policy for the benefit of young people's health.

Chapter 1

1 Introduction

Supportive public health policies improve people's ability to make healthier choices. School is a place where students spend a good deal of time away from family life and have opportunities to make their own decisions about what they eat and physical activity participation. The school setting, therefore, has been highlighted as an important health promotion space for young people (Department of Education and Skills, 2015; Wechsler et al., 2000). Approximately one fifth to a quarter of Irish children and adolescents are overweight or obese (Keane et al., 2014; Department of Children and Youth Affairs, 2012). In recent years, specific recommendations for the prevention and management of childhood obesity have been made for the school setting (EU Action Plan on Childhood Obesity, 2014; Department of Health and Children, 2005).

Research from other jurisdictions demonstrates that school food environments, policies, and practices have a significant impact on the quality of students' diets. The implementation of food and nutrient standards in schools improves nutrient intakes among students (Adamson et al., 2013; Pearce et al., 2013; Stevens et al., 2013; Briefel et al., 2009). Removing high energy, fat, sugar and salt foods from the school environment can enhance the uptake of healthier options (Briefel et al., 2009; Kubik et al., 2003). Opportunities to be active during the school day through adequate physical education (PE), active break-times, extra-curricular sports, and support for active transport are critically important in order for young people to meet their daily physical activity needs (Brusseau & Kulinna, 2015). Increasing student physical activity levels at school can have a positive impact on physical activity levels both in and out of school, and increase fitness (Dobbins et al., 2013).

Current literature for Irish schools describes school environments and practices that are out of sync with healthy eating and physical activity recommendations (Callaghan et al., 2015; Shanley, 2015; Department of Education and Skills, 2014; Woods et al., 2010).

Food and physical activity in Irish post-primary schools were explored in this thesis, with an examination of how policies, practices and infrastructures impact student behaviours using a cross-sectional study design, and by employing mixed methods. An ecological model of health promotion research (McLeroy et al., 1988) with researcher/participant collaboration (Stokols et al., 2003) formed the theoretical framework for the study. Ecological models are recommended for physical activity and nutrition behaviour research because eating and being active extend to many social and physical settings (Sallis et al., 2008; Glanz et al., 2005). Collaboration with participants within an ecological model deepens understanding of how people perceive their environments and its impact on health behaviours, as well as contributing important information to solution development (Richard, Gauvin & Raine, 2011; Stokols et al., 2003). Participatory methods, where students contributed through peer led research within the school environment, were the collaboration techniques used in this study.

1.1 Researcher Position and Contributions

As a researcher, I approached this study from a background in nutrition and dietetics. While nutrition science is a largely quantitative tradition, I had exposure to qualitative and participatory methods through previous experiences in developing health promotion programmes for children and adolescents. In the last decade, the 'client-centred approach' (rather than the didactic approach) has firmly established itself as the method of assisting individuals in taking action towards better health in dietetic interventions in the health and health promotion services. These pre-PhD experiences contributed to two beliefs I brought to the current study. The first is that individuals' accounts of their behaviours in context are as important as defining the behaviours themselves; and the second is that we must collaborate with young people if research and interventions are to work in practice. This study was funded by a PhD scholarship from the School of Nursing and Human Sciences, Dublin City University. The funding for a school based nutrition and physical activity research project was in place when I joined as a PhD candidate, and from there I developed the study design and prepared an application for ethical approval. After ethical approval was granted for the study I

worked up the protocols to operational level and carried out the tasks required for the research presented in this thesis.

Chapter 2

2 Literature Review

2.1 Background and Introduction

There has been a surge in research exploring the lives of children and adolescents in the last two decades. A significant portion focuses on health related measures such as anthropometry, physical fitness, diet, and physical activity and lifestyle behaviours. Increasing overweight and obesity prevalence rates among adults, adolescents and children have placed urgency on continued monitoring, as well as the development of targeted prevention and management strategies. An understanding of socio-environmental factors that influence diet and physical activity behaviours is an important base for planning appropriate solutions to problem areas. The aim of this review was to explore current literature with regard to anthropometry, diet and physical activity among adolescents (12-18 year olds), with a focus on Ireland and the Irish post-primary school setting.

2.1.1 Search methods

A number of data sources were used to search for relevant literature throughout the duration of the study.

1. The online MEDLINE/PubMed database of references and abstracts on life sciences topics was first used to identify peer reviewed publications. Search terms, with the adjunct keyword 'adolescents,' included 'nutrition', 'physical activity', 'participatory research', 'focus groups, 'school environments', 'school food', 'school nutrition', 'food environments', 'school physical activity', 'anthropometry', 'overweight', 'obesity', 'fitness tests', 'food diaries', 'dietary behaviours', 'physical activity behaviours', 'health behaviours'.
2. Reference searching from initially sourced publications was used to identify a wider body of published research. At this stage, the online databases of key adolescent health, health behaviour, and public health, and school health journals were searched individually and they include: The Journal of Adolescent Health,

Adolescence, Health Education, Health Education Research, Public Health Nutrition, and the International Journal of Behavioral Nutrition and Physical Activity.

3. International reports and publications such as those from the World Health Organisation, the European Union, and the Network of Health Promoting Schools were accessed by searching their respective websites.
4. National reports and publications from governmental bodies (e.g. The Department of Education and Skills, the Department of Children and Youth Affairs, the Department of Health) and research groups (e.g. The National Teen Food Survey and The Children's Sport Participation and Physical Activity Study, the Health Behaviours of School Aged Children, Growing up in Ireland Study) were sourced from their respective websites.
5. The library at Dublin City University was used to source books on adolescent development and research methodologies.

Inclusion criteria used for peer reviewed literature were as follows:

- Exploratory, observational, experimental and review publications from the previous 10 years were favoured
- Publications older than ten years of methodological or theoretical relevance were included

2.2 The adolescent years

Adolescence is an important stage of life that bridges childhood with adulthood. The World Health Organisation (WHO) defines adolescence as the period between 10 and 19 years (Sawyer et al., 2012). Adolescence may be further broken into three distinct stages - early (10 to 14 years), mid (15 to 17 years) and late adolescence or young adulthood (18 to 24 years) (Goossens, 2006a; Kroger, 2007). While the WHO range for the adolescent years is in line with the 'teen' ages, it is acknowledged that significant cognitive, physical and emotional development continue into the early twenties and 'young people' or 'adolescents and young adults' are less formal terms that refer to people aged 10-24 years (Sawyer et al, 2012). A brief background of physical, emotional and psychological factors associated with this time of life is first presented to give context to the population in this study.

Research into a distinct adolescent phase in childhood development began in the early 20th century when a period of strong emotional upheaval was first described in scientific literature by G. Stanley Hall (Hall, 1904 described by Arnett, 1999). There are three key elements that the "storm and stress" idea of adolescence has come to encapsulate. The first is that adolescents tend to experience mood disruptions, the second that they have more conflicts with their parents and the third is that they are more likely to engage in risky behaviours (Arnett, 1999). While problem behaviours associated with the adolescent period form a large part of research literature, it is acknowledged within modern child development discourse that a period of storm and stress is not an inevitable life stage for adolescents (Steinberg & Morris, 2001; Arnett, 1999; Buchanan, Eccles & Becker, 1992).

Puberty is a sequence of changes and significant physical transformations that happen gradually over 5 or 6 years in early- to mid-adolescence (Goossens, 2006b). Physical pubertal changes along with cognitive maturation in early adolescence signal changes for familial relationships. As conflicts between young adolescents and their parents increase in early puberty, adolescents spend less time with their parents and report reduced closeness (Steinberg & Morris, 2001). Beginning in early adolescence, young

people seek extra-familial outlets of expression for independent identity development and they begin to disengage from parental authority (Kroger, 2007). This is a time when the peer group becomes increasingly important. In a study by Brown et al. (1987) early adolescents reported the peer group to be important for belonging, emotional support, friendship and social interaction. Compared to childhood friends, who might be chosen on the basis of common activities, friendships in adolescence widen to include friends that share interests, values and beliefs (Steinberg & Morris, 2001).

Young adolescents also experience a shift in expectations at the home and societal levels. Childhood behaviours are no longer tolerated and increased cooperation is expected. In Ireland, the move from primary to post-primary school coincides with early adolescence at 12-13 years. Such social changes, occurring during puberty, can have a stronger effect than if they happen before or after pubertal changes (Kroger, 2007; Eccles et al., 1993).

By mid-adolescence (15-17 years), the rate of biological and physiological changes for the average adolescent is declining. Most boys and girls will have reached 98% of their total adult height. Mid-adolescents begin to accept the biological transformations of puberty and assimilate them into a revised sense of identity (Kroger, 2007). It is a time of ongoing negotiations at home as adolescents further distance themselves from values and goals of parents. During middle adolescence, peer and one to one relationships assume more prominent roles, and adolescents are most influenced by peers, compared to early and late adolescence (Steinberg & Morris, 2001). All these social changes signal a quest for a concept of self and personal identity that is uniquely their own.

Compared to younger children, adolescents can conceive various possibilities inherent in situations, allowing them the capability to solve a great variety of problems (Ginsburg & Opper, 1988). Nevertheless, adolescence is typically linked with a period of heightened risk-taking behaviour (Sawyer et al., 2012; Steinberg & Morris, 2001). Risk-taking behaviours associated with adolescence range from substance (cigarettes, alcohol, drugs) abuse, risky sexual behaviour, and violence, to poor dietary practices,

lack of physical activity, and an increase in sedentary activities (Sawyer et al., 2012). Adolescents are more easily influenced by emotion, which has a functional role in terms of experimentation and autonomy development (Konrad et al., 2013). Factors that heighten emotion – for example the presence of peers or the prospect of a desired reward – are more likely to influence behaviour than rational decision-making processes. Adolescents seem to be more affected than adults when making decisions in exciting or stressful situations, particularly in the presence of peers. At this age, peer acceptance and reward seem to be more highly considered than the risk itself (Konrad et al., 2013; Sawyer et al., 2012). Societal disapproval is wholly insufficient for prevention of risk-taking behaviours during adolescence. Initiatives that aim to research or address health behaviours of adolescents need to place young people at the centre of their design (Lerner et al., 2005). Participatory methods are one such approach and are promoted in the Health Promoting Schools ethos (Simovska, 2007; Griebler et al., 2012). Participatory approaches will be discussed in more detail later.

2.3 Physiological Growth and Overweight and Obesity Rates

The adolescent years are a time of high nutritional requirements for growth and development. Bridging the gap between childhood and young adulthood, they are also considered formative years in terms of long-term diet and physical activity habits. While it is normal for height and weight to increase during this time, we are witnessing, over the past 30 years, disproportionate increases in body weights. Perry and colleagues (2009) document the changes in heights & weights of Irish children from the post-war era through the 1970s and onto 2002. The average weight of 14-year-old boys and girls increased from 37kg and 39.5kg in 1948 to 60.9kg (65% gain) and 58.7kg (48% gain) in 2002 respectively. Mean BMI for boys and girls showed similar increases from 17 kg/m^{-2} and 18 kg/m^{-2}, respectively, in 1948 to 21 kg/m^{-2} and 22 kg/m^{-2} in 2002,

While a good portion of this is positive in terms of improved nutritional status, weight gains in the latter period, from the 1970s to 2002, are disproportionately higher than height increases (Perry et al., 2009).

Anthropometric surveys since 2002 have been more frequent and provide evidence of increasing overweight and obesity prevalence among young people. The largest representative sample of Irish children and adolescents surveyed for weight and height was in 2002 (n=19,617) in both the Republic and Northern Ireland (Whelton et al., 2007). Overweight and obesity prevalence among 15-16 year old adolescents in the Republic of Ireland (n=1139) was 21% and 5% respectively. These are higher than findings from the National Teen Food Survey (NTFS) in 2006 when a representative sample of 441 Irish 13 to 17 year olds took part in anthropometry and food records. Fifteen percent were overweight and 3% obese using the International Obesity Taskforce (IOTF) age and sex specific BMI cut-offs (Cole et al., 2000). Irish 15-17 year old male adolescents had higher overweight prevalence than females (14.7% vs. 12.9%, respectively) but girls were more likely to be obese at this age than boys (3.2% vs. 0.8%) (Walton et al., 2014). Both anthropometric surveys were carried out in the first half of the 2000s with post-primary schools as the primary sampling frames; and both

reported similar data collection procedures and response rates (Walton et al., 2014; Whelton et al., 2007). The lower prevalence of overweight and obesity observed in the NTFS may be the result of less variability in findings owing to a smaller sample size. Additionally, the two studies did not define lower socio-economic status in the same way; holding a medical card was the socio-economic surrogate marker for disadvantaged status used by Whelton and colleagues (2007) and parental occupation and education was used by the NTFS. Socio-economic disparities in childhood obesity is well described in the literature, with evidence of strong inverse associations between obesity and lower socio-economic groups in high-income countries (El-Sayed, Scarborough & Galea, 2012; Keane et al., 2012; Wang & Lim, 2012). This may be a factor contributing to the lower overweight and obesity prevalence observed in the NTFS.

More recent evidence shows overweight and obesity among the Irish child and adolescent population agreeing with Whelton et al. (2007) (Barron et al., 2009; Department of Children and Youth Affairs, 2012; Keane et al., 2014, Heinen et al., 2014). For a group of 4-13 year old children in 2007, prevalence of overweight was 17.8% and obesity 6.8% (Barron et al., 2009). Among the 13 year old Growing Up in Ireland (GUI) cohort, 20% were classified as overweight and 6% as obese (Department of Children and Youth Affairs, 2012). The GUI longitudinal study reports surveys from the largest national child cohort. On initiation with 9 year olds, the sample of 8500 children represented 14% of children living in the ROI (DoHC, 2010). Their most recent prevalence findings for overweight and obesity are considered to be the most representative assessment of the current situation in Ireland (Keane et al., 2014; Heinen et al., 2014).

The GUI study found that more 13 year old girls than boys were overweight (22% vs. 18%) and obese (8% vs. 5%) (DCYA, 2012). A similar finding was also observed by Whelton and colleagues (2007); and girls in the NTFS were more likely than boys to be obese, but not overweight (Walton et al., 2014). International literature indicates country level differences with regard to a gender effect on overweight and obesity

prevalence among children and adolescents (Ahluwalia et al., 2015; Sweeting, 2008). In ethnically diverse population studies gender patterns tend to differ according to ethnic group. In the UK, for example, the highest obesity rates are observed among young black females and the lowest among South Asians (Wardle et al., 2006). A review by Sweeting (2008) explores the evidence for causes of gender differences in obesity rates and suggests roles for biological, behavioural, and social factors. Compared to childhood, when girls and boys have similar energy requirements, boys' fat free mass and hence, resting energy requirements are generally greater than girls during adolescence. Additionally more girls than boys reduce their physical activity participation as they enter adolescence and boys typically engage in more energetic play and sports than girls, thus boosting their energy requirements further. Gender differences in food choice and dietary concerns are usually the result of socio-cultural factors (Sweeting, 2008). Gender differences in food choice have been reported in sociological and nutrition literature for some decades, with a review by Jensen and Holm (1999) highlighting that meat, potatoes and alcohol comprise a relatively greater proportion of men's diets than women's, while fruit, vegetables, fish and dairy products comprise a greater proportion of women's diets. Dietary behaviours such as higher sugar-sweetened beverage consumption and lower fruit consumption have been reported among boys (Callaghan & Nic Gabhainn 2013; Neumark-Sztainer et al. 2005). Overall, however, gender differences in dietary behaviours of adolescents are less clear than those for physical activity behaviours because of the trend towards under-reporting food intake, especially among adolescent girls (Brandini, 2003). While many studies report gender differences in their findings, there is a paucity of research exploring the causes of gender differences in obesity prevalence among adolescents. The available evidence suggests that small energy imbalances as a result of body composition and physical activity related energy expenditure are contributing to the small, but higher overweight and obesity rates observed among young females (Sweeting, 2008).

Socio-economic group differences in childhood obesity prevalence have been highlighted by the GUI study with higher rates observed among children from unskilled

classes compared to those from professional – 11% versus 4% obese respectively (Keane et al., 2012). This agrees with international research from high-income countries (El-Sayed, Scarborough & Galea, 2012; Wang & Lim, 2012). In the UK, common household and individual-level metrics of childhood socio-economic status were found to be reliable determinants of childhood obesity in a systematic review of the literature between 1980 and 2010 (El-Sayed, Scarborough & Galea, 2012). Obesity is just one element of the health inequalities that exist across the socio-economic gradient in society. Social conditions predict child development, school performance, opportunities in life, mental and physical health, disease risk and life expectancy (Marmot, 2015). Unhealthy behaviours - such as smoking, drinking alcohol, poor diet, and sedentary lifestyles - more prevalent in less well-off groups cannot simply be labelled irresponsible behaviours. Poverty-associated stresses, empowerment and opportunity issues are not being adequately addressed by social and health systems (Marmot, 2015). European and North American data from the Health Behaviour of School Aged Children (HBSC) Study from 1994 to 2010 found social inequality issues in multiple health complaints reported by adolescents in the majority of participating countries, with no decreases observed over time (Moor et al., 2015).

More recent research in Ireland has highlighted a high, but stabilising trend in overweight and obesity among younger children (Keane et al., 2014; Heinen et al., 2014). A systematic review of overweight and obesity prevalence among primary school children found no increases from 2002 to 2012. While figures were high (15-19% overweight and 4-7% obese in national studies), a small significant declining trend in obesity prevalence was observed over time when all studies were reviewed (Keane et al., 2014). The Childhood Obesity Surveillance Initiative (COSI) also observed reductions or no change among 7-9 year olds from 2008 to 2012 (Heinen et al., 2014). Improvements in overweight and obesity prevalence observed for 7 year olds did not apply to children from disadvantaged schools. In terms of weight tracking in the GUI cohort, a healthy weight in childhood is protective in that most children (89%) who were non-overweight at 9 years were still non-overweight by 13 years. Interestingly, if

children were overweight, rather than obese at 9 years, they had a better chance of becoming non-overweight by 13 years (Layte & McCrory, 2011).

International child and adolescent overweight and obesity prevalence rates vary by country. In the USA and Canada, approximately one third and one quarter, respectively, of children and adolescents are overweight or obese (Ahluwalia et al., 2015). At a European level, the average overweight/obesity prevalence rates for adolescents are 18% of males and 15% of females (World Obesity Federation, 2014). Between 2002 and 2010 HBSC data demonstrates increasing overweight prevalence among boys and girls in Eastern European countries (Ahluwalia et al., 2015). According to the same study, rates in the USA and Western European countries remained relatively stable over the 8 year period, with no decreases observed. The disagreement between HBSC data, which show no decreases in overweight prevalence, and recently observed decreases among younger children reported by Heinen and colleagues (2014) may be explained by methodological differences related to the use of direct measuring versus self-report (HBSC method) anthropometry, the ages of samples examined, sample representativeness and participation rates. BMI data were missing for the majority of Irish HBSC participants in the 2010 wave of the study (Ahlualia et al., 2015).

Table 2.1 Adolescent overweight and obesity prevalence in the Republic of Ireland from studies using direct measures of anthropometry to calculate body mass index (BMI) and International Obesity Task Force thresholds to define overweight and obesity

Study	Data collection years	Sample Size	Age years	Overweight %			Obese %		
				boys %	girls %	total %	boys %	girls %	Total %
Whelton et al., 2007	2001-2002	3823	13-16.9	16	20	18	5	6	6
NTFS, Walton et al., 2014	2005-2006	441	13-17	15.2	14.7	15.0	2.7	3.2	3.0
GUI study DCYA, 2012	2011-2012	7400	13.0-13.9	18	22	20	5	8	6

Public health concern regarding overweight and obesity among youth falls into a number of categories. Firstly, there are both physical and psychological health risks.

Metabolic syndrome – a cluster of anthropometric (abdominal obesity) and biochemical risk factors (hyperlipidaemia, hypertension, impaired fasting glucose) that raise the risk of heart disease, diabetes, stroke and cancer (Kumar & Clark, 2012) - has been reported in almost one quarter of obese Caucasian children (Invitti et al., 2006). Psycho-social issues including low self-esteem, social isolation and depression are more common in overweight and obese young people (Puhl & King, 2013). A systematic review by Griffiths et al. (2010) found strong evidence of lower self-esteem and quality of life in obese youth, with poor perceptions of athletic/physical competence and physical appearance showing the greatest influence of obesity. If obesity isolates young people and prevents them from engaging with their peers in health promoting activities, opportunities for them to move towards a healthy weight narrow even further. Overweight and obese adolescents are much more likely than their non-overweight peers to become overweight or obese adults, signalling long-term consequences (Singh et al., 2008). Recent projections estimate that almost nine out of ten Irish adults will be overweight or obese in 2030 (Keaver et al., 2013). Obesity related conditions - coronary heart disease, stroke, cancer and type 2 diabetes, hypertension - will rise accordingly. Overweight, obesity and associated conditions have serious economic implications (Dee et al., 2014; Keaver et al., 2013). In 2009 the estimated direct and indirect costs of overweight and obesity in the Republic of Ireland was €1.13 billion (Dee et al., 2014), with a projected cost of €5.4 billion by 2030 (Keaver et al., 2013). Despite wide-ranging management and prevention recommendations by the National Obesity Task Force in 2005, progress is slow (Department of Health and Children (DoHC), 2009 and 2005). Recommendations for the education sector are not fully progressing in post-primary schools. For example, more time for physical activity during the school day does not seem feasible and codes of practice for food sales at school have not been implemented (DoHC, 2009). More recently, the government's National Framework for Improved Health and Well-being 2013-2025: 'Healthy Ireland' includes a Special Action Group on Obesity (SAGO), committed to prevention strategies for children and adolescents (http://health.gov.ie/healthy-ireland/obesity/sago/). These will be discussed further in subsequent sections of the review.

2.4 Obesity: A Bio-ecological Issue

The rapid rise in child and adolescent obesity over the last three decades suggests the central role of environmental factors (Procter, 2007; Swinburn, Egger & Raza, 1999). "Obesogenic environments", where high energy foods are readily available and opportunities for physical activity are reduced, have contributed to increasing obesity prevalence rates in developed countries (Sallis & Glanz, 2009; Procter, 2007; Glanz et al., 2005; Swinburn et al., 1999). It is acknowledged that placing responsibilities on individuals with the 'eat less, move more' approach is having little impact on obesity prevention and management (Glanz et al., 2005). Understanding individual and socio-environmental factors that influence health related behaviours is now considered an essential base for planning health promotion interventions (Crosby, Kegler & DiClemente, 2009). Individual-level approaches have traditionally dominated health and social science research with the focus on identifying, quantifying and understanding individual-level determinants of specific health behaviours. In 1986 the Ottawa Charter identified the importance of physical environments on health behaviours (Epp, 1986) and the use of ecological models within health promotion and public health disciplines is growing rapidly in the last number of decades (Richard, Gauvin & Raine, 2011; Green, Richard & Potvin, 1995). Health promotion is defined by the Ottawa Charter as "the process of enabling people to increase control over, and to improve, their health." (Epp, 1986). The limitations of interventions to address individual cognitive processes and behaviour change in public health have been acknowledged, and led to calls for research, interventions and programmes that also include the multiple settings, social and cultural contexts that shape health-related behaviours (Richard, Gauvin & Raine, 2011; Green, Richard & Potvin, 1995). In order to promote health at a population level, according to the Ottawa Charter, people need to be supported in their external environments and also feel they have the means and personal skills to take responsibility for health-related decisions (Epp, 1986). This implies that environments impact how individuals make decisions about health-related behaviours.

Current ecological models that examine how individual and group health behaviours are shaped by social, physical and cultural environments have been influenced by

numerous disciplines, including developmental psychology, social and health sciences, and education (Crosby, Kegler & DiClemente, 2009; Sallis, Owen & Fisher, 2008; Swinburn, Egger & Raza, 1999). Sallis, Owen & Fisher (2008) outline four core principles of ecological models of health behaviour: "(1) there are multiple levels of influence on specific health behaviours; (2) influences on behaviours interact across these different levels; (3) ecological models should be behaviour-specific; and (4) multi-level interventions should be most effective in changing behaviour."

Bronfenbrenner's ecological systems theory of human development is one of a number of theories that have influenced current ecological models (Sallis, Owen & Fisher, 2008). The ecological systems theory places a child's development in a structure that addresses their changing biology, their family/peer/community environment contact and the wider societal landscape over time (Bronfenbrenner, 2005). When using the model it is necessary to collect information about the experiential, subjective qualities of human/human and human/environment interactions, as well as objective information about biology, environments and systems (Bronfenbrenner, 2005). Expanding layers of micro-, meso-, exo-, and macro-systems were used by Bronfenbrenner to describe the levels of interacting influences on the person. The theory arose from the absence of "real-life settings" in child development and behaviour research (Bronfenbrenner, 2005). The systems framework developed by Bronfenbrenner has been applied by researchers from disciplines outside of psychology seeking to understand multiple levels of influence on child diet and physical activity behaviours (Sallis, Owen & Fisher, 2008). While acknowledging the important influence Bronfenbrenner's ecological systems theory had on current ecological models, there are contemporary theories that are particularly suited to the discipline of health promotion. This is because ecological models of intervention that address institutional, community and public policy factors are now the distinctive feature of disease prevention and health promotion in public health discourse (Richard, Gauvin & Raine, 2011; Green, Richard & Potvin, 1995).

The multi-level factors determining behaviour described in current ecological models for health promotion resemble Bronfenbrenner's micro- to macro-systems (Sallis, Owen & Fisher, 2008; McLeroy et al., 1988):

1. Intrapersonal factors – knowledge, attitudes, behaviour, self-concept, skills.
2. Interpersonal processes and primary groups – formal and informal social network and social support systems including family, friends, work groups.
3. Institutional factors – school, work.
4. Community factors – relationships between organisations and informal networks.
5. Public policy – local, state, and national laws and policies.

The subjective experiences of humans within their contexts, emphasised by Bronfenbrenner (2005) are currently considered essential for understanding the influence of environmental layers (Richard, Gauvin & Raine, 2011). Stokols and colleagues (2003) explored dimensions of community capacity for health promotion and argued that in order to prevent disease and promote wellness "health promotion strategies must be tailored to the unique sociocultural and environmental contexts of particular groups and communities." (Stokols et al., 2003). There are multiple human (social, moral, and human capital) and material (economic, natural, and technological capital) resources within a community that can be harnessed for a health supportive environment (Stokols et al., 2003). Advocates for intensive community involvement in health promotion research and programmes view people in their environments as "unseen but powerful influences" (Stokols et al., 2003) that have the potential to address health priorities and promote health at both individual and collective levels (Wendel et al., 2009; Stokols et al., 2003).

Community capacity, as a framework for health promotion research, could be applied to the school setting. Wendel et al., (2009: 285), define community capacity as *"a set of dynamic community traits, resources, and associational patterns that can be brought to bear for community building and community health improvement."* The dimensions of community capacity include level of skills, knowledge, leadership and resources, the

nature of social relationships, capacity for community dialogue and action, extent of civic participation, value systems, community boundaries, and community composition (Wendel et al., 2009). There are natural boundaries to the human composition and material resources of a school setting. However, a pure community capacity approach has limitations because the theoretical and analytical principles of capacity-building are still developing (Wendel et al., 2009). In addition, public health priorities, such as obesity prevention, are not necessarily lined up with priorities for community groups (Power et al., 2010). These alternative priorities do not preclude research and interventions with specific population groups for obesity prevention. They do, however, encourage the researcher to collaborate with people in order to deliver meaningful results and targeted interventions.

Population level approaches to obesity prevention need strong public policy infrastructure in the first instance (Sallis, Fisher & Owen, 2008). An assumption of the current study is that schools are an important health promotion setting for young people. This assumption arises from literature highlighting the role of the school in promoting healthy eating and physical activity (Nelson & Breda, 2013; Glanz et al., 2005), and is supported by obesity prevention strategies at national and international levels that call for the education sector to provide health education, as well as affordable, and convenient healthy food, and sufficient physical opportunities for students (WHO, 2016; Council for School Health 2015, EU Action Plan on Childhood Obesity 2014-2020, 2014; DoHC, 2005; WHO, 1997). As public education facilities, government policy and directives have a direct effect on schools and the student body. State school food policies, for example, have had demonstrable effects on improving nutrition intake of students in the UK (Adamson et al., 2013; Stevens et al., 2013). State influence, however, is just one element of ecological models, which address all levels of influence on individuals and groups from interpersonal and intrapersonal to institutional, community factors and public policy as described earlier (McLeroy, 1988). Elements of community capacity can be incorporated into ecological models of health promotion research and practice, and advocates would argue that it is necessary (Wendel et al., 2009; Stokols et al., 2003).

A broad ecological health promotion model was used in this study to put a framework on exploring school life and the interconnections to it (Sallis, Owen & Fisher, 2008; McLeroy et al., 1988). Ecological model research is typically used to provide an evidence base for planning cost-effective, widespread health promotion interventions that encourage shifts in socio-cultural norms (Sallis, Owen & Fisher, 2008; Swinburn, Egger & Raza, 1999). While gathering contextual information about settings is an essential component of any ecological model, the constructions participants create about their environments are equally important (Richard, Gauvin & Raine, 2011; Sallis, Owen & Fisher, 2008; Bronfenbrenner, 2005). The latter point underlines the relevance of using alternative methodologies to explore the views of participants within environmental contexts and has contributed to the increasing use of qualitative and mixed-methods approaches in health promotion research (Creswell et al., 2011). Another important component of ecological models outlined in this discussion is the necessity for researchers to adopt a collaborative style with participants. This collaboration, where participants can contribute local knowledge, is considered essential for understanding determinants of health behaviours in relation to settings, and building community capacity for successful interventions (Richard, Gauvin & Raine, 2011; Wendel et al., 2009; Stokols et al., 2003).

Ecological models are particularly appropriate for understanding eating and physical activity behaviours because the frameworks incorporate many social groups and settings (Sallis & Glanz, 2009; Glanz et al., 2005). How the individual and the group interacts with and responds to the everyday environments of school and locality are the focus of this thesis. The remainder of this literature review examines current diet and physical activity behaviours of Irish adolescents, and individual, peer and school level factors associated with them.

2.5 Current knowledge: Diet and Physical Activity Behaviours

The next section will detail what we currently know about the diet, physical activity, and sedentary behaviours of Irish adolescents. The health implications of unhealthy behaviours will be examined.

2.5.1 Physical activity participation

The importance of regular physical activity for child and adolescent health and obesity prevention is well documented. The Department of Health and Children (DoHC) recommend at least 60 minutes of moderate to vigorous physical activity (MVPA) every day (DoHC, 2009). This recommendation has been endorsed by the HELENA study (Healthy Lifestyle in Europe by Nutrition in Adolescence), reporting that 49-52 minutes of MVPA daily prevented excess body fat in European adolescents (Martinez-Gomez et al., 2010). The HELENA researchers further specified that, for maximum benefit, out of 60 minutes per day at least 20 minutes for boys and 10 minutes for girls should be vigorous physical activity.

The Children's Sport Participation and Physical Activity Study (CSPPA Study) surveyed over 4000 Irish post-primary school students aged 12-18 years in 2009. School physical education (PE), extra-curricular sports, and extra-school physical activity participation were taken into account by researchers in the CSPPA study. In general, participation in physical activity was poor and only 12% of 12-18 year olds met the recommended 60 minutes of MVPA every day (Harrington et al., 2014). Both the CSPPA study and the Health Behaviour of School-aged Children research (HBSC) have found that Irish adolescents engage in less physical activity as they get older. Among HBSC respondents, exercising four or more times per week decreases from 64% of 10-11 year olds and 59% of 12-14 year olds to 42% of 15-17 year olds. This decrease is apparent for both genders but more pronounced among girls, dropping from 58% of 10-11 year olds to 28% of 15-17 year olds (Sullivan & Nic Gabhainn, 2013). This finding agrees with international literature, and a review of correlates of physical activity among children and adolescents by Sallis and colleagues (2000) found that the most consistent and frequent finding between studies was that boys are more active than girls. The

CSPPA study found that only 10% of post-primary students receive the Department of Education and Skills recommended 120 minutes of PE per week and less time is allocated to the students in the senior cycle. Boys' schools, however, often allocate more time to PE than girls' schools (on average 81 minutes versus 74 minutes per week). This is of particular concern for girls where PE is a significant contributor to their weekly MVPA levels. Although both genders reduce their participation in extra-curricular and extra-school sports as they get older, adolescent girls do not engage in as much of these as boys at any age (Woods et al., 2010). Boys also engage in vigorous exercise more frequently and for longer than girls of the same age (Sullivan & Nic Gabhainn, 2013).

Table 2.2 National and European surveys of physical activity and fitness levels of adolescents showing age group, methods used and results.

Study	Data collection years	Age	Sample size	Methods	% meeting 60 mins MVPA/day or other measure	Fitness
Belton et al. 2016	2011	12-14 yrs.	413	7-day accelerometry	32.4% (41.4% males & 22.7% females)	Not investigated
HBSC Study Gavin et al., 2015	2014	9-18 yrs.	13,611	Self-report survey	23% physically active on 7 days of week. Time spent in activity not specified	Not investigated
CSPPA Woods et al., 2010	2008/2009	11 – 16 yrs.		Self-report survey	12%	Not investigated
HELENA study Ruiz et al. 2011	2006-2008	13.9-15.8	2200	7-day accelerometry	41.0% (56.8% boys and 27.5% girls)	31.6% boys & 35.8% girls low cardio-respiratory fitness
HELENA study Ortega et al., 2010	2006-2008	12.5-17.5 yrs.	3428	Fitness: 20m shuttle run test	Not investigated	39% boys & 43% girls low cardio-respiratory fitness

The only exception to the poor PE allocation for post-primary schools is fourth year/transition year students. They receive significantly more PE time than all other groups in post-primary school, indicating the flexibility of time allowed to physical

activity in a non-exam focused school year. Time pressure due to school was the most common reason cited by principals for not allocating sufficient time for PE within their school (Woods et al., 2010).

Woods and colleagues (2010) found no significant socio-economic differences between adolescents meeting recommended physical activity targets, which disagrees with others. The GUI study reported that 13 year olds from higher social classes, with more educated parents take more frequent exercise and have more opportunities to engage in organised sports than other 13 year olds (DCYA, 2012). A review paper by Leech and colleagues (2014) found that higher parental education, family income and adolescent education level were associated with high physical activity/sports participation, while excessive time spent in sedentary behaviours were associated with low parental education and family income (Leech et al., 2014). The HELENA study has reported significant positive associations between socio-economic status and cardio-respiratory and muscular strength fitness tests independent of body fat and objective measures of physical activity among adolescents from nine European countries (Pavon et al., 2010). The wider literature, therefore, would indicate that socio-economic status is a strong predictor of physical activity levels and findings from the CSPPA study may have underestimated differences that exist in Ireland. The absence of a relationship observed by Woods et al. (2010) in the CSPPA may be a result of poor variability in the sample in terms of socio-economic status representation, and issues with misreporting in self-report questionnaires.

Socio-economic differences in physical activity participation is related to both objective and perceived access to physical activity resources in local neighbourhoods (Sallis et al., 2012; Humbert et al., 2006; Estabrooks, Lee & Gyurcsik, 2003; Giles-Corti & Donovan, 2002). Higher socio-economic neighbourhoods tend to have better physical activity facilities, and these are also more accessible to people with disposable income to pay for them (Sallis et al., 2012). Humbert et al. (2006) conducted focus groups with adolescents from low- and high-SES groups separately and found agreement between groups about some factors influencing physical activity participation for intrapersonal

factors (fun, perceived competence, time), and social factors (the influence of friends, adults as facilitators). Differences that emerged between groups were environmental factors, where low-SES youth cited long distances from facilities, the poor quality of facilities, safety concerns and cost as barriers to participation (Humbert et al., 2006).

2.5.2 Physical activity levels and physical fitness

Physical fitness describes and encapsulates some key physiological components. Broadly speaking, physical fitness is an integrated measure of many functions of the body and defines an individual's *"capacity to perform physical activity"* (Ortega et al., 2008). Genetics partly determine physical fitness through inherited factors of height, body composition, muscular strength and aerobic endurance potential (Guth & Roth, 2013), but it can be hugely influenced and developed by environmental factors – i.e. through quantity and quality of physical training, socio-environmental supports and opportunities, and socio-cultural factors (Davids & Baker, 2007). Adolescents who meet the recommended 60 minutes of MVPA per day are more likely to have a healthy cardio-respiratory fitness level (Martinez-Gomez et al., 2011; Ortega et al., 2008). Adequate total physical activity may attenuate the harmful effect of excessive sedentary time on cardio-respiratory fitness (Martinez-Gomez et al., 2011), although some studies show inverse associations between daily screen time and fitness (Pate et al., 2006; Aires et al., 2009).

Moderate to vigorous physical activity and cardio-respiratory fitness are inversely associated with total body fat and abdominal adiposity (Moliner-Urdiales et al., 2009; Ortega et al., 2008). Both cardio-respiratory and muscular fitness play a role in moderating cardiovascular risk factors in children and adolescents. While cardiovascular and other chronic diseases are typical of later decades in life, there is increasing evidence of risk factors in obese children and adolescents (Invitti et al., 2006). Physical fitness is closely related to cardio-metabolic risk, where high cardio-respiratory fitness can overcome risks associated with high body fatness (Jiménez-Pavón et al., 2013). Buchan et al. (2015) found that adolescents in the lowest cardio-

respiratory fitness quartile had significantly higher cardio-metabolic risk scores than all other quartiles in a recent cross-sectional UK study.

Areas of physiological growth are also affected by fitness. The prepubertal and pubertal growth periods are when children and adolescents gain their peak bone mass. Physical fitness, particularly muscular and speed/agility fitness, before and during this time are important factors contributing to short and long-term bone mineral density (Gracia-Marco et al., 2011; Ortega et al., 2008). The assessment of health-related fitness, therefore, is of interest and importance to public health research and planning.

2.5.3 Dietary intake, patterns & quality

The most comprehensive and recent Irish adolescent food consumption data are detailed in the National Teen Food Survey (NTFS) from 2005-2006 (NTFS, 2006). A representative sample of 441 adolescents aged 13-17 years recorded their food and beverage consumption using a seven-day semi-weighed food diary. Over half of the participants were between 15-17 years (57%, n=253) with a breakdown of 129 males and 124 females. The most recent Health Behaviours of School aged Children (HBSC) survey of over 16,000 school age children from 2010 (10-17 year olds) investigates dietary behaviours (Callaghan & Nic Gabhainn, 2013). Both resources will be used to describe current Irish adolescent dietary intakes, patterns and quality, with particular focus on 15-17 year olds.

Adolescent diets are typically associated with high intakes of fat and sugar that is linked to more frequent snacking patterns (Callaghan & Nic Gabhainn, 2013; Walton et al., 2009). The NTFS researchers have found that sugar consumption impacts on the overall diet quality of Irish adolescents. As added sugar increases, there are significant decreases in calcium, magnesium, zinc, Vitamin B12, Vitamin D, and folate. Diets higher in added sugars include more carbonated beverages, chocolate and non-chocolate confectionery and are associated with significantly lower intakes of vegetables, fruit, fruit juice, bread and milk (Joyce & Gibney, 2008). According to the HBSC survey, having sweets "every day, more than once" nearly doubles from 10-11 year olds to 15-17 year olds. Soft drink consumption also increases significantly as children get older. In contrast to younger children, the majority of adolescents have more access to sweet treats and believe that it's ok to get something else to eat if they don't like the food being served at home (Callaghan & Nic Gabhainn, 2013). Higher sugar intakes among adolescents compared to children has also been reported in Swedish young people from the European Young Heart study (Patterson et al., 2010). This trend is evidence of the increasing autonomy and personal food choice that develops during adolescence and points to a preference for less healthy foods. The following food groups contribute to a high saturated fat intake among adolescents: whole milk, meat products, sugars, confectionery and preserves, and biscuits, cakes, buns and pastries (Joyce et al., 2008).

In the NTFS both males and females fell short on calcium, Vitamin D and vitamin A intakes, while the majority of female adolescents did not meet iron requirements, and approximately one quarter did not meet riboflavin and folate requirements (Hayes et al., 2009). Overall, dietary fibre intakes are lower than recommended, particularly in 15-17 year old females (Devlin et al., 2013; Bannon et al., 2009). Table 2.2 describes the mean micronutrient and dietary fibre intakes for males and females from the NTFS and the percentage of adolescents with inadequate intakes.

Table 2.3 Mean intakes of dietary fibre and selected micronutrient for 13-17 year old Irish male and female adolescents from the National Teen Food Survey, with percentage of adolescents consuming inadequate levels.

Micronutrients	Males (n 224) 13-17 years		Females (n 217) 13-17 years	
	Mean (SD)	Inadequacy (%)	Mean (SD)	Inadequacy (%)
Calcium (mg)	1070 (409)	23	738(328)	42
Iron (mg)	14(12)	19	11(12)	72
Vitamin A (ug)	901(601)	25	686(441)	31
Thiamine (mg)	2(2)	0	2(3)	1
Riboflavin	3(3)	6	2(3)	23
Vitamin B12 (ug)	6(3)	0	4(3)	5
Folate (ug)	320 (157)	5	230(129)	29
Vitamin C (mg)	98(87)	6	92(100)	7
Dietary fibre	17.5(5.5)	70	13.3(4.2)	92

Sources: Hayes et al. (2009); Bannon et al. (2009)

The average fruit and vegetable intake of 2 servings per day among 13-17 year olds, fell significantly short of the five servings recommended (Doyle et al., 2009). The majority of adolescents may not eat fruit and vegetables on a daily basis, with over half of 15-17 year olds in the HBSC survey reporting to eat fruit and vegetables on only 4 days per week or less. Girls report eating fruit more often than boys and younger adolescents (11-13 year olds) eat more fruit and vegetables than mid- to older-adolescents. In Ireland, skipping breakfast is more common among 15-17 year olds than younger children, particularly among girls (Callaghan & Nic Gabhainn, 2013). This trend has

implications for nutritional adequacy of the diet since the NTFS shows that breakfast contributes significantly to a positive diet quality in terms of fibre and micronutrients (Devlin et al., 2013).

The NTFS found social class and geographical differences in sugar and fat intakes among adolescents – rural dwellers had lower intakes of sugar and higher intakes of fat and a higher parental education was associated with lower sugar consumption (Joyce & Gibney, 2008; Joyce et al., 2008). The HBSC also report certain healthy eating behaviours (e.g. eating fruit and vegetables, regular meals, eating sweets less frequently) to be more common among adolescents from higher socio-economic social classes (SC) 1 and 2 and decrease as we move from SC3-4 and onto SC5-6. Daily soft drink consumption, for example is twice as high among 15-17 year olds from SC5-6 as from SC1-2 (Callaghan & Nic Gabhainn, 2013). Across Europe, fruit and vegetable consumption is lowest among low-socio-economic status groups while wholegrains, lean meats, fish, and low-fat dairy products are preferably consumed by individuals of higher socio-economic status (McCartney et al., 2013; Novakovic et al., 2013; Vereecken et al., 2005). Disadvantaged young Irish women (18-35 years) are less likely to consume nutrient dense foods, and more likely to consume larger portion sizes of high energy, fat and sugar foods than advantaged women (McCartney et al., 2013). This pattern results in a range of negative consequences for energy, macronutrients and micronutrient intakes among socially disadvantaged people. There is little published literature on the effects of dietary patterns on nutrient intakes of children in lower socio-economic groups (Novakovic et al., 2013).

Findings from the NTFS give insight into macronutrient and food groups that affect the energy density of the Irish adolescent population. High energy density diets are associated with foods high in fat and saturated fat, as well as white bread, processed potato products, carbonated beverages and confectionery. Low energy density diets are associated with more carbohydrate and protein foods, wholemeal and brown breads, potatoes, fruit and vegetables (O'Connor et al., 2013). Despite being lower in total

energy, low energy density diets contain foods with higher nutritional value and therefore contribute more to a superior diet quality than high energy density diets.

2.5.4 Body image and food/activity behaviours

The NTFS and HBSC also addressed body weight satisfaction with their participants. Over half of NTFS participants reported being dissatisfied with their body weight, with more girls than boys dissatisfied (McConnon et al., 2009). All obese adolescents expressed a desire to weigh less, while a significant proportion of girls compared to boys in both the overweight and healthy BMI categories felt this way (83% vs. 38% and 54% vs. 13% respectively). Over one fifth of 15-17 year old girls in the HBSC survey reported being on a diet or doing something else to lose weight and another 26% reported that they needed to lose weight. This shows almost half of older adolescent girls are actively thinking about or trying to lose weight, an increase from 2006 (Callaghan & Nic Gabhainn, 2013). These figures were much lower for boys with one quarter reporting a weight loss concern and 7.7% reporting a preference for weight gain in the HBSC study (Kelly et al, 2016), and dissatisfied boys from the NTFS were more likely to say they would prefer to gain than lose weight (McConnon et al., 2009). The HBSC study has a considerably larger representative sample size than the NTFS and, as such, may represent the views of adolescents on this issue more accurately. The NTFS findings are comparable with weight concerns and dietary behaviours of adolescents in other jurisdictions (Neumark-Sztainer & Hannan, 2000). "To look better" was the most frequently cited reasons for boys and girls to alter their dietary behaviours in a large US study (Neumark-Sztainer & Hannan, 2000). Body image concerns have been highlighted by young people in Ireland as an important topic for national conversation. A 2012 peer-led survey with the Department of Children and Youth Affairs found that body dissatisfaction affects a large proportion of Irish adolescents, with concerns peaking at age 15 years (O'Connell & Martin, 2012). Dieting and exercise behaviours tend to affect adolescents of all weight status, with a number of contributing factors. Looking good for other people affects a majority of young people and body image concerns impact participation in social and sporting activities (O'Connell & Martin, 2012). Body changes associated with puberty and higher

incidences of overweight and obesity – both of which conflict with cultural and media ideals of body shape – are significant contributors to heightened body image concerns in adolescence (Neumark-Sztainer et al., 2012; Kroger, 2007).

2.5.5 Implications of current diet/physical activity patterns

The combination of very low levels of physical activity with high fat, high sugar, nutrient poor diets predict some stark health issues for adolescents both now and into the future. We are already seeing the physiological effects in terms of high overweight and obesity prevalence among young people. Unfortunately, long-term health problems associated with presented risk factors are on the horizon. Bone health, for example, will be compromised for life by lack of weight bearing exercises and inadequate intakes of calcium, vitamin D and magnesium in the critical growth period of adolescence (Weaver & Heaney, 2005). The health consequences include increased risk of fractures throughout life and a predicted population of older adults with high incidences of osteoporosis. Lifestyle risk factors for cardiovascular disease, type 2 diabetes and cancer are commonly displayed by Irish adolescents, putting them at higher risk of developing these chronic conditions earlier in life. Lack of regular MVPA combined with high intakes of saturated fat, and refined sugars, and low intakes of essential micronutrients are creating deficiencies during a time when the body needs to prioritise nutrients for healthy growth and development.

In addition to physical problems, overweight and obesity in childhood and adolescence is associated with social stigmatisation and can lead to significant psychological issues (Puhl & King, 2013). In the Growing up in Ireland (GUI) cohort, overweight and obese children are more likely to report being victimised or bullied by peers than non-overweight children (Reulbach et al., 2013). Early experiences of victimisation and social isolation can contribute to poor self-image. Low self-esteem in adolescence is strongly linked to body dissatisfaction and overweight/obese individuals are more likely to engage in higher risk weight loss strategies (van den Berg et al., 2010). Body dissatisfaction in adolescence may also have more far-reaching consequences. Longitudinal studies show tracking of unhealthy weight control behaviours and body

dissatisfaction into young adulthood and an association with later overweight and obesity (Quick et al., 2013; Neumark-Sztainer et al., 2012).

There is also the question as to the extent to which diet and lifestyle patterns established during childhood persist to adulthood. A longitudinal study with a birth cohort of almost 1000 participants followed up to 26 years in New Zealand found that excess television viewing (more than 2 hours per day) in childhood and adolescence was associated with overweight, poor cardio-respiratory fitness, smoking, and raised cholesterol in early adulthood, independent of potential confounding factors including childhood socio-economic status, BMI at 5 years, parental BMI, parental smoking and physical activity levels at 15 years (Hancox, Milne & Poulton, 2004). These findings highlight the longer-term health risks associated with excessive sedentary behaviour in early life, and similar risks have also been reported for dietary behaviours in childhood. A recent review of the evidence shows that childhood fruit, vegetable and polyunsaturated fat consumption are associated with lower adult cardiovascular risk (Kaikkonen et al., 2014). Tracking complex behaviours such as diet and physical activity from childhood to adulthood presents measurement challenges which are considerably greater than disease risk factors, such as body weight or cholesterol, for which standardised protocols are available (Craigie et al., 2011). Numerous methods of assessing dietary habits and physical activity levels are in common use for research, and there are major issues with quantifying habitual behaviours because both physical activity and eating behaviours are highly variable within and between days. Despite these methodological challenges a systematic review of the literature tracking diet and physical activity behaviours from childhood to adulthood observed strong evidence to support tracking for both behaviours (Craigie et al., 2011). For physical activity, the strength of tracking into adulthood increased with the age at which the baseline measurements were made. A similar finding has been reported by the Cardiovascular Risk in Young Finns Study in relation to food choice where stronger tracking was observed among participants who were older at baseline (15-18 years) compared to younger children (Mikkila et al., 2005). The study followed a cohort of children and adolescents (age range 3-18 years) who had taken part in a cross-sectional study after 6

and 21 years. The most stable tracking observed were among those whose diets were within 'traditional' or 'health-conscious' dietary patterns (Mikkila et al., 2005).

The Northern Ireland Young Hearts Project examined diet, fitness, physical activity levels, and anthropometry at age 15 and 22 years among a cohort of 245 male and 231 female participants (Boreham et al., 2004). The strongest tracking variable observed was anthropometry in female participants, while fitness and dietary intake showed poor tracking over time for males and females, and physical activity levels showed fair tracking among male participants. Mean estimated energy, total fat and carbohydrate intakes were significantly lower at age 22 for both males and females, as was cardio-respiratory fitness assessed via a 20-metre shuttle run (Boreham et al., 2004). The quality of diets also improved at young adulthood when thiamine, vitamin B6, folate, vitamin C and vitamin D were all significantly higher than at 15 years (Gallagher et al., 2006). The diet history method, used by the Northern Ireland Young Hearts Project, was the most common dietary assessment method in studies included in the systematic review by Craigie et al. (2011), and evidence of dietary tracking was considerably stronger in other studies using this approach. The European Youth Heart Study (Patterson et al., 2009) used a 24-hour recall method with food groups as outcome variables to examine dietary tracking among 9 to 15 year olds and 15 to 21 year olds in Sweden and found slight to fair tracking for certain food groups and nutrients over time. Fruit and dietary fibre showed the strongest tracking from adolescence to early adulthood (Patterson et al., 2009).

The studies described here highlight the difficulty in drawing clear conclusions about what diet and physical activity behaviours track from adolescence to adulthood. Factors that explain different outcomes between studies include differences in study protocols, recruitment methods and population representation, the lack of information about drop-outs over time, different time periods between measurements, and potential cultural differences. Despite challenges and differences, an overview of available evidence indicates that some behaviours do persist and mid- to late-adolescence is a

particularly influential time in terms of predicting behaviours in early adulthood (Craigie et al., 2011).

Current diet and physical activity patterns of Irish adolescents have been described, and the implications for current and future health briefly examined. The next section will focus on socio-environmental factors relating to school that influence adolescent knowledge, attitudes and behaviours with regard to food and physical activity.

2.6 School Policies and Practices

This section will first look at current nutrition, food and physical activity practices in Irish post-primary schools. Key international, European and Irish documents that relate to the promotion of healthy eating and physical activity in schools will be outlined. Finally, research evidence of how school food and physical activity practices can impact student behaviour and health will be explored.

2.6.1 Role of formal education in Ireland

From a formal education perspective, the Department of Education and Skills (DES) state that 'Healthy Living' is covered by school curricula at primary and post-primary levels. The subjects Social, Personal and Health Education (SPHE) and physical education (PE) at both primary and post-primary levels, with the addition of home economics at post-primary level "cover the areas of healthy eating and the food pyramid, healthy lifestyle, physical health, body care, exercise, relaxation and diet." (https://www.education.ie/en/Schools-Colleges/Information/Curriculum-and-Syllabus/Healthy-Living.html). SPHE is compulsory for all students up to junior certificate in post-primary school. The subject covers a range of topics including mental health, drug and alcohol use, relationships and sexuality and healthy living (O'Sullivan, 2012). Home economics is an optional subject for students in post-primary school, and girls significantly outnumber boys in uptake (O'Connor, 2007).

The 'Food Dudes' and the 'Active School Flag' programmes are ongoing health promotion initiatives available to school students. Ireland aligned the Food Dudes Programme with the EU School Fruit Scheme in 2009 and planned to double the schools in receipt of the scheme to 675 primary schools in 2014/2015 (Department of Agriculture, Food & the Marine, 2014). It is a primary school programme aimed at increasing fruit and vegetable consumption among children. Originally designed by the Food Research Unit, School of Psychology in Bangor University in Wales, research in Irish schools has shown increases in fruit and vegetable consumption with changes that persist at 12 months following the intervention (Horne et al., 2009). The long-term benefits of the programme have been questioned however, with a recent review

reporting that, to date, no evidence exists to show sustainable, long-term increases in fruit and vegetable consumption among children (Taylor et al., 2015). The Active School Flag award encourages a whole school initiative of physical activity promotion through PE, extra-curricular programmes and community links. It is open to both primary and post-primary schools.

There are plans to review the entire junior cycle in post-primary schools in the coming years and introduce short courses under 6 areas of education. Healthy Living is one of the 6 areas and more time for healthy eating and exercise education is envisioned (Department of Education and Skills, 2015).

2.6.2 Foods in Irish post-primary schools

There are a wide variety of practices in terms of food available to students in post-primary schools in Ireland. The majority of schools provide food to students (Callaghan et al., 2015; Kelly et al., 2010). A recent survey with 63 schools who had participated in the HBSC study reported that 70% had a school canteen, 53% a school shop and 38% vending machine(s) (Callaghan et al., 2015). The findings suggest an increase in school-based canteens in the last number of years when Kelly et al. (2010) found 53% of 331 schools had a tuck shop or canteen. Both studies used principal or teaching staff questionnaires to assess the food environments of schools across a range of urban, rural and geographical locations in the Republic of Ireland, and had similar response rates of 44% (Kelly et al., 2010) and 56% (Callaghan et al., 2015). While the majority of schools make nutritious foods such as milk, yogurt, sandwiches and fruit available to purchase, these are usually sold alongside what have been termed "competitive foods" - confectionery, soft drinks, sweet and savoury snacks, and biscuits (Browne et al., 2015; Callaghan et al., 2015; Shanley 2015; Kelly et al., 2010). The Department of Health and Children (DoHC, 2008) produced guidelines for developing a healthy eating policy in post-primary schools which is available for schools to access online. Surveys indicate that between 36% (Kelly et al, 2010) and 55% (DES Lifeskills Survey, 2014) of post-primary schools have healthy eating policies in place. It is not clear from the literature, however, how many schools have accessed or used the guidelines available to them.

For the dietary supplementation of students at risk of food poverty there is a School Meals Scheme in operation in Ireland, which is funded by the Department of Social Protection. Schools that are designated disadvantaged, within the 'Delivering Equality of Opportunity in Schools' (DEIS) initiative, are given priority for extra food funding. Schools are responsible for initiating and developing their own particular approach or projects such as breakfast clubs and lunch schemes. There are currently no mandatory standards for food provided within the programme. The following statement appears on the Department of Social Protection website with regard to food covered by funding:

"What is covered by your funding: Funding is for healthy nutritious food only and must not be spent on confectionery, crisps, fizzy drinks, fried food, fast food etc. Your end-of-year accounts and receipts will be inspected to ensure you are complying with this requirement. Further information regarding healthy eating for children is available from the Health Promotion Unit of the Health Services Executive and in 'A Good Practice Guide for School Food Initiative' produced by Healthy Food for All." (Department of Social Protection, 2011)

Healthy Food for All is a multi-agency Irish charity that promotes access to, and the availability and affordability of healthy food for low-income groups on the island of Ireland. They provide support and practical guides for healthy food provision in schools (www.healthyfoodforall.com).

Allocation of funds for the school meal programme has risen significantly from €4.6m in 2004 to €37m in 2014. Spending increases come in conjunction with more awareness and attention focused on food poverty in Ireland (Carney & Maitre, 2012). Historically schools provided "milk and buns" (and to a lesser extent sandwiches, fruit and soup) to disadvantaged students under the scheme (Department of Social Protection (DSP), 2002). This has changed in the last 10 years to include more structured breakfast clubs, and lunch and after-school schemes (HFfA). Although post-primary schools are eligible to apply for funding under the School Meals Programme, in the past it has been associated with primary schools. In 2013/2014 just under a quarter (23%, n=260) of

schools in the programme were post-primary schools (DSP, unpublished data). A review of the funded programme in 2002 found the approach to be ineffective and inefficient for the intended purpose. Lack of specific nutritional goals, poor monitoring, and poor uptake by post-primary schools were viewed as significant gaps contributing to the ineffectiveness of the programme (DSP, 2002). Essentially it was clear that the scheme was not reaching older children who would benefit from the provision of food at school, and that nutrition standards would be required in future.

In summary, food practices are likely to be varied across the post-primary school sector in Ireland. Despite most Irish post-primary schools having a school canteen, shop and/or vending machines, there are no mandatory or minimum food and nutrition standards governing food availability to students. Additionally, many Irish school students bring their food from home or buy food in outlets local to the school. Recent research has demonstrated that schools are frequently located near shops, delis and fast food outlets (Callaghan et al., 2015). However, we currently have no information about food consumed by students during school time and cannot assess the impact of these food sources. Various state departments and non-state bodies are recommending a more structured approach to school food. The Irish Heart Foundation have recently called for school food policies that limit student access to low-nutrient, energy dense foods and increase exposure to healthy options (Shanley, 2015). The Department of Social Protection review recommends clear nutritional guidelines for the School Meal Scheme (DSP, 2002). The National Taskforce on Obesity (2005) and the Special Action Group on Obesity (Healthy Ireland, 2014) have recommended a code of practice with regard to the provision and content of vending machines in post-primary schools, as well as provisions for standards in relation to industry sponsorship of activities. Guidelines for the development of a school nutrition policy and healthy breakfast clubs have also been published by the Department of Health and Children, the Department of Education and Skills and Healthy Food for All (2008). Awareness of the importance of healthy school food has been increasing in recent years (DES, 2015; Nelson & Breda, 2013), but research and outcomes in terms of food provision and dietary behaviours are lacking for Ireland.

2.6.3 Physical activity practices in Irish post-primary schools

Ten percent of Irish adolescents (Woods et al., 2010) receive the DES recommended 120 minutes of PE per week (DES, 2014). Factors influencing PE and sport in schools include time pressure due to academic subjects, as well as lack of facilities, lack of interest from students and lack of teachers (Woods et al., 2010). Time and resource issues are the most frequently reported barriers to implementing national PE policy or guidelines from other countries (Greenfield et al., 2015; Larsen, Samdal & Tjomsland, 2012; Jenkinson & Benson, 2010). In Ireland, transition year is the exception, where PE allocation is usually in line with recommendations because it is an non-exam focused year (DES, 2014). At present the average weekly minutes of PE in Irish post-primary schools is 77 minutes. Boys (81 minutes compared to 74 minutes for females) and fourth year students (94 minutes) receive the most time in PE, while sixth year students (53 minutes) receive the least time. Girls, particularly in 5th and 6th year, are more likely than boys to have no PE or be timetabled for single periods of PE. (Woods et al, 2010). A reduction in time allocated to students as they progress through post-primary has also been reported in the UK and is related to increasing time demands from exam subjects (Greenfield et al., 2015).

Extra-curricular sport and physical activity play a major role in many post-primary schools and can be a central focus of identity for students and staff (Lynch and Lodge, 2002). The extent and quality of extra-curricular sport and physical activity in Ireland depends on individual schools and their ethos, expertise, resources, facilities and goodwill of staff volunteering to run them (Woods et al, 2010). In 2009, 73% of post-primary students were involved in extra-curricular physical activity at least once per week, with 57% participating two or more days. Boys were more likely to participate than girls and non-participation rates were highest for 16-18 year old females at 30%. Gaelic games (football, hurling, camogie, handball), soccer, basketball, and athletics and cross-country running are the most popular extra-curricular activities among post-primary students (Woods et al., 2010).

A combination of behavioural, social, environmental and personal factors predicted the likelihood of extra-curricular physical activity participation according to the CSPPA study (Woods et al., 2010). For boys, being involved in sport outside of school (extra-school physical activity) was the strongest predictor of extra-curricular physical activity. More time in PE, and positive peer and teacher influence were key predictors of extra-curricular physical activity participation for both genders. Personal factors influenced females only, where respondents said they participate if they feel they have enough energy (i.e. not too tired) to do so (Woods et al., 2010). There is an overlap between extra-curricular and extra-school sport participation, particularly for more traditional sports like the Gaelic games. Principals in the CSPPA study acknowledged the supportive role local clubs play in providing staff and expertise to extra-curricular programmes.

2.6.4 What's happening at policy level?

A number of key obesity reports have identified schools as an important health promotion setting for young people (WHO, 2016; EU Action Plan on Childhood Obesity 2014-2020, 2014; DoHC, 2005). Three important areas for school involvement in the EU Action Plan on Childhood Obesity 2014-2020 are (1) *"promote healthier environments, especially in schools and pre-schools",* (2) *"Make the healthy option the easier option",* and (3) *"Restrict marketing and advertising to children"* (EU Action Plan on Childhood Obesity 2014-2020, 2014).

National

The National Taskforce on Obesity recommended the development of school policies to promote healthy lifestyles as one of the management and prevention strategies for childhood obesity within the education sector (DoHC, 2005). As previously discussed, despite calls for national mandatory nutrition or physical activity policies in Irish schools, none are currently in place. The government appointed Special Action Group on Obesity (SAGO) stated *"the supply of healthy food products in vending machines in schools"* as one of their top five priorities in 2015 (Healthy Ireland, 2014). To date, the Department of Education and Skills have avoided regulating foods sold in schools

through vending machines, shops or canteens. At present individual schools are responsible for choices surrounding food and beverages sold on school grounds. A recent circular to post-primary schools from the Department of Education and Skills (2015) advised schools to adopt the Healthy Vending Policy from the Health Service Executive (HSE) (HSE, 2014) which indicates that no item for sale at school should contain greater than 250 calories and most should be within a 'Better Choice' category, which is defined as an item which contains less than 150 calories and meets criteria set out in the guidelines for schools healthy eating policy document (DES, 2015; DoHC, 2008). With regard to physical activity, there is one key recommendation from the DES – that all post-primary school students be allocated at least 120 minutes of PE per week. Extra-curricular sporting activities are a matter for individual schools and their capacity to provide them. In order to address the fact that most schools do not provide the recommended PE time to students (DES, 2014), a recent circular from the DES (September 2015) has recommended that schools (1) work with student councils to increase the range of opportunities available for students to become physically active at school (2) get involved in the Active School Flag initiative (3) develop a School Physical Activity Plan using DES resources and (4) develop a Green-Schools Travel Plan to encourage more active transport to school. The absence of reference to PE provision in these recommendations indicates the major time and resource barriers schools face in implementing 120 minutes per week on their timetables as was reported in a 2009 review of the National Taskforce on Obesity recommendations (DoHC, 2009).

The Schools for Health in Europe Network (SHE network) brings together national coordinators from 43 countries in the European Region. The network is supported by the WHO, the Council of Europe and the European Commission. Its aim is to develop and sustain school health promotion by providing a European platform for Health Promoting Schools (HPS). The HPS approach is a whole school approach to health education that encompasses the health curriculum, physical and social environments, and school/community collaboration (Parsons, Stears & Thomas, 1996). Ireland's current membership of SHE is in the form of a national coordinator, with regional officers for Health Promoting Schools as part of the Health Promotion Unit at the Health

Service Executive. The 2011 Health Promotion Strategic Framework identified education as one of three key settings for health promotion (HSE, 2011). Subsequently 'Schools for Health in Ireland': Framework for Developing a Health Promoting School, with the support of the DES, was published in 2013. Health promotion officers situated in each HSE region are available to help schools make changes under four key headings: 'Social and Physical Environment', 'Curriculum', 'Policies and Planning' and 'Partnerships'. The topics that schools address at their own pace, through consultation with a health promotion officer, depend on individual priorities. They include emotional and mental health topics, as well as healthy eating and physical activity. The overarching aim of any action is to create supportive environments that promote the physical and mental health of the whole student body.

The HSE award a 'Health Promoting Schools Flag' to acknowledge schools that have worked through the process of improving the health of their school communities. The adoption of a HPS approach by schools in Ireland has grown since the creation of the Irish Network of Health Promoting Schools in 1993 when five post-primary schools participated in a pilot study (Lahiff, 2000). A review of the early implementation by Lahiff (2000) found that schools had difficulties with the HPS concept in terms of appropriate facilitation of health education classes, and whole school awareness, contribution and participation to the process (Lahiff, 2000). The most recent review of HPS in Ireland was conducted via questionnaire on 394 schools (56% response rate of 704 post-primary schools in Ireland) with a close representation of national school type (Moynihan, Jourdan & Mannix-McNamara, 2016). In this study 56% of schools who responded to the survey identified themselves as a HPS, while only 2% had achieved the national HPS award and 6% were in the process of obtaining the award. Half of the schools surveyed had not heard of the HPS award. Despite a low number having pursued the formal HPS award, over one third of schools had an explicit policy aimed at promoting a healthy lifestyle among students and 35% had a designated team to co-ordinate HPS activities (Moynihan, Jourdan & Mannix-McNamara, 2016). The most recent report from the Department of Education and Skills shows a higher uptake of 37% post-primary schools nationally for the HPS award (DES, 2015). It is unclear why

these figures don't agree, however given that almost half of schools outside of the formal HPS award identified as health promoting based on local activities in the Moynihan et al. study (2016), responses to and subsequent analyses of the DES survey (2015) may not have differentiated between formal and local HPS activities.

2.6.5 How school food impacts students

National

Recent research in Ireland has identified wide availability of high sugar, fat and salty foods and beverages in schools and local environments (Browne et al., 2016; Callaghan et al., 2015; Shanley 2015; Kelly et al., 2010). Approximately half of schools surveyed by Callaghan and colleagues (2015) sold pizza, sugar-sweetened soft drinks and confectionery (defined in the study as chocolate, sweets, biscuits, cakes, crisps), and one third sold chips. A trend towards a healthier food profile in schools with a healthy eating policy in place was reported, although differences were small and not statistically significant, and unhealthy options such as confectionery, pizza and flavoured milk were still available in these schools. Differences in healthy options in schools with a healthy eating policy compared to schools with none in place included bottled water (92.3% versus 87.5%), 100% fruit/vegetable juices (69.2% versus 56.3%), fruits (59% versus 43.8%), vegetables or salads (35.9% versus 31.3%), wholegrain bread products (69.2% versus 56.3%). While unhealthy items were still available in these schools, they were less likely to sell confectionery (56.4% versus 75.0%), diet soft drink (28.2% versus 31.3%) and chips (30.6% versus 35.7%). Differences in food profiles of the school were also found for gender, urban/rural location and disadvantaged status. More girls and mixed groups than boys had access to healthy items including fruit, vegetables or salads, and 100% fruit/vegetable juices. Rural schools were found to have more healthy choices than urban schools and non-disadvantaged schools had more total food choice (including less healthy options) than schools designated disadvantaged. These recent findings highlight the widespread promotion of low-nutrient, energy dense foods in the internal Irish post-primary school environment, and that healthy eating policies may not be effective (Callaghan et al, 2015). They also indicate the lack of progress in tackling this situation since earlier work on food marketing in schools by Kelly et al.

(2010). What is lacking for Ireland at present is research examining the impact of school food environments on students' dietary behaviours and nutritional status. Evidence is available from international school-based literature and will be used to examine relationships between school food and the dietary behaviours of students.

International

In the United States (US), the poor quality of food offered in schools is well documented and many believe it is contributing to the obesity crisis (Council on School Health, 2015; Story, 2009). Briefel and colleagues (2009) examined the impact of school food environments and practices on the eating behaviours of students from a nationally representative sample of US schools. Schools that limit the availability of competitive, low nutrient, energy dense foods and beverages can reduce the energy intakes of students by 16-90 kilocalories per day. The upper end of this can be achieved with three specific practices – serving French fries (chips) less than once a week, having no pouring rights contracts between the school and beverage industry for the exclusive sales of certain brands of sugar-sweetened beverages in the school and not selling low-nutrient, energy dense foods and beverages in competition with the school meal programme. Fruit and vegetable consumption is negatively affected by the availability of low-nutrient, energy dense foods in school shops or vending machines (Briefel et al., 2009; Kubik et al., 2003). A Belgian study from the HBSC dataset shows that the consumption of sugar-sweetened beverages and foods among post-primary school students is significantly impacted by their availability at school and school food rules (Vereecken et al., 2005).

While school food practices clearly influence students' food choice, the impact on body weight is not as conclusive. All-day access to foods/beverages, using unhealthy foods as rewards and for fundraising (Kubik et al., 2005), offering French fries or desserts more than once per week and making low-nutrient, energy dense foods available in general food service areas (Fox et al., 2009) are factors reported to be associated with higher student BMIs. A study examining overweight and obesity showed no significant associations with school food practices (Terry-McElrath et al., 2009), and research from

the WHO European Childhood Obesity Surveillance Initiative (COSI) in 12 European countries has shown small positive associations between supportive school nutrition practices in primary schools and mean BMI levels (Wijnhoven et al., 2014). Authors of the latter study did not have data on school level healthy eating or nutrition policies and were unable to draw conclusions about whether supportive practices were the consequence of school response to existing overweight and obesity levels (Wijnhoven et al., 2014). A longitudinal study by Van den Berg et al. (2013) in a large sample of Dutch secondary schools found a marked increase in school actions or intentions to prevent overweight among students between two time points: from the first surveys in 2006 and 2007 to the follow-up surveys in 2010 and 2011. The findings from Wijnhoven et al. (2014), although tentative, may be the result of a broader awareness of the role of schools in obesity prevention across Europe, and momentum in relation to school action on their food environments. The divergence between US and European findings may be the result of many factors including different food cultures, age levels and methods used. Studies cited here that have examined associations between body weight and school food environments have been cross-sectional (Fox et al., 2009; Terry-McElrath et al., 2009; Kubik et al., 2005) or of short duration (Wijnhoven et al., 2014). BMI and obesity are influenced by such a wide range of factors outside of the school setting that longitudinal studies are required for a more robust examination of the relative impact of school food practices and student exposure over time (Larson & Story, 2010). A longitudinal study by Van Hook and Altman (2012) specifically examined the availability of competitive foods at school and obesity from 1998/1999 to 2006/2007, over which time children moved from kindergarten to middle school. No evidence was found for any relationships between exposure, or changes in exposure to competitive foods at school and BMI, weight changes, or obesity levels in the children, and the authors did not find any variation to their results based on gender, race/ethnicity, or family SES (Van Hook & Altman, 2012). One of the limitations of this study was that it did not account for broader food practices such as specific school policies, other foods available, marketing or advertising, and selection effects. Selection effects are typically not accounted for in large studies, so more direct relationships between school cultures, availability, consumption, student characteristics and obesity are not clear.

United Kingdom (UK)

The United Kingdom countries (England, Scotland, Wales, and Northern Ireland) introduced compulsory nutrition standards for school foods from 2007. The School Food Plan was subsequently launched in 2013 to support positive uptake and roll out (http://www.schoolfoodplan.com/). Previous voluntary measures had not been effective in changing school food practices because competitive snack foods and beverages were not restricted (Adamson et al., 2013). School lunches and all other foods available in schools such as from breakfast clubs, vending machines, tuck shops and after school snacks/meals are covered by the most recent standards. The standards are in line with national macronutrient recommendations. They also specify maximum sugar, salt and saturated fat levels, as well as minimum fibre and micronutrient (Vitamin A, C, folate, iron, zinc and calcium) levels for an average school lunch. Apart from school lunches, there are also restrictions on processed meats, fried foods, salt and salty snacks, and cakes and biscuits, with a complete prohibition on confectionery of any kind (UK Department of Education, 2014). Evaluations of the approach have shown clear nutritional benefits and dietary improvements for children and adolescents (Adamson et al., 2013). School lunches under the compulsory standards have been compared to packed lunches and found to contain a better nutrient profile in terms of sodium, fibre, vitamin A, folate, iron, zinc and macronutrient energy sources (Stevens et al., 2013). Statutory regulations do not extend to packed lunches at present in the UK and two studies have shown that packed lunch students eat more food and drink items not permitted under the regulations (Stevens et al., 2013; Pearce et al., 2013).

Finland

School food policy in Finland is frequently used as an example of good practice. They see education, meal provision, and cooking skills as a holistic approach to fostering healthy eating practices among young people, calling it an "investment in learning". Finnish school legislation guarantees a well-balanced free school meal for each student every school day. Government policy expects that school meals be "tasty, colourful and well-balanced". Policy documents outline the nutritional benefits of indigenous Finnish

food and their role in school lunches (Finnish National Board of Education, 2008). They work on the plate model, whereby half the plate is vegetables, one quarter is carbohydrate and one quarter is protein. Fish must be served at least once, but preferably twice, a week. Milk and water are the only beverages served and fruit is the only dessert. The availability of confectionaries and soft drinks is not recommended at school. Students have the opportunity to work in their school canteen at some point during their education years in order to complete the food education model.

Implications for the Irish School System

What the US, UK and Finnish models have in common is a national school food programme. Irish schools have no history of school meals for all students. As a result, they have no state system to turn to for support when setting up food provision at school. The Netherlands is similar to Ireland in that no state school meal programme exists, and research indicates that soft drinks and confectionery are available in the majority of secondary schools (Scholtens et al., 2010; Van den Berg et al., 2013). In contrast to Callaghan et al. (2015), where 38% of Irish schools had a drinks or snack vending machine, almost all schools in The Netherlands reportedly have beverage *and* confectionery snack vending machines (Scholtens et al., 2010). Since 2009 the Dutch Ministry of Public Health, Welfare and Sports have prioritised healthy school food as part of government obesity prevention goals (Van den Berg et al., 2013). A follow-up study to the work by Scholtens et al. (2010) has found small changes in school food environments and action or intentions by schools to prevent obesity (Van den Berg et al., 2013). One initiative that is growing in popularity with Dutch schools is the 'Healthy School Canteen' (Mensink et al., 2012). Since it began in 2012 almost one third of Dutch secondary schools have worked through the programme that involves students, parents, school boards, canteen employees, Municipal Health Services, and caterers (Mensink et al., 2012). The programme consists of four stages: (1) inventory, (2) action plan, (3) implementation, and (4) evaluation and the Municipal Health Services and dietitians guide schools through components. The pace of change is very much decided by schools and an evaluation survey of participating schools conducted by Mensink et al. (2012) found that 69% changed the food on offer in the canteen, 64% made healthy

eating part of the regular curriculum, and 61.5% changed school food policy. Adequate external support to guide schools through necessary changes was reported as a major challenge to implementation (Mensink et al., 2012).

One of the benefits of state school food programmes is the potential for policy implementation. The example of Finnish school food as described above may not have relevance for the Irish setting given the absence of a co-ordinated state school food system, no history of hot school meals and no standard catering infrastructures in schools. In contrast, the Dutch model of working with existing canteens to improve the health profile of foods on offer may be more realistic for Ireland. This approach has recently been piloted and recommended by the Irish Heart Foundation (Shanley, 2015). The evidence from other countries suggests at least two elements that are required to enhance the success of such a model including incentives to participation (Mensink et al., 2012) and clear, defined guidelines on appropriate and inappropriate foods and beverages (Adamson et al., 2013; Briefel et al., 2009; Story et al., 2009). The second element is derived from UK and US experiences with implementing state nutrition policies, which found that policies need to extend to all foods sold at school (i.e. including competitive foods) and not just those within school food programmes in order to effect change (Adamson et al., 2013; Briefel et al., 2009; Story et al., 2009). Restrictions on competitive foods in schools are a sensitive issue because their sales often generate valuable revenue for the school (Story et al., 2009). In a national US survey, schools in California were particularly successful at reducing the sale of competitive foods compared to other states. The authors propose a relationship between this finding and the California Childhood Obesity Prevention Act of 2003, which prohibited the sale of unhealthy beverages from vending machines and other sources at school (Terry-McElrath et al., 2009). A study by Kelly et al. (2010) found some type of commercial sponsorship in 38% of Irish schools surveyed with sports (71%) and IT (48%) equipment and student prizes or awards for competitions (40%) being the most common. Thirteen percent of schools reported commercial sponsorship for their vending machine. Although school management are open to receiving

guidance and support for commercial sponsorship arrangements, there is currently no legislation concerning this issue for Irish schools (Kelly et al., 2010).

The literature would suggest that policy implementation is easier for younger children. Restricting the sale of competitive foods is less common at post-primary compared to primary level schools (Hirschman & Chriqui, 2013; Terry-McElrath et al., 2009). In Europe, post-primary schools are also less likely to have written nutrition policies or programmes (Vereecken et al., 2005). This difference probably relates to a number of factors aligned with increasing age and autonomy of students, as well as the changing role of school as students become more independent.

2.6.6 How physical activity at school impacts students

Like food, the physical activity culture of a school can influence student attitudes towards physical activity, and participation behaviour. School physical activity culture includes physical education (PE), extra-curricular sports activities available to students, dominant school transport practices, break-time opportunities and activities, and the use of school facilities (Brusseau & Kulinna, 2015; Story et al., 2009; Pate, 2006; Trudeau and Shepherd, 2005; Wechsler et al., 2000). Other less tangible factors may include the school's ethos on the importance of being active, how it encourages, supports or rewards participation and staff volunteering culture (Lynch and Lodge, 2002). Similar to other countries, adolescents in Ireland spend approximately one third of their waking hours at school. Accumulating an equal proportion of their daily physical activity requirements during this time is considered an important component of public health (Brusseau & Kulinna, 2015; McKenzie & Lounsbery, 2013). Good physical activity practices at post-primary level become even more critical when we consider the general decline in physical activity participation from childhood to adolescence, particularly among girls (Belton et al., 2016; Sullivan & Nic Gabhainn 2013; Woods et al., 2010). A review of the evidence by Trudeau and Shepherd (2005) shows global variations in terms of PE time allocation. Similarities between countries exist when it comes to the reduction in PE time from primary to post-primary schooling, which is more pronounced in the final years of school. An adequate volume of PE is

considered essential to make a meaningful contribution to the overall physical activity levels of young people. The school environment plays a role in terms of offering opportunities, equipment and supervision to students to be active outside of formal PE and extracurricular programmes. Extra-curricular sports programmes often miss opportunities for diversity and are generally geared towards team-based sports and more available to students from higher socio-economic groups. The authors of this review state an important objective of school-based physical activity – to develop a positive attitude to physical activity that would preferably last for the entire lifespan (Trudeau and Shepherd, 2005).

Student engagement behaviours with PE and other aspects of school physical activity are not straight-forward. Young students generally have a positive attitude to PE at school but this diminishes among older adolescents, particularly girls (Trudeau and Shepherd, 2005). A US study with adolescent girls reports BMI, self-efficacy to be physically active, perceived benefits of physical activity and perceived teacher support for girls being physically active as predictors of PE class enjoyment (Barr-Anderson et al., 2008). In Ireland, more PE time allocation is associated with increased extra-curricular participation, as is smaller school size and positive social supports like encouragement from teachers and peers (Woods et al., 2010). Indeed, characteristics of the PE teacher and their class management have been reported by many studies as either a barrier to or facilitator of student engagement in PE (Smith and McKenzie, 2014; Lewis, 2014; McKenzie & Lounsbery, 2013; Rees et al., 2006).

Academic pressures are a frequently reported reason for insufficient PE allocation in post-primary schools (Greenfield et al., 2015; Larsen, Samdal & Tjomsland, 2013; Jenkinson & Benson, 2010; Woods et al., 2010). Many believe there is sufficient evidence to warrant a new approach to time allocation of physical activity at school. It is thought that long periods without physical activity breaks might actually be counterproductive to academic performance (Mahar et al., 2006). Strong and significant relationships have been found between physical fitness and academic achievement among adolescents (Van Dusen et al., 2011; Chomitz et al., 2009). A review

of the evidence concludes that academic achievements are not improved by limiting time allocated to PE and physical activity at school (Trudeau & Shephard, 2008). There are indirect associations between school physical activity and lower drop-out rates, better classroom behaviour, self-esteem and engagement in school (Dobbins et al., 2013). Mahar et al. (2006) demonstrated improved concentration at school with short, physical activity 'energisers' to break up long periods of classroom time. Unfortunately, with PE and opportunities for activity consistently nudged or narrowed on the school timetable, these benefits may not be fully realised in Irish schools.

2.6.7 School physical activity contribution to fitness, BMI and other health measures

Rashad-Kelly et al. (2010) examined the effects of school level physical activity practices on cardio-respiratory fitness and BMI. Positive physical activity practices including mandatory PE, meeting PE time recommendations, student and community access to sports facilities outside of PE, and teacher certification were all significant predictors of cardiovascular fitness, but not BMI (Rashad Kelly et al., 2010). More frequent PE lessons (4-5 per week) with young adolescents have shown improved physical fitness (Erfle & Gamble, 2015; Ardoy et al., 2011). PE and multiple break-times are known to increase moderate to vigorous physical activity during school time (Brusseau & Kulinna, 2015). In addition to increased activity and fitness, intensive PE programmes have shown other metabolic health benefits. Long-term studies that increase time in PE in US schools (2-4 years of 6 versus 2 PE lessons per week) report significant reductions in triglycerides, systolic blood pressure and insulin resistance in intervention compared to control groups (Klakk et al., 2014; Telford et al., 2013).

A review of randomized controlled physical activity interventions in schools by Dobbins and colleagues (2013) found positive behavioural and health-related outcomes for students in terms of increased time spent in moderate to vigorous physical activity, reduced television viewing time and improvements to cardio-respiratory fitness. Effective school based interventions should combine formal education with printed education materials, physical activity specific sessions and community-based initiatives (Dobbins et al., 2013). Two recent studies have not found significant differences

between total student physical activity levels when comparing the effects of longer or more frequent PE classes with regular PE (Smith et al., 2015; Moller et al., 2014). A recommendation in the review by Dobbins and colleagues to include the community in school-based interventions would provide multiple environments to support active children and adolescents, which may be required to increase total physical activity levels (Dobbins et al., 2013). Examples of relationships between the community and school sports and exercise include links between local sports clubs and school teams such as sharing coaches and expertise (Woods et al., 2010), school use of community facilities to broaden their available resources for students, school links with local health professionals who can provide expertise (WHO, 2008), school participation in planning – for example in relation to the built environment for supporting active transport (WHO, 2008), and scope for community use of school physical activity facilities outside of school hours (Spengler et al., 2010). These type of connections educate students about what's available in the locality as well as support and promote student involvement in physical activity inside and outside of school hours.

The evidence indicates that school plays a significant role in the physical activity lives of adolescents. It is part of a public health system that aims to foster physical activity participation in youth with maintenance into adulthood. Globally, there are calls for more intensive PE and more diverse and accessible extra-curricular programmes for all ages at school. Experimental studies have demonstrated their academic, fitness and metabolic benefits. The important role of the physical environment at school and how it facilitates more spontaneous physical activity in young people is increasingly recognised. In addition, the potential for individual school values and practices to contribute to an overall physical activity ethos for students is probably a powerful, but less measurable agent for change.

2.6.8 Barriers to nutrition and physical activity policies at school

Challenges with implementation of mandatory nutrition standards at post-primary levels have been reported in the UK and US (Adamson et al., 2013; Gilmore et al., 2010; Kubik et al., 2010). Post-primary school students are more likely to eat foods that don't

comply with nutrition standards and these items are usually brought from outside school (e.g. from home or local shops). Authors of a US school study found evidence of students sourcing low-nutrient, energy dense foods and beverages from elsewhere if they are banned in school (Briefel et al., 2009). Home as a source of unhealthy foods is one barrier. Parents of primary school children in Northern Ireland, for example, were more likely to be aware of their schools nutrition policy than post-primary school parents (Gilmore et al., 2010). Lack of support from home was the top issue principals experienced in implementing nutritional standards in schools. As one of the stakeholders in school health promotion, parents are an integral element of successful implementation of policy. While the majority of parents supported the idea of school nutrition standards in a Northern Ireland survey, teachers and principals do not perceive the support as strong (Gilmore et al., 2010). The other issues in this study were the cost of healthy food and loss of revenue in removing unhealthy items from school, outside school catering competing with school food, and reluctance of students to try healthier foods (Gilmore et al., 2010). Lack of time is a consistently reported barrier to adequate PE allocation in post-primary schools (Woods et al., 2010; Boyle et al., 2008). While teachers and principals see the value of more curriculum time for PE and physical activity, the competition from other subjects is a major barrier to policy implementation. In qualitative interviews with school staff in the UK lack of student input into curriculum, competition and sporting elitism, low fitness, lure of sedentary behaviour, school physical activity ethos, physical activity facilities (both school and local), student self-confidence and student home influences were all cited as barriers or facilitators to PE participation in school (Boyle et al., 2008). Among Irish principals, lack of facilities, competing academic timetable, lack of interest from students and teacher shortages are the most commonly cited reasons for not providing sufficient PE (Woods et al., 2010).

While schools have a role in the promotion of healthy eating and physical activity through education and environment, it should also be acknowledged that the education system is not the answer to every social ill (Moynihan & Mannix-McNamara, 2012). Solutions to newly identified social and health issues are frequently placed at the school

door. This places increasing pressure on school principals and teachers that can negatively influence their attitudes about health promotion initiatives at school level.

2.7 Local Environment to School

2.7.1 The impact of food environments

Changes to community food environments and increases in the availability of low-nutrient, energy dense foods are risk factors for obesity (Holsten, 2009). Fast food consumption increases from childhood to adolescence (Braithwaite et al., 2014). There is a growing body of evidence globally to show easy access to fast food in the environments close to schools (Callaghan et al., 2015; Virtanen et al., 2015; Héroux et al., 2012; Davis & Carpenter, 2009). A recent study of food establishments close to Irish schools reported that local shops and fast food outlets were the most common food operator, followed by coffee shops and restaurants (Callaghan et al., 2015). The majority of schools in this study (75%) were located within 1km of a fast food restaurant. Findings by Callaghan et al. (2015) are similar to the Netherlands where 78% of schools are located within 1km of a supermarket, gas station or fast food restaurant (Scholtens et al., 2010). In Northern Ireland independent food outlets pose significant competition to the successful implementation of healthy school food standards in post-primary schools according to school teachers (Gilmore et al., 2010). Many post-primary schools in Ireland permit some or all of their students to leave the school grounds at lunch-time. Whether local retailers and food outlets cater specifically for the student is not known. We do not have data on how these food sources impact the diets of Irish adolescents on school days. Recent investigations of food environments in the GUI cohort have found that the nature and proximity of food outlets close to children's home were not strongly associated with dietary quality or BMI, with the exception of convenience stores and dietary quality in boys (Keane et al., 2015). The cohort was aged 9 years, a group with less purchasing independence than adolescents, and not directly related to retailers close to schools.

When examining food environments for research purposes, studies typically employ a geographic information system (GIS) and compile data from business directories about the proximity and density of food outlets to the study site(s). For young people, a reasonable walking distance (e.g. up to 1km or 10-15 minutes by foot) is usually the chosen proximity indicator. The food outlets are categorised into fast food outlets,

chain cafes, grocery and convenience stores etc. Outlets that sell foods affordable to young people are of particular interest as they are associated with affordable low-nutrient, energy dense foods.

A Canadian study demonstrated that the density and presence of fast-food outlets within 1km of home and school increased the likelihood of adolescent self-purchase of fast-food alone and with friends (He et al., 2012). In East London, a longitudinal study examined retail food outlets near schools and healthy and unhealthy diet scores among adolescent participants at three times points over 4 years, and found associations between food retail location and adolescent diets (Smith et al., 2013). The farther students had to travel to a takeaway or shop, the healthier their diet tended to be in terms of fruit and vegetable and breakfast consumption. Data from the Finnish School Health Promotion study, with a cohort of over 20,000 adolescents, found that most schools were within 500metres of a fast food outlet. The strongest links between fast food outlets and dietary behaviours were seen in low socio-economic status (SES) groups. Low-SES adolescents with a fast food outlet or grocery store close to school were more likely to be overweight and have irregular eating behaviours (skipping breakfast and receiving free school lunches and snacks) than those with a longer distance from such outlets, as well as high-SES adolescents in general. Skipping breakfast was a factor that may have reflected family eating patterns, however proximity of fast food outlets was not associated with the frequency of family dinners in the evening, suggesting that the findings among low-SES adolescents were unrelated to typical dietary patterns at home (Virtanen et al., 2015). The Finnish free school food for all is a unique system in a European context and one of the interesting observations was that low-SES adolescents were more likely than high-SES students to skip free school lunches and snacks if a fast food outlet was close to their school, which is suggestive of factors other than affordability dictating food choices of adolescents. A relationship between low socio-economic background and unhealthy diets in adolescents has been established in the literature, however the exact mechanisms explaining the SES differences observed by Virtanen et al. (2015) were not clear and the authors indicated further longitudinal research is warranted.

Héroux and colleagues (2012) examined lunch-time behaviour data arising from 13-15 year olds' participation in the HBSC studies in the US, Canada and Scotland with the addition of information about food retailers from Yellow Pages databases. Significantly more Scottish students (43.7%) consumed lunch at a snack bar, fast food restaurant or café compared to Canadian (7.7%) or US (2.6%) students. Only the lunch-time eating behaviours of Canadian students were related to the number of chain food retailers located within 1km of schools. No relationship to BMI was observed in any of the three countries. This study had several limitations, not least that differing school food practices and policies in each country were not included in the analyses. In contrast, a US study of over 500,000 adolescents showed a direct relationship between the presence of a fast food restaurant within half a mile of a school and student BMI, but not the density of fast food restaurants or other convenience food outlets. This study also observed lower fruit and vegetable and higher soft drink consumption among students with close access to fast food restaurants (Heroux et al., 2012).

While there is a logical flow to the assumption that easy access to affordable, low-nutrient, energy dense foods promotes poor dietary behaviours and weight gain, the current evidence linking food outlets with student BMI and eating behaviours is not consistent between studies. None the less, the negative influence of at least one fast food outlet within 1km of school appears to be a common finding across studies with adolescents (Virtanen et al., 2015; Smith et al., 2013; He et al., 2012; Davis & Carpenter, 2009). The impact is not just on the consumption of fast food, but also an observation of lower consumption of higher quality foods such as fruit and vegetables. Davis & Carpenter (2009) conducted the largest of these studies in the US and it was fast food, rather than any other type of food outlet, that influenced dietary behaviours, which is also a finding from Canadian studies (He et al., 2012; Heroux et al., 2012). The relevance of US and Canadian literature to youth from other countries, and the impact of outlets other than fast food restaurants are less clear. The variations Heroux et al. (2012) observed between Scotland, Canada and the US were indicative of socio-cultural differences between countries in school practices like student access to outside food

sources at lunch time, different types of local food retailers and student behavioural norms. Despite more food retailers being located within 1km of US schools than in Canada or Scotland, fewer American students typically sourced lunch from an external food environment (Heroux et al., 2012). Previous studies have shown the popularity of chip vans and independent food retailers in the UK (Macintyre et al., 2005; Bowker et al., 1999), while chain fast food outlets are more common in the US and Canada (Heroux et al., 2012). Studies that have examined the impact of local food retailers on overall dietary behaviours (Virtanen et al., 2015; Smith et al., 2013; He et al., 2012) are important, because accessibility to foods from these sources before and after school are also accounted for. However, different methods for examining dietary behaviour have been used by studies including an eating habits questionnaire (Virtanen et al., 2015), a healthy/unhealthy eating score derived from a questionnaire (Smith et al., 2013), and a purchasing behaviour questionnaire (He et al., 2012). The source of information about geographical location of food retailers was similar for these studies (Virtanen et al., 2015; Smith et al., 2013; He et al., 2012), however, only He and colleagues reported validating the presence of the outlets through field surveys, inspections of aerial photos or telephone calls (He et al., 2012). Literature reviews examining the relationship between food environments and obesity (Holsten, 2009; Feng et al., 2010) have concluded that cross-study methodological agreement, direct measures of the environment, individual level consumption, and longitudinal study designs are required to understand more fully relationships between changing food landscapes, potential 'obesogenic environments', dietary behaviours and weight status.

2.7.2 The impact of the built environment on physical activity

The built environment, transport infrastructure, urban planning and design, and recreational facilities all impact physical activity behaviours of young people. These factors have the potential to facilitate convenient, active modes of transport. Neighbourhoods that make it easier for young people to walk or cycle to school can have a significant impact on their physical activity levels (Sallis and Glanz, 2009). Community design, therefore, is relevant to youth physical activity and considered a public health issue. Lack of footpaths and bike lanes, long distances to schools and the

need to cross high-traffic, busy streets are reported barriers to active school transport (Sallis & Glanz, 2009). A systematic review of literature on the relationship between the built environment and active school transport in children and adolescents found distance to be the only consistently negative factor across studies (Wong et al., 2011). Most the of the studies included in the review (Wong et al., 2011) were American and Canadian, with only two studies from European countries (Switzerland and the UK). Safety issues including a main street crossing, a busy main road on the route or route directness were reported as barriers to active school transport from the European studies, however children were aged 9-14 years (Wong et al., 2011) and these safety concerns may not be relevant for older adolescents (Nelson et al., 2008).

An Irish study with over 4000 15-17 year old adolescents from 61 post-primary schools found that one third actively commute to school with a higher proportion of boys than girls doing so (41% versus 33.8%) (Nelson et al., 2008). This difference was mainly explained by more boys than girls cycling to school (9.4% versus 1.0%). Those who walked or cycled to school had average journeys (0.98 miles) that were significantly shorter than those who travelled inactively (6.31 miles). Findings by Nelson and colleagues agree with evidence from the wider literature (Wong et al., 2011) that distance is one of the strongest predictors of transport to school for adolescents, and this was independent of gender, socio-economic status, population density and school clustering. Criterion distance for walking and cycling to school in Ireland was calculated at ≤1.5miles (2.4km) and ≤2.5miles (4.0km) respectively. These distances differ from a Belgian study where distance criterion was estimated at 2.0km for walking and 8.0km for cycling among older adolescents (Van Dyck et al., 2010). Studies from other European countries including Belgium (Van Dyck et al., 2010), Portugal (Santos et al., 2009) and Denmark (Ostergaard et al., 2012) report that approximately two-thirds of older adolescents take active modes of transport to school. Comparing this with one third of Irish adolescents (Nelson et al., 2008) indicates that active school transport is a particularly under developed area for youth physical activity participation in Ireland. The support for active modes of transport in Belgium and Denmark is very much related

to strong cycling cultures and built environments that support active transport (Ostergaard et al., 2012; Van Dyck et al., 2010).

Qualitative interviews with older adolescents show that active transport is an important aspect of independence from parents, and friends influence the modes of transport they choose. Travel distance, access to bikes and weather were other considerations when deciding on mode of transport for this group (Simons et al., 2013). A quantitative survey by Verhoeven et al. (2016) in Belgium has highlighted the importance of social norms, social modelling and social supports in promoting active transport among older adolescents. If a minority of Irish adolescents are actively commuting to school, then issues with peer norms and social modelling are likely to exist as barriers at present. While the majority of Irish adolescents surveyed by Nelson et al. (2008) perceived distance (57%) and lack of time (17.2%) as the primary barriers to active transport, the authors have suggested that perceptions about distance represent a potential modifiable factor. Evidence from countries where cycling is the dominant mode of active transport would certainly suggest that interventions addressing social and environmental issues should be a consideration for interventions targeting active school transport among older adolescents (Verhoeven et al., 2016; Ostergaard et al., 2012; Van Dyck et al., 2010).

Active transport to school is particularly important for adolescents since their physical activity participation declines from childhood. Research shows that active transport contributes to physical activity levels, fitness and body composition (Larouche et al., 2014; Ostergaard et al., 2012; Carver et al., 2011). An Australian longitudinal study with three time points over 5 years found that active transport was associated with boys' and girls' moderate to vigorous physical activity behaviours in late adolescence, but not earlier (Carver et al., 2011). A Danish study examined the effect of active versus passive transport to school on the self-reported BMI of over 4,000 15 year olds in an urban area (Ostergaard et al., 2012). Cycling to school was associated with active students from higher-SES families of Danish ethnicity. After adjusting for possible confounding factors, cycling was still significantly associated with lower student BMI. Students who

walked to school had lower odds of being overweight. Larouche et al. (2014) reviewed the evidence on associations between active school transport and physical activity, body composition and cardiovascular fitness. Active school transport was significantly associated with higher physical activity levels in 82% of studies reviewed. Associations with body composition were inconsistent with 56% showing no difference between active and passive travellers, 36% showing a more favourable body composition and 8% a less favourable body composition for active travellers. Interestingly there was good evidence to support the cardiovascular fitness benefits of cycling to and from school but not walking (Larouche et al., 2014).

In summary, active transport to school can make a significant contribution to the daily activity levels of adolescents, and cycling in particular provides additional fitness benefits for young people. While distance is the most consistent factor predicting active transport to school across studies, the criterion distance between countries varies, particularly for cycling. Different socio-cultural norms with regard to walking and cycling exist between countries, and recent research has highlighted the importance of psychosocial factors (social norms, social modelling, and social supports) in influencing older adolescents to actively commute (Verhoeven et al., 2016). The challenges for Ireland include a social norm of passively commuting to school, longer distances to school, and poor infrastructures for active transport in rural areas (Nelson et al., 2008).

2.8 The Views of Adolescents

While the family and home are the constant features within the lives of children, the transition from childhood to adulthood during adolescence is a unique stage in human development. The various changes – physical and emotional developments, increasing independence and more significant extra-familial relationships – add layers of complexity to behaviour motivations. Factors unique to this time in life are likely to impact lifestyle choices. We know that sweet and savoury snack and soft drink consumption increases (Callaghan & Nic Gabhainn, 2013; NTFS, 2006) and engagement in physical activity participation significantly declines during the adolescent years (Belton et al., 2016; Harrington et al., 2014; Sullivan & Nic Gabhainn, 2013; Woods et al., 2010). Adolescents start to eat more meals away from home than they did in childhood and the energy contribution to the diet increases as a result (Lachat et al., 2012). The school environment also changes from primary to post-primary schools, level of independence in the local environment increases and young people gradually attain more freedom of choice. The question then is: how do adolescents manoeuvre through this time in their lives and what factors do they employ to make decisions, particularly with regard to food and activity behaviours?

Although they do not consistently follow them, it is generally agreed that adolescents have a good knowledge of healthy eating recommendations (Fitzgerald et al., 2010; Shepherd et al., 2005). In terms of knowledge of certain behaviours for health, adolescents easily identify behaviours that support eating healthily, for example, limiting junk food and finding "balance" in eating. Using semi-structured interviews with 12-13 year old Irish adolescents on the broad topics of health and happiness, O'Higgins, Sixsmith and Nic Gabhainn (2010) reported that nutrition and being active were considered by all to be important contributors to good physical health. There is little evidence, therefore, that young people lack information about what it means to eat well and be active in order to be healthy. In a systematic review, Shepherd et al. (2005) describe facilitators and barriers to healthy eating among adolescents. For young people, healthy food is associated with adults and the home and unhealthy or 'fast food' associated with friendship, convenience and life outside home. Healthy eating is linked

to dieting, slimness and fitness, while unhealthy foods like fast food are linked to bad skin and laziness. These body image perceptions relating to foods don't necessarily have a strong influence on food choice. Taste surfaced as the most consistent and important factor governing food choices during adolescence and would most likely be more influential than whether food is healthy or not. Poor food choice at school and in local environments poses major barriers to healthy eating according to young people. Socio-environmental supports that would allow young people to make healthier food choices are important for change, according to this review. Recommendations from this review include improved availability and price of healthy food in everyday environments and support from family and friends (Shepherd et al., 2005).

In terms of physical activity, Rees and colleagues conducted a systematic review of the research on facilitators and barriers to being active among 11-16 year olds (Rees et al., 2006). Most studies show that young people see physical activity as something positive and important to do. They find value in physical activity in terms of increasing health and fitness, developing new skills and creating opportunities for socialising and enjoyment. Gender differences were apparent in the literature, where young men see physical activity participation as confirmation of their masculinity; young women are more likely to value physical activity for weight maintenance and body toning. Competitive sports tend to be disliked by adolescents with low levels of physical activity participation. Not being good enough and feeling that lack of skill would reduce enjoyment is a major barrier to physical activity participation in many studies. Linked to this were fears about looking stupid in front of peers and getting negative feedback. Lack of motivation and being self-conscious of personal appearance in the context of being physically active (particularly in mixed gender groups) were barriers for young women. Practical issues like lack of time, lack of facilities and opportunities, and lack of transport all impact physical activity participation of young people. Many young people, particularly women, have negative impressions about school physical education (PE). Inadequate changing or shower facilities, lack of time to change, and negative or insensitive behaviour from PE teachers were cited as difficulties with PE. Facilitators of physical activity are frequently reported by young people who are already active.

Showing off skills, enjoyment and relieving stress all motivate young people to be active. Social supports from parents and friends are also important (Rees et al., 2006). In a large sample of Irish adolescents from the CSPPA study, reported enjoyment of both physical activity and PE were significant predictors of physical activity participation (Woods et al., 2010). The top reasons Irish adolescents dropped out of an activity as they got older were losing interest, times of the activity didn't suit, didn't like the activity leader, poor skill, and friends dropped out (De Róiste & Dinneen, 2006). According to young people, physical activity opportunities that are fun, social, accessible, and affordable would encourage more participation. Young women's ideas reflect a need for more equal opportunities in a wider variety of activities (Rees et al., 2006).

2.8.1 Qualitative research with adolescents

2.8.1.1 Food

Qualitative research enhances what we know from larger surveys and reviews by further examining adolescent discourse on diet and physical activity to understand attitudes and behaviours (Yoshida et al., 2011; Fitzgerald et al., 2010; Stevenson et al., 2007; Contento et al., 2006; Croll et al., 2001; Neumark-Sztainer et al., 1999). In food choice, a common theme among all studies is the strong influence of taste and food aesthetics – both in the preference for unhealthy food and as a barrier to healthy eating. Hunger, convenience, time constraints and situation specific (time, place) factors were reported as major influences on food choices and often barriers to healthy eating from adolescent single sex focus groups with 12 and 16 year olds in the US (Neumark-Sztainer et al., 1999). Familiarity with food or habit was reported from another US study that conducted individual interviews with 108 adolescents aged 11-18 years (Contento et al., 2006). Both Contento et al. (2006) and Neumark-Sztainer et al. (1999) used food choice tools to prompt and elicit discussion. In the first study students were presented with lunch options (Contento et al., 2006) and in the other students were asked, in advance of the focus groups, to record their food and beverage consumption for the previous 24 hours (Neumark-Sztainer et al., 1999). While these methods 'focus' the topic for discussion, it's also possible they limited discussion about wider socio-

environmental factors influencing food choice. A study by Stevenson et al. (2007) followed a less structured approach to interviewing groups of Irish adolescents in single sex groups (6 male groups, 6 female groups, 12-15 years old) with questions that focused on food and eating behaviours more generally. While taste still emerged as an important factor governing food choice, the authors found this factor to be bound up with unhealthy foods in terms of social desirability of certain foods, the normative expectation of peers, and subjective mood (Stevenson et al., 2007). A number of studies agree that adolescents seem to attach a low priority to healthy eating (Stevenson et al., 2007; Croll et al., 2001; Neumark-Sztainer et al., 1999). This may be related to their association of healthy eating with weight loss and disease management rather than general health and well-being (Stevenson et al., 2007), the higher priority of factors other than food and health in their lives (Neumark-Sztainer et al., 1999), and lower priority of long-term health (Croll et al., 2001). Attitudes and behaviours among peers (peer norms) that are unsupportive of healthy eating is another commonly reported barrier in the literature (Stevenson et al., 2007; Croll et al., 2001). Eating with peers becomes more important during adolescence and food choices in those situations are less healthy than food eaten at home (Fitzgerald et al., 2010; Story et al., 2002). When contrasting child (9 year olds) and older adolescent (18 year olds) focus groups, Irish researchers reported a divergence of perspectives at some point in childhood (Fitzgerald et al., 2010). Adolescents gain autonomy as well as some financial power, and extra-familial influences (peers, environmental factors) were stronger than they were for children. Although some financial autonomy provides adolescents with the means to buy food away from home, unhealthy foods are usually more affordable, according to Irish youth (Fitzgerald et al., 2010). Fitzgerald and colleagues (2010) observed that older adolescents had more control over their food choices than children as a result of eating more away from home, self-purchasing power, and the ability to prepare and cook food. Findings from this and another Irish study suggest that adolescents identify their personal food choices with unhealthy foods (Fitzgerald et al., 2010), yet depend on their parents to take care of their nutrition needs (Stevenson et al., 2007).

Other factors that impact adolescents' decisions about food include the school environment, cost of food, media and advertising influences as well as inconsistency in messages they receive with regard to food and health (Yoshida et al., 2011; Fitzgerald et al., 2010; Share, 2008; Stevenson et al., 2007; Story et al., 2002; Croll et al., 2001; Neumark-Sztainer et al., 1999). A study by Share (2008) in both Southern and Northern Irish schools found that discrepancies between formal health education and the school food environment resulted in confusion among students and posed a barrier to healthy eating. Stevenson et al. (2007) argue that it is a combination of internal (personal preference, taste) and external factors (including social desirability, social pressures, inconsistent media messages, social food rewards, and unhealthy food environments) that conflict with healthy eating knowledge to produce unhealthy eating behaviours.

Almost all of the studies cited in this section used single-sex focus groups and gender differences relating to body image were reported by some (Stevenson et al., 2007; Croll et al., 2001; Neumark-Sztainer et al., 1999). American girls reported changing how they ate to lose weight, while boys indicated height, muscle and weight gain were also motivators for dietary changes (Neumark-Sztainer et al., 1999). Stevenson et al. (2007) found that the importance of body image was particularly pronounced in girls' discussions, but both genders valued thinness and feared fatness. Girls were likely to discuss food restriction in relation to weight loss, while boys reported exercise as their behavioural strategy (Stevenson et al., 2007). Again, Croll and colleagues (2001) found that girls discussed healthy eating in relation to appearance, while boys were interested in healthy eating for energy and sports performance.

There is good agreement in qualitative literature that adolescents know of the benefits of healthy eating and being active. Barriers and facilitators of both can be found at all levels of the ecological health behaviour model with interpersonal, social, and environmental factors influencing their choices.

2.8.1.2 Physical Activity

Collier, MacPhail and O'Sullivan (2007) conducted a study with young and mid-adolescents in Ireland, examining the role of physical activity and sport in their lives through analysis of written narratives. Compared to the younger group (10-12 years), older girls (14-17 years) were less likely to mention physical activity in a description of their lives, indicating the diminished importance in later adolescence. Boys were more likely to share information about the soccer team they supported or their sporting role models, whereas girls mentioned pop stars, actresses and singers more often as role models (Collier et al., 2007). This gender difference in the role of physical activity in the lives of adolescents is widely acknowledged in the literature and it extends to the school setting where PE participation can be an issue in girls and mixed gender schools (Barr-Anderson et al., 2008; Brooks & Magnusson, 2006; Trudeau & Shepherd, 2008; Sallis et al.; 2000).

In 18 focus groups with 12-18 year old Irish adolescents conducted as part of the CSPPA study, Tannehill et al. (2015) found that the enjoyment of being with friends during physical activity was a dominant theme from all groups. Overall, fun and competition were the most common reasons cited by both boys and girls for participating in sport (Tannehill et al., 2015). While these findings refer to physical activity in general, the fun and sociability of being active with peers has also been reported as the most positive aspect of PE from focus groups with 15-16 year old adolescents in the UK (Smith & Parr, 2007). Smith and Parr (2007) specifically explored the nature and purpose of PE and found that young people acknowledged the relationship between PE and health, but felt that the time available for PE and the nature of the lessons were insufficient to make any demonstrable impact on their health (Smith & Parr, 2007). Lack of time is viewed as a barrier to PE and physical activity participation among Irish students (Tannehill et al., 2015). Tannehill and colleagues (2015) conducted their focus groups with gender compositions according to schools' composition (boys/girls/mixed) and separated students into active and inactive groups. In relation to PE, all groups felt strongly that inadequate time allotted to PE at school reduced the value they placed on the class and the potential enjoyment of it. More inactive boys and girls reported lack of time for

sport participation outside of school that was related to other interests and part time jobs now that they were older, and busy parents unable to transport them to training/matches (Tannehill et al., 2015). Despite negative attitudes to PE found among adolescents in Ireland and the UK, some see PE as a place to develop skills and enhance performance, which may be more relevant to those with an interest in sport (Tannehill et al., 2015; Smith & Parr, 2007). Generally, young people believe having a range of activities available would enhance PE participation, and older adolescents value choice, input into PE options, and being treated like adults in PE class (Tannehill et al., 2015; Smith & Parr, 2007). Choice, empowerment and being listened to were found to be key facilitating factors in an intervention to improve PE participation in a mixed gender school in the UK (Brooks & Magnusson, 2006).

Catering for students who are not involved in team or club sports with alternative activities has been recommended for PE because many students see this lack of alternatives to team based sports as a barrier to participation (Tannehill et al., 2015). Boys and girls who were rated as 'generally inactive' by their school or PE teachers in the CSPPA focus groups were more likely to discuss their interest in alternative activities to competitive sports such as informal play, cycling, swimming, pitch and putt, canoeing, and rock climbing (Tannehill et al., 2015). MacPhail, Kirk and Eley (2003) worked with adolescent groups (n=608, aged 14-18 years) on a single question: 'What can be done to help young people participate in sport?' Good conditions for participation were organisation, communication, sport promotion, and school and club provision. In terms of school provision, more time for PE and more opportunities to be active at lunch-times and after school were viewed as important (MacPhail et al., 2003). It may be concluded from current research with young people in Ireland, that time and variety are two of the most immediate factors requiring attention for the improvement of physical education at school (Tannehill et al., 2015; MacPhail et al., 2003).

2.9 Peers and Participatory Research

The influence of peers on health behaviours

After home life, the peer group and the school context influence adolescents the most (Viner et al., 2012; Kroger, 2007; Lerner & Castellino, 2002). A 2012 review by Viner and colleagues stated that safe and supportive families and schools, and "positive and supportive peers" were crucial to helping young people develop their full potential and attain the best health (Viner et al., 2012). Behaviours of close friends are known to be strong correlates of young adolescent health related behaviours, particularly outside of the home (Ali et al., 2011).

Recent review papers conclude that peer networks may be a critical element of prevention and intervention strategies for child and adolescent obesity (Fitzgerald et al., 2012; Salvy et al., 2012). Observational studies with adolescents have documented significant correlations between adolescents' weights and the average weight of their immediate peer group, particularly among young people with high BMIs (Valente et al., 2009; Trogdon et al., 2008). Studies show that a combination of selection effects (the formation of relationships with similar individuals), environmental confounders and genuine peer influences explain shared weight related behaviours within social networks (Barclay et al., 2013; Ali et al., 2011; de la Haye et al., 2011). A survey with almost 3000 Swedish 19 year olds found that the probability of engaging in regular exercise and eating a healthy diet was higher when individuals had friends who engaged in these activities, and the stronger the relationship between individuals, the greater the probability of similarities in behaviour (Barclay et al., 2013). A physical activity focused study (de la Haye et al., 2011) found that both friend selection and assimilation of behaviours among friends played a role in physical activity behaviours in adolescent social networks. An important finding of this study was that selection of friends with similar physical activity behaviours was actually explained by the tendency for adolescents to make friends based on similar attitudes, rather than behaviours. These attitudes can also be influenced, and change within the social network and lead to direct social network influences (de la Haye et al., 2011). Longitudinal data from the US 'Add Health' study with almost 4000 adolescents found significant peer effects for playing

sport, engaging in regular exercise and the frequency of eating in fast food restaurants, but not for TV viewing, eating 5 servings of fruit and vegetables, calorie dense snacks, and breakfast consumption (Ali et al., 2011). Eating and exercise activities centred outside of the home, therefore, are of particular interest when examining the potential influence of peers. Peers can be both a positive and negative influence in terms of health related behaviours. Positive peer support, friendship and acceptance can improve physically activity participation and eating behaviours (Fitzgerald et al., 2013; Fitzgerald et al., 2012).

2.9.1 Participatory research

Participatory models of health promotion research and education are based on the principles that young people share a social world with their peers that is different to the social world of adults, they possess a common language, they are competent to act on topics that affect their lives and they feel a greater sense of empowerment by being part of the research process (Griebler et al., 2012; Mayall, 2008; Murray, 2006). Participatory approaches are part of a democratic health promotion process, where young people are active participants in knowledge generation and have genuine choices that are potentially effective (Simovska, 2007).

Participatory research with children and adolescents is recommended across a range of disciplines and advocates of the approach emphasise the potential for more robust research findings, targeted interventions and social action (Langhout & Thomas, 2010; Simovska, 2007). Young people can also develop skills through guided participation and active involvement (Langhout & Thomas, 2010). A review of children and adolescents in community based participatory research by Jacquez et al. (2013) found that where participatory methods are used, youth typically participate in the identification of needs, priorities and goals of research (77% of studies reviewed), and in designing or conducting the research (84%). Participation in youth advisory boards (59%), data analysis (54%), and disseminating research findings (52%) were observed less often in the literature (Jacquez et al., 2013).

A recent review shows that peer involvement in school health promotion can improve participants' skills, knowledge, self-esteem, self-efficacy and their sense of social effectiveness (Griebler et al., 2012). Very often, one of the aims of participatory research is to create conditions for social action (Duckett et al., 2010; Langhout & Thomas, 2010). Key principles underpinning the Health Promoting Schools approach are democracy and the empowerment of students (WHO, 1997). Griebler and Nowak (2012) define student participation as *"involvement of students in collective decision making processes at school or class level that requires a dialogue between students and other decision-makers."* Student participation in councils is common, along with less frequent types of participation including temporary working groups, once-off consultations, and less formal participation in class and school decision making (Horgan et al., 2015; Griebler & Nowak, 2012). Recent research indicates that, outside of student councils, Irish post-primary schools offer limited processes for student participation and decision-making (Horgan et al., 2015). While principals and teachers rate the formal student council system, the wider, non-appointed student body does not feel it addresses their views fully. Findings from a systematic review by Griebler and Nowak (2012) show that students who represent their peers on student councils report gaining responsibility, a sense of agency, communication skills, problem-solving skills, and self-confidence. Benefits for the whole student body are less clear. A study with Irish 10-17 year olds found that school participation (in making school rules, expressing views and organising school events) was associated with positive school perceptions and positive health and wellbeing (de Roiste et al., 2012). Reported participation levels were lower among older students in this study, indicating inadequate opportunities for participation at post-primary level.

Carlsson and Simovska (2012; Simovska and Carlsson, 2012) have demonstrated that the process of student involvement in identifying problems and planning change around school food and physical activity helps to develop their confidence and sense of ability to effect change. The authors were evaluating the IVAC model (Investigation-Vision-Action-Change) as part of a European schools health promotion project – Shape Up. The 'investigation' and 'vision' stages of the IVAC participatory model are considered as

important as the 'action' and 'change' stages because students learn by experience at each stage. In this way, they become more aware of problems and how to develop appropriate solutions.

While a number of studies have actively involved students in food and physical activity interventions in the school setting (Simovska & Carlsson, 2012; Bogart et al., 2011; Meninger et al., 2010; Hamden et al., 2005), for some participation can be limited to peer education and advocacy rather than full participation that includes problem identification and study design. Two US studies, for example, recruited and trained peer advocates as a means of promoting new healthy foods at school in interventions designed by adult researchers (Bogart et al., 2011; Hamden et al., 2005). In one study attitudes and behaviour changes were observed among peer advocates only (Bogart et al., 2011), and in the other both highly involved and less involved students reported increased awareness and trying of healthier options, with more significant positive outcomes among active participants (Hamden et al., 2005). Gaining leadership skills were reported by peer advocates in both studies and this sense of autonomy and decision making power were considered to be factors influencing the experiences of highly involved students (Bogart et al., 2011; Hamden et al., 2005). That other students were less affected by the interventions suggests engagement issues, and perhaps a lack of attention to local food issues in individual schools.

Involving young people in research to understand the nature of problems within the school setting, and supporting them to take leadership in influencing policies and decisions are core aspects of youth participatory research (Ozer, Ritterman & Wanis, 2010). Simovska and Carlsson (2012) described five European case studies where students successfully changed or enhanced food and physical activity practices at school. Examples of interventions were free fruit at breakfast, establishing a vegetable garden at school, removing hot dogs from the canteen, changing the content of the vending machine, establishing a bicycle workshop at school, increasing the safety of the traffic around the school and using the local swimming pool for PE classes. Interventions in each school were unique, illustrating that students were involved in

problem identification within their own settings and were given scope for change based on their findings. Three main forms of participation were reported for the change processes in this study – participation as a motivation strategy, as a teaching-learning strategy and as an influence strategy. Problem identification and vision for change were considered critical stages in terms of influencing students' motivation, learning and influence (Simovska & Carlsson, 2012).

A number of challenges to using participatory research methods in the school setting are reported in the literature (Duckett et al., 2010; Ren & Langhout, 2010; Simovska & Carlsson, 2012). Conflict typically arises when traditional school approaches don't match with the aims of participatory methods. Lack of support from teachers because of students missing important academic classes can be a barrier for student participation (Simovska & Carlsson, 2012). This point highlights the often inflexible nature of school curricula and timetables, and the limitation this places on student participation in school life. Ren and Langhout (2010) found that a school superintendent did not agree with their stance that children would know more about playground behaviour than staff, and thought that their involvement as collaborators was a waste of time and resources. Although the researchers continued to collect data with children through adult-led observations and focus groups, their preferred methods of teaching students "relevant social science methods so that they could be involved in data collection and analysis" were not possible (Ren & Langhout, 2010: 127). Duckett and colleagues (2010) met a conflict with the local education authority who attempted to censor the reporting of findings on bullying within schools because they felt the students' views may be biased, unsubstantiated and inaccurate. In addition, the sustainability of student-led initiatives in the school setting is always under question unless sufficient time, resources and support are provided (Simovska & Carlsson, 2012; Bogart et al., 2011). Despite a provision for democratic processes and empowerment in the blueprint for Health Promoting Schools (WHO, 1997), a number of factors have been outlined that make education settings difficult for the use of participatory research processes. Notwithstanding these challenges, strong theoretical and methodological rationales as well as research outcomes exist to support student involvement in health

promotion research at school (Griebler et al., 2012; Simovska & Carlsson, 2012; Simovska, 2007). When young people are involved in decision making, they are more likely to engage positively with the outcomes (Simovska, 2007). The same rationale exists for youth consultation in the research process – not only does it afford young people their right to have their voices heard, it also raises awareness and supports their participation in outcomes for change. At present, there is a national conversation about obesity and within that, the role of schools. Despite recommendations to include their voice (NOTF, 2005), young people are still under-represented in this conversation (Horgan et al., 2015; DoHC, 2009).

2.10 Gaps in Current Knowledge

This review of the literature began with an examination of overweight and obesity prevalence rates for Irish adolescents and explored known diet and physical activity behaviours that are contributing to these. Increases in energy dense food consumption and reductions in physical activity participation are two major health behaviour issues during adolescence. It was established that the school setting plays a major role in promoting healthy eating and physical activity participation to adolescents. The available evidence indicates that Irish post-primary schools are not providing adequate opportunities for their students to eat healthily, be sufficiently active or be involved in decisions relating to these aspects of school life. While recommendations and guidelines exist, Irish post-primary schools are not currently subject to national policies on food or physical activity provision for students. A number of gaps for the Irish school setting were identified in the literature, which were used to inform the aim and objectives for the current study.

No previous research has:

- Explored how the provision of and access to food in the school setting influences the diet and nutrient intakes of adolescents in Ireland.
- Explored how the provision of and access to physical activity within the schools setting influences the fitness and physical activity levels of adolescents in Ireland.

- Captured the views of Irish adolescents, teachers and principals in relation to the current provision of and access to both food and physical activity at school.

2.11 Research Question, Study Aim, and Study Objectives

Research Question

How do post-primary school practices, policies and infrastructures impact the diet and physical activity behaviours of students?

Aim

The overall aim of this thesis was to conduct an in-depth study with post-primary schools to explore the impact of the school setting on the quality of dietary intake and physical activity levels of students

Objectives

1. To recruit students and staff from a convenience sample of Irish post primary schools (all female, all male, mixed, urban and rural, disadvantaged).
2. To engage students as active participants, in so far as possible, in the research process.
3. To explore the school setting in terms of food and physical activity policy, practices, cultures and infrastructures.
4. To capture the views of the students and staff about food and physical activity practices in their school.
5. To measure the anthropometry of the students.
6. To examine student's physical activity levels.
7. To examine student's fitness levels.
8. To investigate the associations between anthropometry, reported physical activity levels and fitness.
9. To examine nutrient intakes of students, and further investigate the food and nutrient content of school day lunches.
10. To examine how school policies, practices and infrastructures impact the food available to, and nutrient intakes of students.
11. To identify barriers and facilitators to healthy eating and physical activity in the school setting make recommendations for future research and practice.

Chapter 3

3 Methodology

3.1 Introduction

This chapter outlines the design and methodologies employed in the study. The first section (Section 3.2) describes the overall study design and the rationale for choosing it. In the next section (Section 3.3.) the subject of employing mixed methodologies within the study design is explored. The background and rationale for using mixed methods are presented, and other potential methodologies to address the research questions are considered. In Section 3.4 participatory research processes are explored from a methodological perspective. The practical aspects of carrying out the study are described from Section 3.5 to Section 3.10 including the development of methodological protocols, school and participant recruitment, practical aspects of data collection, data management and data analysis. Ethical considerations and the process of obtaining ethical approval are outlined in Section 3.11. The Chapter concludes with a short description of the participating schools and a guide for the reader on the style of presentation used in the subsequent chapters of the thesis.

3.2 Study Design

Cross-sectional Study

Bryman (2012: 58) defines a cross-sectional research design as *"…the collection of data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables (usually many more than two), which are then examined to detect patterns of association."* Cross-sectional studies can be purely descriptive (i.e. defining a problem, disease or behaviour), or they can be undertaken to investigate the association between exposure to risk factors and the outcome of interest. One limitation of the analytical cross-sectional design is that while associations can be identified, it is difficult to establish

causal relationships because measurements of exposure and outcome are made at the same time (Bryman, 2012; Bonita et al., 2006).

A rationale for employing this design, as outlined by Bonita et al. (2006), is that cross-sectional studies can be useful for assessing the health-care needs of populations or populations groups by providing indications of trends. The current study had a clear purpose – to address gaps in knowledge about how the Irish post-primary school setting influences the diet and physical activity behaviours of students. The main advantages of using a cross-sectional study design to address this broad question were (1) the design offered an opportunity to identify associations and trends that would expand our current knowledge of the Irish post-primary school system (2) cross-sectional designs are relatively inexpensive to conduct, and (3) a cross-sectional design was realistic with the time-frame of a PhD project.

Cross-sectional study designs can include many research methods, both quantitative and qualitative. Willenberg et al. (2010) demonstrated a cross-sectional design with a mixed methods approach when they investigated the impact of the school environment on the physical activity behaviours of children at break times. The researchers quantified children's physical activity levels, created school environment variables based on observations, and conducted focus groups with children to understand how the two interacted. Willenberg et al. (2010) were interested in identifying common environmental factors that promoted greater levels of physical activity in the playground. While this could have been done in a purely quantitative manner, the meanings children attached to patterns of behaviours in the playground were important. Children were able to convey the importance of how different factors interacted to produce or explain their behaviours (Willenberg et al., 2010).

The rationale for obtaining a cross-sectional sample of adolescents in the school context for the current study was based on the assumption that patterns of eating and physical activity behaviours would be identified. The question of whether these patterns could be generalised for the adolescent population arose. In order to address this schools that

would represent Irish adolescents in terms of gender, geographical spread, and socio-economic status were sought. Achieving a representative sample of adolescents, however, was not without challenges, and this is discussed further in Section 3.3 of this chapter and later in the limitations of the study in Chapter 9.

A case study was another possible design for studying the impact of schools on the health behaviours of their students. According to Creswell (2007: 73), *"case study research is a qualitative approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information, and reports a case description and case-based themes."* Yin (2014) takes this further and argues that within case-study research there is the potential to identify associations and even causal relationships. He also acknowledges the potential for combining qualitative and quantitative data within a case study design, which is in contrast to the views of others who see it as a purely qualitative approach (Yazan, 2015; Creswell, 2007).

Measuring eating and physical activity behaviours of students within the school setting quantitatively was set as an objective for the current study. This decision was influenced by gaps identified in the literature and the researcher's background in the nutrition discipline. The research questions posed in response to the literature review placed the current study at odds with some of the usual epistemological commitments of case study research as described by Creswell (2007), Yin (2014) and Yazan (2015). For Creswell (2007) and Yazan (2015) the definition of case-study research is not expanded to include quantitative or mixed methods. Simovska and Carlsson (2012) provide a good example of a case study in the school setting where students were involved as agents of health promotion changes. The authors drew from interviews, project documentation, web portal data and observations in their school based case study research. Data were initially analysed within single cases, followed by the presentation of cross-case findings. While Yin (2014) does allow for quantitative or mixed methods in theory, in his approach case study designs are also concerned with the 'how' and 'why' of behaviour or phenomenon. Surveys, however, look at 'who',

'what', 'where', 'how many', 'how much'. All these forms of research questions were incorporated into the current study – i.e. to measure who, what, where, how many and how much in relation to student behaviour, but also to understand the how and why these behaviours come about.

Mixed methods literature offered flexible methodological approaches within the cross-sectional design. A pragmatic approach, which imposed no limits on the methods used to address the study question, was taken (Morgan, 2007). This gives priority to the research question and allows the researcher use of a full array of quantitative and qualitative methodologies. Research methods were chosen in the view that they were appropriate to use with study participants and would contribute understanding to the underlying question of the study (Teddlie & Tashakkori, 2009). A mixed methods approach allows for interdisciplinary collaboration, where researchers contribute their respective expertise to address a common problem. Supervisors from a range of disciplines including nursing, anthropology, paediatrics, physical activity, nutrition and medicine were available for advice during all stages of this study. Collaboration, where researchers can contribute from a disciplinary specific bases, is recommended for successful mixed methods research in the health sciences (Creswell et al., 2011).

3.3 Mixed-method Research (MMR)

Background

An ecological health promotion model with participant collaboration was described in the literature review as the theoretical framework used for this study (Richard, Gauvin & Raine, 2011; Wendel et al., 2009; Sallis, Owen & Fisher, 2008; McLeroy et al., 1988). Irish secondary schools were the ecological settings with adolescent students the main social actors in that world. It was established that while contextual information about settings is an essential component of any ecological model research, the constructions participants create about their environments are equally important (Richard, Gauvin & Raine, 2011; Sallis, Owen & Fisher, 2008; Bronfenbrenner, 2005). An acknowledgement of this supports the use of collaborative approaches to research with participants, and the use of methods that can explore their subjective experiences (Richard, Gauvin &

Raine, 2011; Wendel et al., 2009; Stokols et al., 2003). Mixed-methods approaches are increasingly used in ecological health promotion research and allow the researcher to draw on a range of qualitative and quantitative methodologies (Creswell et al., 2011). The advantages of mixed methods within a study employing collaborative and participatory approaches are that people, their behaviours and attitudes, and their social and physical environments can be viewed from subjective and objective angles (Lucero et al., 2016; Creswell, 2011).

A mixed-method study refers to one that incorporates both qualitative and quantitative data collection and analysis in the same study (Creswell & Plano Clark, 2007; Teddlie & Tashakkori, 2009). Mixed-method approaches have been widely used for some decades, typically in sociology, social psychology and business disciplines (Bryman, 2006). They are increasingly popular and encouraged in other disciplines, including public health and health science research (Creswell et al., 2011). In essence MMR combines the strengths of both types of inquiry, which can be particularly useful when searching for explanations about behaviours. The definition and designs of MMR approaches are very much evolving as their popularity increases. There are alternative terminologies depending on the worldview of the researcher and typology of methods integration (Teddlie & Tashakkori, 2009; Bryman, 2006). Most mixed-methods researchers agree on one key element - the importance of integrating data from multi-methods at some point in the study. It is the combination of data or findings that characterise MMR designs. The timing of and rationale for integration depends on the overall study design.

3.3.1 Rationale for MMR Approach

The general rationale for a mixed-method approach is to overcome the limitations of a single-method study. In research with children and young people, it is useful when the research problem can "be seen from as many fruitful angles as possible" to obtain a better understanding of micro- and macro-influences (Qvortrup, 2008, Page 81).

Teddlie & Tashakkori (2009) outline three areas where mixed methods are superior to a single approach. The first is that MMR can answer research questions that the other methodologies cannot, the second that MMR provides stronger causal inferences (e.g. factors influencing behaviour) and thirdly, MMR provides opportunities for uncovering a diversity of views.

Depending on the rationale for MMR, there are a number of considerations for the researcher at the planning and design stage (summarised by Bryman, 2006):

1. What is the rationale for integration – e.g. triangulation, explanation or exploration?
2. Are quantitative and qualitative data collected concurrently or sequentially?
3. Does one approach have priority over another or are they equally important?
4. At what stage(s) of the research does the MMR occur –e.g. data collection, analysis, interpretation?

A mixed-methods approach was employed in this study for a number of reasons. Understanding attitudes, knowledge and behaviours requires an examination of people in their personal and socio-environmental contexts. Any single-method approach has limitations in terms of exploring all these layers. Combining methods in this study will allow the researcher to (1) answer questions that cannot be answered by quantitative or qualitative methods alone, (2) provide a more complete picture of the lives of adolescent participants, and (3) use findings from one approach to help explain phenomena or results generated from the other approach.

The data collection sequences for the mixed-method approach in the current study was a concurrent model, whereby quantitative and qualitative data were collected in the same phase and both methodologies had equal status within the study (Creswell & Plano Clarke, 2007). A parallel mixed analysis process, as described by Teddlie & Tashakkori (2009) was undertaken, whereby the quantitative and qualitative datasets were analysed separately. The integration of data from various sources occurred at the interpretation stage. Emerging themes from interviews with adolescents, teachers and

principals and visual photographic analysis contributed to the interpretation of quantitative findings. Figure 3.1 illustrates the various methodologies undertaken in the study.

3.3.2 Mixed-method versus single-method research

Current literature generally reports child and adolescent obesity, diet and physical inactivity from a purely quantitative or qualitative perspective. Previous quantitative studies exploring the influence of the secondary school environment on the diet and physical activity behaviours of students have used similar methods of defining environmental characteristics and varying methods of assessing behaviours. The effects of food (Driessen et al., 2014; Briefel et al., 2009; Kubik et al., 2005; Kubik et al., 2003) and physical activity (Brusseau & Kulinna, 2015; Czerwinski et al, 2015; Rashad Kelly et al., 2010; Haug et al., 2008) environments are typically explored independently. Briefel and colleagues (2009) characterised school food environment and practice with 20 binary variables developed from questionnaires with school principals and food service directors, school site observation checklists and school menu data in 287 US schools. The dietary behaviours of students (n=2314, ages 6 to 18 years) was obtained through a 24-hour dietary recall. This study built on previous US research by examining practices related to the provision of low-nutrient, energy dense foods (Kubik et al., 2005; Kubik et al., 2003) and demonstrated that students' energy consumption was related to some of these practices (Briefel et al., 2009). The link to existing knowledge was a strength of the study design, as was the large and representative school and participant samples, which bolstered the inaccuracies associated with the 24-hour recall method. Other studies have used similar school food environment scores or scales and explored the relationship with student BMI (Fox et al., 2009; Kubik et al., 2005). A systematic review of school food environment interventions and dietary behaviour or BMI outcomes found that food sales data and self-reported dietary behaviours – including food diaries and dietary surveys - were the most common quantitative methods used in the 18 studies described (Driessen et al., 2014).

Research approaches examining the effects of school physical activity practices are similar in that school level and student data are collected. As part of the HBSC study in Norway (Haug et al., 2008) and Germany (Czerwinski et al, 2015), for example, questionnaires with school principals were used to define school physical environment characteristics, with students' physical activity and interests in physical activity assessed through self-completed questionnaires. Others have used management level reporting to characterise physical activity practices at school, but employed more direct measures of student physical activity and fitness (Brusseau & Kulinna, 2015; Rashad Kelly et al., 2010), and some studies have narrowed their focus to examine the effects of PE time on cardio-respiratory fitness (Erfle & Gamble, 2015; Ardoy et al., 2011) and metabolic markers (Klakk et al., 2014; Telford et al., 2013).

Although a combination of healthy eating and adequate physical activity is recommended for the school setting to promote healthy body weights among young people (WHO, 2016), few studies have reported the impact of both school food and physical activity environments together. One such study by Sallis and colleagues (2003) estimated the behaviours of the 'average' student by observing PE class and break times rather than using objective measures of student physical activity levels, and fat analysis of available food rather than food consumption data. The authors cite resource limitations as the reason for restrictions placed on the methods used in the study (Sallis et al., 2003). So while the combined characteristics of healthy or unhealthy school practices are documented in the literature (Watts et al., 2014; Story et al., 2009; WHO, 2008), reporting the impact on behaviours in the same study poses a greater challenge. In addition to extra resources, using reliable methods to study both behaviours requires more lengthy data collection periods in schools and expertise from nutrition and human performance disciplines.

What is absent from quantitative approaches described, in the context of a collaborative ecological study design, is students' descriptions and perceptions of their school food and physical activity environments and practices, and the relative influence their constructions have on behaviours. Typically school principals or food service managers

describe school environments and students are consulted, if at all, by participation in food and physical activity surveys or fitness tests. Not only does this approach omit the views of the most important school stakeholders, interventions arising from such research may not be targeting subtle but important elements of school life that have significant impact on student behaviours. Assessing student experiences with or attitudes about their environments can be done from a quantitative perspective through a self-report survey, for example (Lytle et al., 2004); however qualitative approaches are particularly appropriate for exploring subjective human experiences in context (Denzin & Lincoln, 2005).

Focus groups have commonly been used as a qualitative method of exploring the views of children and adolescents on health behaviour topics including diet (Yoshida et al., 2011; Fitzgerald et al., 2010; Share, 2008; Stevenson et al., 2007; Croll et al., 2001; Neumark-Sztainer et al., 1999) and physical activity (Tannehill et al., 2015; Smith & Parr, 2007). Other approaches include individual interviews (Contento et al., 2006), written narratives (Collier, MacPhail and O'Sullivan, 2007), and participatory photography (Wilson et al., 2012; Barron, 2011; Nic Gabhainn & Sixsmith, 2006). These approaches reveal a more complex range of factors influencing food choice and physical activity behaviours such as the social desirability of certain eating and physical activity behaviours, peer influences, adolescent independence and the inconsistency of health education messages with school environments and practices (Tannehill et al., 2015; Fitzgerald et al., 2010; Share et al., 2008; Smith & Parr, 2007; Stevenson et al., 2007). Qualitative approaches are frequently used as a method for more active student engagement with issues surrounding food and physical activity choice at school (Simovska & Carlsson, 2012; Brooks & Magnusson, 2006; Lytle et al., 2004), which is in line with principles from the WHO Health Promoting Schools framework (WHO, 1997).

For the current study potential single-method approaches included:

- Pure quantitative: survey of school environment characteristics, student survey assessing knowledge, attitudes and behaviours, principal, teacher and catering staff surveys, and student anthropometry, food records, and fitness testing.

- Pure qualitative: Group and individual interviews with students, principals, teachers, parents, and environmental observations mapping food and physical activity environments.

Collaborative methods are possible in both of these approaches and students and other school stakeholders could be involved from the earliest stages in terms of study design, recruitment methods and content of data collection tools. The advantages of using a quantitative study design include the availability of pre-existing validated data collection tools, international health science definitions of weight status, nutrition status and fitness levels for the study sample, the possibility of comparing results with studies using the same tools, and examining associations between variables. Health science research is traditionally quantitative in nature and seeks to provide measurable evidence, to establish causal inferences, to create the possibility of replication and generalisation to a population, and to facilitate the comparison of groups (Creswell, 2011). The HELENA study is an example of how a quantitative nutrition and physical activity study design delivers on the advantages of quantitative research where findings from a large number of participants can be used to represent European adolescents (Vicente-Rodriguez et al., 2007). In smaller cross-sectional studies, however, generalisation of findings to a population can be limited by a number of factors that are often related to time, resources, and sampling frame (Bryman, 2012). These factors were relevant here because the study was being conducted by one PhD researcher over a pre-defined time-frame with limited resources. An important drawback of taking a purely quantitative approach in the current study was the limitations pre-defined measures would place on available data. Although food and physical activity practices within Irish secondary schools have been described before this study began (Kelly et al., 2010; Woods et al., 2010) and more recently (Callaghan et al., 2015; Shanley, 2015; Tannehill et al., 2015), compared to other jurisdictions we still lack understanding of how policies, infrastructures, practices and cultures come about and how they influence student behaviour. In the US, for example, Briefel and colleagues (2009) built a quantitative school environment scoring tool informed by a large body of existing evidence. Although we can learn from studies such as this, the tools are not directly transferable to the Irish context. As described in the literature review, the education

sector in Ireland is different to well-researched jurisdictions, particularly in relation to food provision, and there is a strong case to be made for studies that are exploratory and designed for Irish secondary schools.

In ecological models, both the objective and subjective elements are viewed as important in driving human development and behaviour. Where quantitative research is driven by pre-defined hypotheses, qualitative research is open to the generation of theory and hypotheses (Denzin & Lincoln, 2005; Richards, 2005). Focus groups, interviews, observations, document examination, photo, video or internet inspection are all examples of commonly used qualitative methods. The subjective or experiential qualities of human to human and human to environment interactions are less fact based and more loaded with emotion and motivation. They pertain to individual feelings such as "anticipations, forebodings, hopes, doubts, or personal beliefs" (Bronfenbrenner, 2005, p.5). Qualitative research methods are especially useful for exploration and discovery. They are defined as naturalistic approaches that seek to understand phenomena, including routine and problematic moments, as well as meanings, in the lives of individuals in context-specific settings (Denzin & Lincoln, 2005). Qualitative enquiry can provide understanding, context and depth where other methods fall short, about groups of people or topics that are poorly understood. Interpretation of qualitative data can help explain how behaviours come about in a more natural way than quantitative approaches (Denzin & Lincoln, 2005).

A discomfort associated with qualitative research, particularly within public health or health science disciplines, is the lack quantitative outcomes on causal inference and the view that findings cannot be used to generalise population behaviours as study samples tend to be small (Bryman, 2012). Qualitative researchers would argue that data arising from their approach provide more depth and understanding of behaviours, therefore are essential in bringing real understanding to problems in society (Denzin & Lincoln, 2005). Mixed methods research brings this concept a step further and integrates qualitative and quantitative methods and findings to "combine the power of stories and the power of numbers" (Pluye & Hong, 2014).

In the context of collaborative research processes with young people, qualitative methods have been used by many studies and are particularly appropriate because young people are afforded the opportunity to express their voice and tell their story (Barron, 2011; Chen et al., 2010; Simovska, 2007; Murray, 2006; Nic Gabhainn & Sixsmith, 2006; Punch, 2002). Based on available evidence, qualitative methodologies were considered the most appropriate means for collaborative processes exploring the views of students about their schools and their behaviours. With other school stakeholders (principals, teachers), qualitative methods were also favoured because they allowed for deeper exploration of school issues with health promotion, would provide more opportunities for unexpected findings (Richards, 2005), and had the potential to contribute new findings to school based literature for Ireland.

3.4 Participatory Research

Since the UN Convention on the Rights of Child (UNCRC, 1989) stated the importance of the rights of young people to meaningful participation in decisions that affect their lives, there is a duty on researchers to address it in study designs.

> *"State Parties shall assure to the child who is capable of forming his or her own views the right to express those views freely in all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child" (Article 12, United Nations High Commissioner for Human Rights, 1989)*

Ireland ratified the UNCRC in 1992 and the Department of Children and Youth Affairs have since provided guidelines and findings emphasising the importance of appropriate research and participation with, rather than on, young people (Horgan et al., 2015; DCYA, 2012). Active participation therefore is appropriate and increasingly popular in studies with children and young people (Alderson, 2008). The European Network of Health Promoting Schools, of which Ireland is a member, promotes democratic processes and active student participation (Griebler et al., 2012; Simovska, 2007; WHO 1997). Power disparities between the researcher and youth participants pose one of the biggest challenges in childhood research and participatory approaches help to reduce or remove these (Mayeahll, 2008; O'Kane, 2008). Meaningful consultation can empower young people and help them to acquire skills, competencies and knowledge, take responsibility for their own health behaviours, and increase self-confidence and self-efficacy (Griebler et al., 2012).

Studies have shown that peer-led education can be as effective as adult led programmes in terms of knowledge and behaviour change (Harden et al., 2001; Mellanby et al., 2000). Peer-led research and education share the same underlying assumptions: young people share a social world with their peers that is different to the social world of adults, they possess a common language, they are competent to act on topics that affect

their lives and they feel a greater sense of empowerment by being part of the research process (Griebler et al., 2012; Mayeahll, 2008; Murray, 2006).

Consultation with young people at each stage of the research process is in the spirit of true youth participation. Young people getting involved in a project should be afforded the following:

- An understanding of the intentions of the project.
- An awareness of who made the decisions concerning their involvement.
- An opportunity for a meaningful role.
- Once informed, the option to volunteer for the project (Hart, 1992).

The importance of these opportunities are echoed by others in social science research with young people, and O'Kane (2008) would add that participatory techniques are most effective when false expectations are not raised and where stereotypical views of methodologies and children can be set aside.

The methods in this study involved an adult-led enquiry with adolescents invited to take up a meaningful role within it. Adult researchers, in response to concern about increasing overweight, obesity, and poor diet and physical activity patterns among adolescents, formulated the question under study. Adults initiated the research process from ethical approval to recruitment. Participatory elements were initiated after successful ethical approval, when adolescents from pilot schools were invited to join a youth panel, who advised on elements of the project design and potential peer-led research methods. According to Lerner et al. (2005) programmes involving youth participation are mostly likely to succeed if they involve *"positive and sustained adult-youth relationships, youth skill-building activities, and opportunities for youth participation in and leadership of community-based activities".* The youth panel and pilot stages of the project were used to explore the proposed research methods with 15-17 year old adolescents and as far as possible, inform the research tools to be appropriate for this age group.

It was clear that young people on the youth panel were interested in the topic under study and thought their peers would be too. At the youth panel and pilot stages, there was time and scope for participants to influence the content and design of methodological tools within the study. Adolescents led two particular methodologies, where their active participation as researchers was expected to enhance findings and have benefits for them. These were peer-led focus groups and student observations of school environments. A strong rationale for peer focus group interviewers is that, in certain groups, an outside researcher may not be able to elicit in-depth, inside data that a peer or community member could (Murray, 2006; Kreuger & King, 1998). This is relevant for adolescents, who are in a transition stage between parental/adult control and independence. Environmental observations by peer researchers through visual techniques were employed to obtain a view of the school and local environments through the eyes of students. Young people generally feel that adults are in control of their worlds, and this adds generational issues to any adult-led research (Mayeahll, 2008). By reducing a known power disparity between the researched and researcher, it was believed that peer-led focus groups and student observations would help to maintain more 'real-life' situations for adolescent participants, which would yield more honest findings.

Based on current literature, it was envisioned that peer researchers in the study would benefit from their active involvement. The potential of peer initiatives to improve knowledge, change attitudes and improve self-efficacy with regard to a variety of health-related behaviours is increasingly recognised (Griebler et al., 2012; Carlsson and Simovska, 2012; de Roiste et al., 2012; Simovska 2004; Story et al., 2002; Turner, 1999). A recent systematic review of student participation in school health promotion fully explores the literature, summarising a variety of topics using participatory methods including healthy eating, physical activity, obesity prevention, sex education, alcohol, tobacco and substance use prevention, first aid, and mental health (Griebler et al., 2012). The most frequently reported positive outcome was the personal impact on students (mostly "satisfaction, motivation and ownership"). Other positive effects of participation were improved relationships and interactions – both peer and adult - and

improvement in school culture or infrastructure. Research with Irish adolescents has shown that active participation in school life is associated with a more positive view of school and positive wellbeing and health (de Róiste et al., 2012). Unfortunately, young people in Ireland feel they have little say in decision making in the school context at present (Horgan et al., 2015). This recent finding by Horgan and colleagues (2015) on behalf of the Department of Children and Youth Affairs highlights the need for more opportunities for participation that has been recommended by others (de Róiste et al., 2012).

3.5 Research Context, Setting and Participants

3.5.1 Context: Post-primary schools

In 2005 the National Obesity Taskforce Report made a number of multi-sectoral recommendations for prevention and management of obesity, which included the education sector. Meaningful consultation with young people to hear their views on the issues related to obesity was also recommended (DoHC, 2005). In a review of progress in 2009, implementation at post-primary school level was slow compared to primary (DoHC, 2009). Two major issues are adequate opportunities for physical activity at school, through school and by other means, and school vending machines. Although recommended in 2005, a code of practice for foods sold in vending machines at post-primary school has not been implemented. Vending machines are a current priority for the Special Action Group on Obesity within the Department of Health (SAGO, 2014). More time for PE and physical activity have been reported as not feasible owing to time and resource limitations (Woods et al., 2010; DoHC, 2009). Lack of progress gives an indication of how soft, non-specific and under-resourced recommendations for the education sector are hampering widespread, meaningful changes. There is also little evidence of actively involving young people in realistic strategies and solutions to change problematic diet and physical activity behaviours. Research from the Department of Children & Youth Affairs into child participation in Ireland found that young people feel they have "little voice" in the school context (Horgan et al., 2015).

The mixed-method design of the study required significant participant input in terms of time commitment (See Figure 3.1). In order to collect a range of data to provide depth of understanding, a data collection period of 3-4 weeks for each school was anticipated. Transition year or fourth year students, at 15-17 years, were at an ideal stage for participation. As a group, mid-adolescents are still within the care of their parents and school, but are close to adulthood and on a path of increasing independence from home and school. There is more evidence that diet and physical activity behaviours in mid-adolescence track into adulthood compared to those in younger children (Craigie et al.,

2011). Senior students, from transition year upwards, are often permitted to leave school grounds unsupervised at lunch times where younger students may not be. The transition year programme was ideally suited to facilitate methods that would take some time to complete and involve students as much as possible.

The transition year programme lies outside the main exam-orientated curricula, independent of the Junior and Leaving Certificate school cycles. It has a broad aim of personal development, giving students a chance to take a break from exam-focused subjects (Clerkin, 2012). The one academic-year (September – May) programme is usually optional to students, and is before they enter the final two years of the senior school cycle. It is currently offered in over three-quarters of post-primary schools in the Republic of Ireland and approximately 55% of students opt to do the programme (Clerkin, 2012). Schools design their own transition year programme, within set guidelines, to suit the needs and interest of their students. Transition year curricula focus on self-directed learning, decision making, social and personal development, work experience and community service (Clerkin, 2012; Department of Education, 1993). There are no state assessments or exams. Students usually attend core subject classes (e.g. Maths, English, Irish, European language) and more time is allocated to PE, project work and transition year courses called 'transition units'. Examples of transition units include 'Global Development Issues', 'Environmental Studies', 'Road Safety', 'Sports Coaching', and 'Food Matters'. These units are developed by individual schools or organisations and shared by the National Council for Curriculum and Assessment (NCCA: www.ncca.ie).

3.5.2 School recruitment

Schools were recruited between April and September 2012. A list of all post-primary schools in the Republic of Ireland was obtained from the Department of Education and Skills website. Initial inclusion criteria were public system schools that had a total student body of at least 400 students and offered a transition year (fourth year) programme. In order for one researcher to have sufficient time to spend obtaining an in-depth picture of food and physical activity practices in each school, six schools were

deemed practical and realistic in the time-frame allowed for data collection (1 year). Schools that represented male, female, mixed gender, rural, urban and disadvantaged students were initially approached in order to obtain a sample of students with diverse socio-demographic backgrounds. Private schools were not approached to participate as they represent a minority of post-primary schools in Ireland (approximately 8%) and within a small study may have imposed an affluent socio-economic bias. Lists of each school type (male only, female only, mixed gender and DEIS) under urban and rural categories were drawn up. One school type from each geographical area was approached and if they agreed to participate, no further schools from that category were approached. In total 13 schools (4 mixed, 5 boys only, 4 girls only) were approached before a sample of 6 schools agreed to participate. There was a poor response from some school types (large male only and mixed gender schools in particular), and there was insufficient time and resources for recruiting these schools. Resources and location were also limiting factors in school recruitment because fieldwork sites could not be too far away from the university in order to reduce travel time and cost. Participating schools, therefore, are a convenience sample of six Irish, public-system secondary schools. Rural schools were located in an urban centre (population greater than 1500; CSO 2011), but had a rural catchment area. The Irish census definitions of urban and rural settlements were used (CSO, 2011). Rural areas included one-off houses outside urban centre boundaries or houses located in settlements with less than 1500 people. Schools that represented disadvantaged students were those who had been granted disadvantaged status by the Department of Education and Skills (Delivering Equality of Opportunity in Schools (DEIS): Department of Education & Science, 2005). Participant socio-economic status (SES) was defined from home addresses using the Pobal HP deprivation index (a measure combining demographic profile, social class composition and labour market situation) from 2011 Irish census data (Haase & Pratschke, 2012).

Initial contact was made with the school principal by email, postal letter, and/or phone contact. In all cases, the school principal deferred to the teacher responsible for co-ordinating the school transition year programme. This teacher ultimately decided

whether the school would participate or not and became the primary link person in each school. Final schools recruited into the study were a convenience sample of 4 urban schools and 2 schools in a rural town with the following profile: one urban female school, one urban male school, one rural female school, one male rural school, one mixed gender urban school in a socially advantaged area and one mixed gender urban school in a disadvantaged area and designated DEIS.

3.5.3 Youth advisory panel

Male and female students were recruited from two participating schools to join a youth research advisory panel in advance of data collection. Teachers offered the opportunity to their fourth year students and put volunteers in contact with the researcher. Written parental permission was obtained prior to meetings. Students were the same age range as proposed study participants but would be a year ahead by the time fieldwork commenced in their school. The researcher met with one rural and one urban group on two occasions. The proposed study design was explained to panel members and they advised on the peer-led research proposals, student focus group questions and school environment observation tools. With their input and planning, I developed content that mid-adolescents could identify with. Their recommended recruitment process for peer researchers (student volunteering favoured over teacher/student nominations), student incentives for participation (online gift vouchers and an iPad-mini competition between all participants) and phrasing of questions for the peer-led student focus group discussions were adopted. In terms of the student-led photography, suggestions on the format, the structure of a typical school day, and content of training workshop were applied to the methods.

3.5.4 Participant recruitment

Students

Following meetings with the youth panel, student recruitment began in six schools. The researcher presented transition year (TY) groups in each school with a talk about the study and what it would involve for them. Students received a written information

sheet and an information and consent form for their parents to read and sign. Two weeks were given for returning the signed forms, which interested students returned to their TY co-ordinator, who passed them on to the researcher. Copies of the information letters, parent consent and student assent forms are included in Appendices A, B and C and illustrate that various aspects of the study had an 'opt-in' format. In order to represent at least half of the intended study population for quantitative measures in each school, a returned consent form rate of greater than 50% of eligible students was sought. Despite using similar approaches to recruitment in each school, a response rate of only 15% was reached in one school – School E, a mixed gender urban DEIS school. Students from this school are represented in the qualitative findings, but not the quantitative findings. This school was located in a socially disadvantaged area and the link teacher reported whole-school issues with attendance, participation, concentration and behaviour. These issues may have contributed to poor engagement with the project among students, however non-participation was not investigated. This limitation is discussed further in the final discussion, Chapter 9.

Teachers

Teaching staff members in participating schools were asked to volunteer to take part in a teacher focus group. The link teacher assisted in recruiting teachers to participate by talking to staff members informally, sending an email to all staff, and/or announcing the focus groups at a staff meeting. Teachers who were willing to participate expressed their interest to the link teacher. Teachers were provided with information letters and consent forms for the focus groups (Appendix K), which they returned signed on the day of the focus groups. A quorum of six teachers was set for the focus groups in order to ensure an adequate number for group discussion as recommended by Morgan (1998). This was achieved in five schools.

Principals

Principals were invited to participate in one to one interviews by either their link teacher, or directly by the researcher. Five interviews were conducted with principals after all other data were collected. The principal in School F was not interviewed.

Recruitment issues: School F

The recruitment of teachers and the principal in School F DEIS was hampered by a number of issues and no focus group or interview was conducted in this school. Compared to other schools it was more difficult to make contact with the link teacher in School F and appointments were sometimes cancelled at the last minute or upon arrival in the school. Poor student response to the project also affected the priority of the study within the school and after helping with student recruitment, the link teacher was not as engaged with the study as link teachers in other schools. The link teacher was not willing to provide assistance in recruiting staff to take part in interviews, and since introductions to staff members began through the link teacher in other schools, this proved a barrier. In comparison to other schools, where the research was conducted over three to four continuous weeks, only 5 days were spent in school F (conducting student led qualitative methods) and overall the study was not as visible. Opportunities to approach staff were not available and as a result, organising interviews independent of the link teacher was not an option.

Table 3.1 Planned study tasks and methods mapped to study objectives

	Objectives	**Task**
1	To recruit students and staff from a convenience sample of Irish post primary schools (all female, all male, mixed, urban and rural, disadvantaged).	School recruitment followed by introductory meetings with students and staff
2	To engage students as active participants (in so far as possible) in the research process.	Peer-led methods: Focus groups and school environment photography and observations
3	To explore the school setting in terms of food and physical activity policy, practices, cultures and infrastructures.	Peer-led school environment photography and observations Teacher & principal interviews
4	To capture the views of the students and staff about food and physical activity practices in their school.	Peer-led focus groups Peer-led school environment photography and observations Teacher & principal interviews
5	To measure the anthropometry of the students.	Direct measures of weight, height and waist circumference
6	To examine students' physical activity levels.	4-day physical activity diaries
7	To examine students' fitness levels.	School based fitness test: 6-minute run
8	To investigate the associations between anthropometry, reported physical activity levels and fitness.	Analysis of anthropometry, fitness and physical activity data
9	To examine nutrient intakes of students, and further investigate the food and nutrient content of school day lunches.	4-day self-report food and beverage diaries
10	To examine how school policies, practices and infrastructures impact the food available to, and nutrient intakes of students.	Discuss quantitative results from food diaries in the context of qualitative findings
11	To identify barriers and facilitators to healthy eating and physical activity in the school setting and make recommendations for future research and practice.	Interpretation and integration of findings through discussion

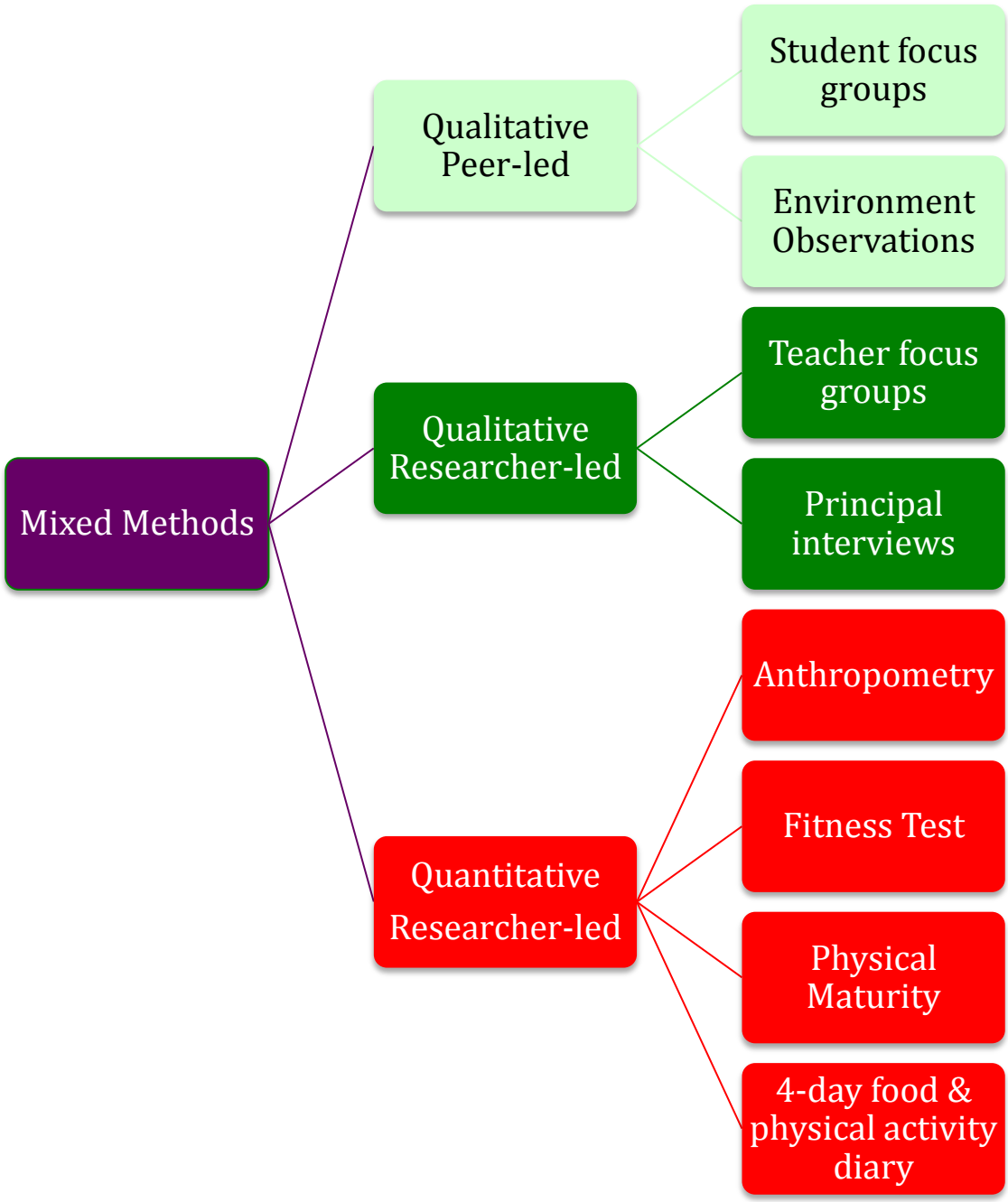

Figure 3.1 Research methodologies used in the mixed methods approach for this thesis including qualitative peer-led methods, qualitative researcher-led methods, and quantitative researcher-led methods

3.6 Participatory Qualitative Methodologies

Two participatory methods were incorporated into the study:

- Student led focus groups
- Student led visual techniques

3.6.1 Recruitment & peer researcher selection

The recruitment method was the same for both participatory methods in the study. The roles of peer researchers were explained to students at the initial information session in each school that was described above. All students were given the opportunity to volunteer for both roles. Across six schools 35% (n=205) of transition year students expressed an interest in the role of peer researcher. Where there were more volunteers than required for data collection (which there were in five schools), peer researchers were randomly selected from a list of all volunteers. The names of volunteers were listed in no particular order. Every fourth name was highlighted and those individuals were invited to participate in training workshops for either focus groups or photography. This method of recruiting students was recommended by the youth advisory panel, it eliminated teacher or researcher bias in selecting 'good' students as recommended by Barron (2011) and acknowledged a guiding principle from the UN Convention on the Rights of the Child that equal opportunity for participation be offered to children (United Nations, 1989). In each school, more students attended peer researcher training than required for data collection. This was to involve as many interested students as possible and make allowances for drop-outs and absenteeism throughout the course of the project.

3.6.2 Peer-led focus groups

Background

Focus groups are group discussions with approximately 6-10 participants that are usually facilitated by a trained researcher with some pre-designed topics and questions (Morgan, 1998). They are widely used in qualitative and mixed-methods approaches (Bryman, 2006). They are a particularly useful qualitative tool when discussions

between participants are likely to yield the best information, when interviewees are similar and when participants to be interviewed may be hesitant to provide information one to one (Creswell, 2007). Focus groups are particularly suited to the study of attitudes and experiences, where the researcher wishes participants to use their own language, generate their own questions and pursue their own priorities on a given topic (Kitzinger, 1995). Although the researcher usually sets the 'focus' of a focus group, essentially the discussion belongs to the group taking part (Morgan, 1998). This method explicitly encourages group discussion to help people explore their views. Group interactions, including both consensus and divergent views, are a reason to choose this method over one to one interviews, which are limited to individual biographies and views (Creswell, 2007).

Rationale

Peer-led focus groups were chosen as the method for obtaining the views of students in the study through group discussion. A number of possible approaches were available and are described in the literature. O'Higgins and Nic Gabhainn (2010), for example, involved adolescents in data generation with peers on the topic of sex education in Ireland. The methodology incorporated individual level data generation through written text, group-level collation and prioritisation of themes and group-level presentation of data. Important elements of this approach were that the methods were carefully developed to be appropriate and fun for use with young people, and students were actively engaged at each stage of the research process. O'Higgins and Nic Gabhainn (2010) used a very narrow range of questions from which participants generated their views. While the process could have been adapted for use in this thesis, choosing one or two focused questions for food and physical activity is difficult because eating and activity behaviours extend to virtually every socio-environmental setting. While school was the focus for student-led enquiries in this thesis, it was deemed important to situate students' views about school in the context of their overall attitudes and behaviours. Bland, Carrington and Brady (2009) describe workshops conducted with adolescents to expose them to various options of peer-led research methodologies including brainstorming, focus group, video and photography methods.

Opportunities for more imaginative learning and exploration of issues, rather than any particular method were important factors for young people.

Peer-led focus groups nested within an in-depth study of post-primary schools were preferable here for a number of reasons. Firstly, they would afford students the opportunity to generate data for study through discussion with their peers without the presence of an adult. The lack of research contexts that facilitate this has been highlighted by Murray (2006). Murray (2006) and others (Mayeahll, 2008; O'Kane, 2008) emphasise that participatory methods, such as peer-led focus groups, can remove the power imbalance between the adult researcher and the youth participant(s). The implications are not simply ideological, but as Murray (2006) points out, there is potential for more meaningful data, because the risk of incorrectly framing or leading the discussion, as happens in traditional focus groups, is reduced. Another reason for choosing focus groups here was related to context – student discussions taking place in school on the topic of school was relevant because even if participants were not in the same close friendship networks, they would still share the same socio-cultural and environmental worlds of their school. Murray (2006), for example, asked adolescents to conduct their focus groups at home because participants were recruited on their close circle of friends. The topic was resistance to criminal activity, and recruitment and setting reflected the context of the study. In the current study it was anticipated that focus groups would provide the open forum required for students to voice their honest opinions about their school and beyond. It was also expected that discussion between students would reveal important data that would complement the findings from other methods in the thesis. Research shows that focus groups are an acceptable method for this age group (Bland, Carrington and Brady, 2009; Murray, 2006) and the researcher concurs with Murray (2006) who recommends peer-led focus groups in order to empower young people and facilitate more 'normal' discussion between them.

Training workshop for students

A workshop for training peer researchers in focus group facilitation was designed specifically for this study. The content of the training was informed by literature on

focus group moderation (Kreuger, 1998; Kreuger & King, 1998; Morgan, 1998; Kitzinger, 1995) and participatory methods (Christensen and James, 2008; Murray, 2006; Lerner et al., 2005), as well as input from the youth advisory panel and adjustments following pilot sessions. Traditional focus group literature was the starting point for placing a frame on how the focus groups would be conducted including participant numbers, setting up the room, setting the focus etc. This information was included in the training workshop for peer moderators. Murray (2006) has previously described workshops for peer moderators where she recommended the inclusion of context and purpose of the study, ethical issues, practicalities of location and audio-recording, and illustration of techniques of moderating. She provided peer moderators with prompt cards for use during the discussion and once they felt they had exhausted one topic, they moved to another. A similar approach was taken here, where questions for the focus groups were drafted at the youth advisory panel stage and refined during the pilot phase (Appendix I). Kreuger (1994) in *Moderating Focus Groups* states: *"when the moderator is comfortable and natural, participants will feel more relaxed and willing to share"* (Page 7). With this in mind, it was deemed important not to over burden peer researchers with theory that could contribute to anxiety about doing something 'wrong'. At the same time, providing adequate information and support are important elements of participatory methods (O'Kane, 2008; Lerner et al., 2005). The aim of training students was to strike a balance between supporting them in their peer research role while maintaining the benefits of peer moderation.

Peer researchers were invited to a 3 hour training workshop in their school. A classroom or meeting space was booked in advance in order to host this session uninterrupted. The workshops were conducted in a focus group style for experiential learning. This meant that the first task of the workshop was to set up the room as if a focus group was about to be conducted. The format of the workshop was explained and an audio-recorder was turned on so that students would know the order of events, and also appreciate how the participant feels when a session is recorded. An i-pod audio-recorder was used for this workshop and for all the focus groups and interviews in the study. It was explained to students that they would be responsible for booking their

venue within the school, setting up the room, organising participants and running the session. Students compiled a list of the tasks to be completed and equipment they would need for the session. Topics covered in the training included the practicalities of setting up a focus group, how to audio-record the session, how to set 'group agreements' at the beginning of the session, how to probe for more information and tools on how to deal with difficult behaviours in groups. Peer researchers took turns in practicing facilitation and asking questions to their peers in the group. Students were encouraged to provide feedback to each other and reflect on the skills they were learning. At the end of training, the group decided who would go on to lead the focus group, who would assist, and who would prefer neither role (See Appendices G and H for protocols, format and education materials for peer researcher focus group training). In some groups, at the request of students, focus group moderation was shared by two peer researchers and one assisted the sessions. The idea that they could help each other out with questions and prompts, and hand-over half way through a session helped some students to feel more comfortable about taking on the role.

Peer-led Focus Group Pilot Study

Two pilot training workshops and two pilot focus groups were conducted: one in an urban male school and one in a rural female school. Participants in the pilot sessions provided feedback about elements that worked and those that did not work well. These sessions were audio-recorded and the recordings used to identify additional issues. Lack of depth in conversation, which would provide understanding about widely held opinions or behaviours, was a weakness identified during the pilot phase. As a result more emphasis was placed on group interactions and equipping peer researchers with generic probing questions – e.g. when the peer researcher wanted more information they were advised to use questions like 'can you explain why you think that?' Certain questions caused confusion or resulted in repetition and adjustments were made to address these issues. In addition, peer researchers in each school were advised that they were free to rephrase any questions or add questions when conducting their own focus groups. In one school, peer researchers opted to phrase all their own questions.

See Appendix I for final guiding focus group questions and for questions developed by students in School E.

Peer-led focus group discussions

Seven focus group sessions lasting 1 – 1 ½ hours were conducted by 17 peer researchers (8 boys and 9 girls) with 54 focus group participants (27 boys and 27 girls). There was an average of 7.71 participants per group. In each school two or three students worked in groups to conduct focus groups with their peers. Two male only, two female only and three mixed gender focus groups were conducted. Two focus groups were conducted in School E because there was a large student body. One group of peer researchers in this school developed their own questions for use in the focus group, while all other peer researchers opted to use the standard questions developed during the design and pilot stages of the study. At the end of each focus group the researcher (S.B.) had an informal discussion with peer researchers. They were asked about their opinions on aspects they felt that went well and those that did not. All peer researchers filled in a self-report open-ended questionnaire about their experience (See Appendix J). Audio-recordings from the focus groups and debrief sessions were taken transcribed the discussions verbatim. At a later date, the peer researchers listened to their focus group recording with a print copy of the transcription and identified individual participant comments using identification numbers that were later converted to pseudonyms. Peer researchers provided additional input into analysis at this stage by writing comments on the transcription and highlighting significant quotes. This was an important step in the participatory process. While the researcher would be conducting the main analysis for all seven focus group discussions, she had not facilitated or been present for them. By identifying significant themes within their own groups, peer researchers had the opportunity to provide their interpretations. Content analysis, described later in this chapter, was used to identify the dominant emerging themes across the focus group discussions and the debrief sessions.

Feedback from peer-led focus groups

At the end of the study period, the findings from focus group discussions were presented to peer researchers and participating students in each school. Students were asked if the results represented young people correctly and if there were any major surprises or gaps in the findings. Notes were taken of their feedback at this stage during informal sessions. One feedback point, for both boys and girls was related to body image and is noted in the findings in Chapter 5.

3.6.3 Peer led photography of the school environment

Background

Observation techniques can provide rich information about participants in their environments. They provide the researcher with an understanding of a new setting, describe the context and can supplement data from other sources (Creswell, 2007). Observation complements other types of methodologies by asking questions about behaviour from another angle (Gillham, 2008). Observations about school life were included to address student behaviours, as well as the everyday reality of school policies. It was also planned that observation results, nested within a MMR study design, would help explain, support or illustrate quantitative food consumption and physical activity behaviour findings. As well as that, results from observations can be integrated with qualitative interviews to create a bigger picture of food and physical activity culture in each school.

Although there are some examples of students participation in data generation about their school environments and what it means to them (Wilson et al., 2007), it is certainly less prolific than adult-led enquiries. Wilson et al. (2007) asked adolescents in disadvantaged areas to take photos of "issues and assets" at school and provided support over one academic year for groups of students to make positive changes in their school environments. The method offered young people the opportunity to tell their stories and highlight important issues through photography. Visual representation by young people has been used by others to explore children's play and activity (Barron, 2011) and children's well-being (Nic Gabhainn & Sixsmith, 2006).

Rationale

When young people feel free to express experiences from their social worlds, the quality of research tends to improve (Scott, 2008). Like other participatory methods, self-observation by young participants can reduce the power imbalance between the adult researcher and children (Barron, 2011; Burke, 2005; O'Kane, 2008; Thompson, 2008). Youth-led observation is supported by evidence of successful participatory observation models with children and adolescents (Barron, 2011; Nic Gabhainn & Sixsmith, 2006; Hart, 1992). Visual techniques, like taking photos, have increased in use in the last number of years when researching with young people about their lives (Barron, 2011; Wilson et al., 2007; Nic Gabhainn & Sixsmith, 2006). An Irish childhood play space study using photos found it to be particularly acceptable to young people as it's fun and they are in control of what to record (Barron, 2011).

The advantages of using visual technique methods are that low literacy levels would not be a barrier to participation, it appeals to young people who are familiar with mobile phones, digital cameras and disposable cameras, young people have described it as fun, and most importantly young people present images that are important to them (Barron, 2011; Wilson et al., 2007; Nic Gabhainn & Sixsmith, 2006). The latter point is important in a physical environmental context such as school, in which students are typically bound within a given space. When photos are generated by young people, previous studies have demonstrated that this is a means of addressing issues in their environments (Wilson et al., 2007) and authentically representing their voice (Barron, 2011; Nic Gabhainn & Sixsmith, 2006).

There were other possible approaches to understanding school spaces. Anderson and Jones (2009), for example, sought to understand the lived 'hang-out' experiences of 14-16 year olds by combining conventional interviewing techniques with more ethnographic practices through interviews at different sites around the school environment. Raittila (2012) also conducted "ethnographic tours" in an urban environment with children and observed their spontaneous chat and actions. Both of the cited studies placed children's experiences with place and space at the centre of

their enquiries. For the current study, an approach that would allow students generate their data without a researcher present was preferred. Obtaining visual representations by students without the intrusion of an outside researcher was advantageous because an authentic view of students' interpretation of food and physical activity at school, and how they use these spaces could be captured. It also allowed participants, who were in the senior cycle of post-primary school, the freedom to research both within and close to the school environment. The approach complemented that of peer-led focus groups – i.e. students were encouraged to generate data without an adult present.

It was envisioned that three additional sources of data would be used to support the interpretation of photos taken by students in this study, which included (1) textual descriptions of their school environments by students, (2) post-photography meetings with students and (3) the researcher's own fieldwork notes. In order for students to record textual descriptions about their school environments and photos a tool was developed for the study (SEOT: School Environment Observation Tool). It was intended that the SEOT would be filled in by students during their data collection. The youth advisory panel, described above, assisted with the structure and content of the SEOT so that they were meaningful to their experience of school. Since break times would be the busiest times for taking photos, students in the youth advisory panel made valuable suggestions for when students could capture some images (e.g. PE equipment, items for sale in the shop/canteen) at other times of the day. The SEOT was divided into two main areas – one addressing food and the other physical activity. Data collection was designed to be completed by students over one typical school day. The rationale for gathering data over one day was to obtain a snapshot of one typical day at school and standardise the method between schools.

Workshop for students taking photos

In each school students who were selected for the role of peer researcher were invited to a 1½ hour workshop on school grounds during school hours. The workshop covered elements of good observation skills, including respecting people's privacy, being open

about their role if asked by peers, making notes and photos anonymous as per research ethics committee requirements, and the importance of taking accurate notes rather than making assumptions. The training materials used are available in Appendix F. Students were instructed on taking photos with disposable cameras. They were asked to write descriptions of the photos they took at the time of capturing the image. Using the SEOT, students were also asked to write additional descriptive information about their school environments in their own language.

Students photoing food were asked to explore food and beverages provided in the school as well as typical food purchases and eating behaviours of students. They were asked to make an inventory of all the foods and beverages for sale at school. Records of the places and spaces students used to buy and eat food also included local food outlets outside the school grounds where relevant. To capture physical activity facilities, practices and behaviours at school students were asked to photo all the spaces and facilities for physical activity, observe and photo students' activities at break times, and observe PE classes and extra-curricular sports activities. They were also asked to gather textual information about weekly PE time allocation for each year group, the number and type of extra-curricular sporting opportunities available and student uptake of them in their school, and any other information they felt was relevant to record. The items on the SEOT were a combination of multiple choice, closed and open questions. As well as their own observations, students also had to talk to PE teachers, extra-curricular volunteer teachers, and catering staff to obtain information. Students were provided with a list of suggested photos to take and they were also reassured that they could take photos of anything they perceived as relevant to food and physical activity at school. They could use all the photos on the disposable cameras or just some.

Pilot Study

A pilot study with student-led photography and the textual SEOT was undertaken in one female urban school and some adjustments were made following this. A student survey on transport to school was suggested by students in the pilot study, which was included in the final tool that was rolled out to all participating schools. This is an example of

students agency in influencing the methodologies used in the study. The survey was conducted with a subsample of students (1 class from each year group) who provided information on their usual and dominant mode of transport to school. The tool that students used alongside their photography is available in Appendices D and E. When satisfied that the SEOT was optimally developed and adjustments made following pilot studies, peer-led data collection proceeded in the six participating schools.

Students' photography fieldwork day

Twenty-eight students (12 male and 16 female), working in pairs, between 15.3 and 16.6 years (average age 16.0 years) conducted the photography method in 6 schools. In each school pairs were assigned to either 'food' or 'physical activity' photo representations. Four students per school conducted the photo research, except for one school where eight students participated because there was a very large student body and bigger school campus. Student researchers were provided with blank SEOT forms, clip-boards, pens and disposable cameras to conduct their observations. Each pair had one camera and one blank SEOT. They wrote their initials, their school name, and either 'food' or 'physical activity' on their disposable camera and on their SEOT. Students arrived to school early on the observation day in order to capture information about general student eating and activity habits on or around school grounds before school started. They had permission to miss classes during the observation day in order to complete the research and continued their observations through break and lunch times. They took time for their own breaks before or after the usual school times. At the end of the school day, the researcher (S.B.) met with the students to discuss their experience of observation over the day. Notes of their feedback were recorded and peer researchers filled in a qualitative evaluation questionnaire about their experience (Appendix J). At this time they returned their cameras and filled in SEOTs.

3.6.4 Evaluation of peer research methods

Focus groups

Students who conducted focus groups filled in an open-question evaluation form about their experience of participation in the role (Appendix J). The researcher also met with

the focus group moderators to discuss their thoughts and feelings about the focus group after participants left, during which time notes were taken. While listening to, transcribing and analysing the focus groups students' moderation skills and techniques were observed and this information was also used to inform the evaluation of the method.

Photography

Students who conducted photography filled in an open-question evaluation questionnaire about their experience of participation. The researcher also met with photography students at the end of their research day to discuss their thoughts and experiences about their observations and the methods. This evaluation is discussed within findings Chapter 4, under study limitations and strengths.

3.7 Researcher-led Qualitative Methods

3.7.1 Focus groups with teachers and interviews with principals

Rationale

The school principal and school teachers play important roles in school health promotion. It is recognised that through commitment to, and identification with health education, teachers can determine the sustainability of health promotion at school (Jourdan et al., 2016; Nic Gabhainn et al., 2010; St. Leger, 1998). Principals play an important supportive, organisational and management role (Jourdan et al., 2016; Nic Gabhainn et al., 2010). While many studies in the area of school health promotion have used questionnaires to obtain information from school principals or other staff members (Moynihan et al., 2016; Callaghan et al., 2015; Woods et al., 2010; Briefel et al., 2009; Vereecken et al., 2005), many have also used focus groups and one to one interviews (Jourdan et al., 2016; Nic Gabhainn et al., 2010; Power et al., 2010; St. Leger, 1998). A qualitative, face to face interview approach was taken here for a number of reasons. Firstly, in order to achieve the thesis aim of conducting an 'in-depth study' with schools, methods that would facilitate deeper exploration of the views of staff was utilised. Nic Gabhainn et al. (2010) conducted semi-structured interviews with principals and school teachers involved in the delivery of the Social, Personal and Health Education (SPHE) programme in Irish post-primary schools. Important local factors contributing to success or shortcomings of the subject on the school curriculum emerged. Results provide an example of one of the underlying motivators behind qualitative approaches: that subjective human experiences can be explored in context (Denzin & Lincoln, 2005). Additionally, Nic Gabhainn et al. (2010) were able to integrate the findings from interviews with views of students (from questionnaires) and parents (from questionnaires and focus groups), and obtain a holistic view which allowed for a more complete interpretation of strengths and weaknesses of the SPHE programme within Irish schools. On the topics of food and physical activity, the views of principals and teachers have been described in the literature (Power et al., 2010; Woods et al., 2010; Boyle et al., 2008; Gilmore et al., 2008), but there are few examples showing where their views intersect and diverge with the views of students. There was

a potential in the current study, through the interpretation of qualitative approaches from various school stakeholders, for new findings about issues surrounding food and physical activity in Irish post-primary schools.

As discussed earlier, group interactions that allow both consensus and divergent views are a reason to choose focus groups over one to one interviews (Creswell, 2007). This was relevant for hearing the views of teachers in the current study because they share a common role with their colleagues within their schools. One to one interviews, being limited to individual biographies and views (Creswell, 2007), were more appropriate for school principals. Interviews with principals, therefore, were separated from focus groups with teachers since the role of the principal is quite distinct from that of teaching staff. Principals have a management, leadership and organisational role within the school, while teachers are in direct contact with students for most of their time. Interviewing is a common and powerful means of understanding people in context. Interviews are conversations that have structure and a purpose (Kvale, 1996). For this study semi-structured, face-to-face interviews were conducted with school principals in their respective school settings.

Focus groups with teachers

The link teacher arranged a time that was convenient for participating teachers and booked a room within the school to conduct the focus groups. Focus groups took place on the school grounds during school hours and were 30- 45 minutes in duration to facilitate teachers' limited time. In two schools teachers gave time at the end of the school day to participate in the focus groups. In two schools focus groups were conducted at lunch time and in one school the focus group took place over one class period.

Questions in the focus groups with teachers were framed to draw out their views of students' diet and physical activity habits, school health promotion activities and their views on the role of staff and school in this area (Appendix L). A semi-structured approach to questioning was taken, where pre-defined questions were asked while also

allowing the group to take the discussion in their own direction. All focus group discussions were audio-recorded and later transcribed verbatim.

Interviews with principals

A number of pre-established questions were asked in each interview. Unlike a strictly structured interview, most questions were open-ended and there was room for the discussion to take unplanned directions where appropriate (Fontana & Frey, 2005). Open-ended, pre-established questions focused on the perceived role of the school, as well as barriers, facilitators and current scenarios with regard to food and physical activity at school. Principals were asked about the history and organisation of the school shop and/or canteen. Interviews were approximately 30 minutes in duration and were conducted at the end of the study period in each school. Questions focused on the overall ethos of the school and barriers to health promotion, healthy eating and physical activity (Appendix N). All the interviews were audio-recorded and later transcribed verbatim.

3.7.2 Focus groups with parents

The information letter students brought home about the study contained an invitation for parents to participate in focus groups with other parents from their child's school (see Appendices B and C). The response to this method was poor in all schools, with 0-3 parents responding in each school. A quorum of 6 was set for conducting focus groups. This limitation is discussed further in Chapter 9.

3.8 Analysis of Qualitative Data

3.8.1 Analysis of focus groups and one to one interviews

Content analysis is a method that takes a systematic approach to finding and describing meaning in qualitative material (Hsieh & Shannon, 2005; Krippendorff, 2004). The approach is most appropriate when dealing with meaning that is less explicit and requires a degree of interpretation (Schrier, 2012). Content analysis provides a structured approach to understanding qualitative data, where techniques used are reliable and the findings replicable. While the analysis is 'data-driven', large volumes of discussion require a defined focus. Inferences drawn from the data, therefore, respond to the theoretical framework and/or research questions (Hsieh & Shannon, 2005). These background structures form part of the context within which the data is interpreted. Other important elements of context include the background of the researcher, the research participants, and social situations in which data were gathered (Krippendorff, 2004; Seale, 1999).

The systematic approach to content analysis used in this study was drawn from qualitative and mixed methods literature (Creswell & Plano Clarke, 2007; Hsieh & Shannon, 2005; Seale, 1999; Schrier, 2012). An open hand-coding process was used in favour of qualitative analysis software. This was a personal preference and a means of becoming fully immersed in the data, which was particularly important for the analysis of student-led focus groups as the researcher had not been present for the discussions. 'Conventional content analysis' as described by Hsieh and Shannon (2005) was used to analyse the focus groups and interviews. The transcripts were first approached in an inductive manner with key thoughts and concepts identified within the data. The onward process of coding and categorising emerging concepts involved refining key thoughts and concepts into categories, codes, and finally themes (Hsieh & Shannon, 2005).

The steps in the content analysis process taken are described in order:

1. Focus group and interview discussions transcribed verbatim from audio-recordings.
2. The researcher listened to audio-recordings of discussions a further 2 to 3 times to become familiar with the conversations and topics discussed.
3. The researcher began reading the transcripts word for word to highlight exact words and phrases in the text that captured key thoughts or concepts.
4. The researcher approached the transcripts by writing notes and comments next to highlighted text. At this stage the concepts were derived from the data only as recommended by Hsieh and Shannon (2005). Examples of these early notes from students' focus groups were 'student showing knowledge', 'routines and rituals', 'peer pressure', 'marketing'.
5. The researcher then reviewed the transcripts again and began to categorise notes.
6. As the researcher moved over and back between focus group and interview transcripts, new labels for categories were assigned that reflected more specific ideas emerging or interactions between categories already identified. Examples of these were 'routines and rituals: situation specific – (1) home, (2) peers, (3) school', 'school: education versus environment'. All discussions were analysed in an over and back manner until all key concepts were categorised and coded. The code labels and all transcriptions were reviewed before proceeding to the next stage.
7. The researcher then used the 'cut and paste' method to collate codes. This involved cutting quotes or sections of conversation that reflected a given code and collating them together in one document. Their origin information– i.e. school group and participant pseudonyms –remained clear in the collated file. These documents were then scrutinised to assess the level of available evidence for the creation of dominant themes from coded categories and sub-categories. Codes that occurred frequently and extensively across discussions were used to develop dominant themes. Codes that represented a sub-group of participants were also identified and presented under existing or new themes. There was

still an opportunity at this stage to move quotes that fit more appropriately into other themes.

8. During and after the process of identifying themes, the PhD researcher met with two senior researchers to verify the results. Where there was disagreement about key themes, further investigation and discussion was held until agreement was reached. Quotes that best represented dominant themes were examined and explored through discussion at these meetings.
9. Findings were written up under dominant themes with quotes that represented themes extracted to illustrate participants' views.

Extra steps for peer-led focus groups:

10. The process for the analysis of peer-led focus groups involved the following extra steps:
    a. Peer moderators reviewed the transcribed documents and highlighted important sections of the discussion with a marker, and made notes to explain their choices before full content analysis was conducted by the researcher.
    b. At the end of the analysis, feedback on dominant themes was provided to participating students in each school, they were then given the opportunity to provide their opinions on the results.

3.8.2 Visual content analysis of photos taken by students

Mason (2005) indicates that the analysis of photography requires more than storing, sorting, coding, and categorizing. It should be a highly conscious activity and requires the use of specific and explicit systematic approaches, which are open to scrutiny. This is particularly important in the case of visual research conducted by young people about space, where images may not be amenable to straightforward adult interpretations. Rose (2001) suggests that visual content analysis is an appropriate technique when approaching a large number of images in a consistent manner. The definition of visual content analysis in this thesis is taken from Bell (2001) who describes it as an

"*empirical and objective procedure for quantitatively recording visual representations using reliable and explicitly defined categories"* (Bell 2001, p.14).

The photos were developed and uploaded to a computer for storage. They were assigned identification codes according to the school, student initials and a unique ID number. Photos were separated into those representing food or physical activity. Exclusion criteria were applied which included poor quality images, images not relevant to the topic and duplicate images. The total number of photos taken and the number analysed after exclusion criteria were applied are detailed in Table 3.2. The final set of images were viewed a number of times before two quantitative analysis frameworks were created on Microsoft Excel with defined categories. The code key for the variables or categories included in each of the analysis frameworks are presented in Appendix O. Each photo was examined individually and the content coded within the analysis framework. The quantitative technique of visual content analysis provided *"a background map of a domain of visual representation"* (Bell 2001: 27) and this analysis was supplemented with textual data recorded by students on the SEOT, fieldwork notes and records of discussions with students who took the photos. Another researcher conducted the content analysis process independently and a number of meetings were held to verify the process and the findings. Any discrepancies were discussed until consensus was reached. Results are presented as dominant emerging themes with photos chosen that represented each theme.

Table 3.2 Total numbers of photos taken by students in six schools, number of photos excluded and final numbers analysed for food and physical activity environment content. Results from analyses are presented in Chapter 4.

	Food	Physical Activity
Total photos taken	214	138
Exclusion criteria		
Poor quality images	22	4
Not relevant to the topic	16	17
Duplicates	8	17
Total analysed	168	100

3.9 Quantitative Methodologies

Background

Some common quantitative methods in obesity, physical activity and nutrition research were chosen for this study. An objective of the study was to define measures of weight status, food consumption, nutrient intakes, fitness status, and physical activity habits within the study sample. In doing so, actual rather than inferred data can be used at the integration stage of data analysis for more robust conclusions. The quantitative methods used in the study are described below.

3.9.1 Quantitative fieldwork in school setting

One or two quantitative fieldwork days were conducted in each school. The link teacher and PE teacher assisted in organising the quantitative fieldwork days by booking the school gym and moving PE classes for non-transition year groups to other locations on these days. Transition year students were asked to come to the gym in class groups (approximately 25-30 students at a time) for 2 class periods (80-90 minutes). During this time they participated in all measures detailed below.

Trained health professionals from DCU assisted with the data collection at schools on fieldwork days. Separate 'stations' were set up for each measurement which included (1) a registration desk, (2) weight station, (3) height station, (4) waist circumference station, (5) 6-minute run station, and (6) a maturity questionnaire station. Three-sided screens were erected around the anthropometry and questionnaire stations in order to provide privacy for students. Students checked in at a welcoming/registration desk to ensure they and their parents had consented to participation. Students received an ID-coded sheet on which all their measures would be recorded by researchers as they visited the different measurement stations. At the end students handed this sheet back to the researchers. Researchers provided feedback on the measures if requested. Some students came at a later date to ask for their measures, which were provided to them at that stage. Students were asked to fill out a short questionnaire about their experience of being measured as part of the study (Appendix P).

A longer period of data collection was required for the food consumption records. The researcher conducted this over a number of weeks in each school. The procedures are described in more detail below.

3.9.1.1 Anthropometry: Weight, height and waist circumference

Background

The availability of valid, reliable and feasible measures to assess weight status in adolescents is important for ongoing public health monitoring. Body weight and height can be used to estimate Body Mass Index (BMI) which can then be used to categorise individuals as underweight, normal weight, overweight or obese (Cole et al., 2000). Waist circumference (WC) is an increasingly important measure in anthropometric studies as age-specific cut-offs for abdominal adiposity can be used to assess no communicable disease risk in different population groups (Zhang et al., 2016; McCarthy et al., 2005; Saava et al., 2000).

Rationale

Weight, height and waist circumference measurements were obtained in this study in order to define the weight status of the sample. As discussed earlier the issue of childhood overweight and obesity influenced the conception and design of this study. Information about overweight prevalence within the sample is valuable in interpreting additional measures including students' fitness, physical activity levels and dietary behaviours. Direct measures of anthropometry are the superior method of estimating overweight among children and adolescents, and although some large-scale studies use the self-report method (e.g. HBSC); it was not considered for this study.

Protocol for anthropometry data collection

Protocols from the World Health Organisation for carrying out anthropometry on young people were followed (WHO, 1995). Participants were in light sports clothing and without shoes. They had their measurements taken at 3 separate 'stations' with one researcher present at each station. There was one 'floating' research assistant between the 'stations' if required or requested. Weight, to the nearest 0.1kg, was measured in

duplicate using a digital Tanita WB100-M scales. Height, to the nearest 0.1cm, was taken in duplicate using a Leicester portable stadiometer. Waist circumference was measured in duplicate to the nearest 0.1cm on naked skin at the midpoint between the lower rib margin and the iliac crest using a non-stretch, flexible tape measure.

Anthropometry data interpretation

Body Mass Index (BMI) was calculated from weight and height (kg/m^{-2}) and individual results were classified as underweight, healthy weight, overweight or obese according the International Obesity Taskforce age and sex-specific cut-off charts (Cole et al., 2000). Percentile charts developed by McCarthy et al. (2001) and available to purchase from Harlow Healthcare (www.healthforallchildren.com) were used to define low, increasing and high health risks according to waist circumference results for each participant.

3.9.1.2 Physical Fitness Tests

Background

The availability of valid, reliable, feasible and safe field-based fitness tests to assess physical fitness in adolescents is important for ongoing public health monitoring. Direct, individual measures of fitness such as the laboratory based VO_2max (the highest Volume of Oxygen the body can take in and use in 1 minute at maximum physical exertion) test for cardio-respiratory fitness are not feasible at a population level. Field tests that can estimate fitness, therefore, are typically used in schools.

Rationale

Physical fitness is consistently and significantly associated with physical activity levels (Ortega et al., 2008). Fitness tests were conducted in the current study in order to provide a measure of the overall physical activity levels of participants. A fitness test called the 6-minute run (or Reduced Cooper Test), not typically used to assess cardio-respiratory fitness in the school setting, was explored in the current study. The 20-metre shuttle run test (or 'bleep test') is the most commonly used field test for cardio-respiratory fitness (Ortega et al., 2011). Some have questioned its use with school

children as it was originally developed for elite, adult populations (Naughton et al., 2006). It requires participants to perform to exhaustion and may not be appropriate for overweight and obese participants. High intensity fitness testing, often included in PE, can have negative associations for some young people, reinforcing the competitive and performance aspects of physical activity (Cale & Harris 2013; Naughton et al., 2006). For these reasons, alternative, easy to administer and indirect field method for assessing cardio-respiratory fitness were explored for this study.

The Reduced Cooper test is a 6 minute, submaximal exercise test that allows participants to set and keep their own pace. Participants run and/or walk around a marked 9*18 metre rectangle for 6 minutes with the aim of covering the maximum distance (Fjortoft et al., 2011; Lammers et al., 2008; Li et al., 2007). Lammers and colleagues (2008) devised normal values of a 6-minute walk test for 4-11 year old children, and the method has been used by others as part of a functional and easy to administer fitness test battery in children (Fjortoft et al., 2011). The same test has been shown to be reliable and valid in a group of 12-16 year old Chinese adolescents, with significant correlation between the test and a direct measure of VO_2max (Li et al., 2007). In order to validate this test with European adolescents in the school setting a sub-sample of participants on the low, medium and high end of 6-minute run results were invited to the School of Health and Human Performance at Dublin City University to take part in the laboratory based VO_2max test. This validation study was carried out by a Masters student. With their permission, results from the validation study were used to interpret students' fitness results in order to complete analysis in Chapter 7 of this thesis (See validation abstract Appendix Q).

6-minute run – cardio-respiratory fitness

The objective of the 6-minute run is to cover the greatest distance (metres) in the time allotted. The test took in place in the PE halls of participating schools on the same day as anthropometry. An area measuring 9*18 metres was marked with tape and cones on the hall floor. Students were first instructed to gently jog 3 laps to warm up. Students were then instructed to run around the marked area in groups of six and count the

number of laps completed. They were encouraged to set a pace they were comfortable with while challenging themselves to complete as many laps as possible. Two physical activity researchers (one of whom was a PE teacher and Masters Student conducting the validation study, See Appendix Q) observed their progress and noted their results on completion.

3.9.1.3 Self-report stage of physical maturity

Background

Physical maturity is a feature of adolescence, however there is widespread variation in the age of onset and the duration (Neinstein, 1982). Sexual maturation can impact measures such as weight, height, waist circumference, and body composition and these factors can in turn impact fitness and physical activity levels (The ALPHA Project, 2009).

Rationale

An assessment of physical maturity is recommended for interpretation of adolescent fitness and anthropometry (The ALPHA Project, 2009). The self-report method has been validated against direct observation and found to be a reliable measure of sexual maturity in adolescents (Neinstein, 1982; Duke et al., 1980).

Participants were asked to view line drawings of each stage of development (The ALPHA Project, 2009; Tanner, 1962) and indicate the ones that represented their current body most accurately. Girls were asked to make this identification for breast development and lower pubic hair. Boys were asked to identify their own stage of development from line drawings of the penis and scrotum, and lower pubic hair. For each question there were five development stages to choose from (See Appendices R (a) and R (b)). For each participant, the combined score from both questions, with a maximum score of 10, was included in the final analysis. To complete these measure students were provided with the line drawings and a blank form to report their stage of development and sat at a desk in private. They enclosed the completed forms in an envelope with their unique ID number written on it and returned it to the researcher.

Response rates to this measure were lower than for fitness and anthropometry (see Chapter 7, Table 7.1). Missing Tanner scores were replaced with the median Tanner score for participants of the same age and gender who completed the questionnaire. This was considered appropriate for analysis purposes since the age range in the sample was narrow and known results for age and gender agreed with expected development stages (Tanner, 1962).

3.9.2 Food and nutrient consumption

Background

In the Irish context, quantitative surveys with school principals have demonstrated that low-nutrient, energy dense foods and beverages are a common feature in post-primary schools (Callaghan et al., 2015; Kelly et al., 2010). Dietary surveys through a 7-day semi-weighed food diary have shown that Irish adolescents are consuming excessive added sugars and total and saturated fats and inadequate dietary fibre and micronutrients such as calcium, iron, Vitamin A, and folate (Walton et al., 2014). No previous study has looked at the contribution of the school setting to the diet and nutrient intakes of adolescents.

Rationale

Given the gaps in knowledge, there is a clear rationale for research that examines food and nutrient consumption related to the school setting in Ireland. The purpose of this is to quantify the nutritional quality associated with foods consumed by students on school days. This information is available from other countries, but results are not transferrable to the Irish education setting because of country-specific practices and policies that impact food choice at school - the UK, for example, have an established school meal programme with mandatory food and nutrient standards in place (Adamson et al., 2013). Despite numerous school food surveys in the UK in recent years (Pearce et al., 2013; Stevenson et al., 2013; Prynne et al., 2013), none have explored the nutrition associated with sources of foods other than home or school. It is acknowledged that this is a common source of food for post-primary school students

(MacDiarmad et al., 2015; Adamson et al., 2013) however there is less evidence to show what kind of impact it is having on dietary intake on school days.

Alternative instruments for assessing food consumption

A 4-day self-report food diary was chosen to collect food and beverage consumption data. Previous Irish research with adolescents used a 7-day semi-weighed food diary (NTFS, 2006); however, this length is considered intrusive and burdensome to participants and may result in altered eating behaviours (Livingstone et al., 2004). The UK National Diet and Nutrition Survey have moved from a 7-day weighed food record to a 4-day estimated food record across all ages of the population (Lennox et al., 2010). A 4-day record, which includes 1-2 weekend days, is considered sufficiently long to estimate habitual nutrient consumption and dietary patterns. With permission from the Human Nutrition Research Centre at the Medical Research Council, Cambridge, UK, a 4-day food diary template – the 'ROOTS Adolescent Food Diary' - was used for this study (See Appendix U). It has been successfully used with adolescents in the school setting by Prynne and colleagues (2013) to show comparisons between nutrients in school and home sourced lunches. The food diary template allowed for all sources of food to be recorded, which was important to capture in the current study.

There are issues with portion size reporting, recall, and under-reporting in traditional food recording among adolescents (Livingstone et al., 2004). Validation studies have found that adolescents under-report energy intake using 7-day weighed dietary records with a bias of 20-50% (Bratteby et al., 1998; Livingstone et al., 1992). Under-reporting seems to be more prevalent among female and overweight individuals (Brandini et al., 2003). Advances in technology based food records for children and adolescents offer solutions to accuracy and compliance (Boushey et al., 2009). These options require the use of digital photography and were beyond the budget of the current study. The diet history method has been reported by some to be the most accurate dietary assessment measure in the older adolescent population (Livingstone et al., 1992). The diet history method was not considered for the current study as detailed information about food source and eating location would not have been possible. A number of steps were taken

to ensure accurate recording by young people of their food intake. These steps are outlined in the next section.

Food Consumption Data Collection

All students in transition year classes were invited and encouraged to participate in the food consumption data collection. Like all measures in the study, the information was provided during an introductory talk with students and by information letters given to students and parents. Food diary workshops were organised by the link teacher in each school. During the school day, students met the researcher in a classroom situation with approximately 20 students per group for sessions lasting 60 to 80 minutes. Each participant was given a blank food and activity record with their unique study identification number. Participants were instructed that for 2 weekdays and 2 weekend days they needed to fill in details of foods and beverages consumed just after eating, and estimate portion sizes in terms of household measures, as small, medium and large, as individual items and/or with manufacturer information. Examples of portion size estimation were provided in writing on the food diary. During the classroom workshop students practiced by recording their food and beverage consumption for the previous 24 hours. They were encouraged to ask questions during this time and the researcher spoke individually with each student to ensure they understood the task. Students were instructed to carry the diaries with them at all times until complete. They were asked to make entries from Thursday to Sunday inclusive. This was intended to ensure food consumption data corresponded to the same school days across the sample and it allowed workshops to be conducted on school days (Monday, Tuesday, Wednesday, or Thursday morning) so that food diaries could commence within the same week. For a small number of participants, weekday food consumption was recorded on days other than Thursday and Friday and further details of weekday breakdown are presented in findings Chapter 8. During data collection students were free to get in touch by email if they had any questions.

On completion the researcher met students at school in smaller groups of 6 to 8. Using copies of a photographic food atlas with eight portion sizes for various foods and meals,

students further quantified portion sizes retrospectively in their diary (Nelson et al., 1992). The researcher checked each diary and asked probing questions to assess accuracy in the food record. Long gaps without food or beverages, inaccurate portion size estimation, obvious under- or over-reporting and unusual patterns were some of the signals used to probe for further information. Participants were asked if his/her food intake was typical for them for the food diary duration and to give a reason if their intake was more or less than usual.

3.9.3 Self-reported physical activity

Background

Physical activity is defined as "any body movement produced by muscles that results in increased energy expenditure" (McCardle et al., 1996 pp. 635). Physical activity can be classified into categories of sedentary behaviours, locomotion, work, leisure activities, and exercise. Within categories the frequency (number of physical activity events in a specified period), duration (amount of time) and intensity (physiological effort) of the physical activity can be classified quantitatively (Butte et al., 2012). Objective and subjective approaches are used in research to obtain estimates of human physical activity levels. Wearable monitors, or objective measures, are based on the measurement of energy expenditure. The main categories of wearable monitors, listed from the least to the most sensitive, include pedometers, load transducers, accelerometers, heart rate monitors, combined accelerometer/heart rate monitors, and multiple sensor systems (Butte et al., 2012). Accelerometry is the most commonly used objective measure of physical activity in youth (Corder et al., 2008). It's superiority to pedometry, which is a cheaper option, is that while pedometers measure the frequency of a certain acceleration threshold only, accelerometers can also quantify the intensity of body movements. Combined accelerometer/heart rate monitors have been recommended as the ideal method for assessing physical activity levels in youth (Butte et al., 2012; Corder et al., 2008). Subjective methods of measuring physical activity include questionnaires, interviews, and activity diaries (logs) (Corder et al., 2008). Corder and colleagues (2008) reviewed studies reporting validity of various self-report instruments for assessing physical activity in children and adolescents. The age of the

target population influences the selection of self-report methods because reports from younger children require interviewer assistance, while independent methods such as self-report activity diaries have been used more successfully with adolescents (Corder et al., 2008).

Rationale

The rationale for obtaining a measure of physical activity for participants in the current study was two-fold: firstly participant physical activity levels are recommended for estimating total energy expenditure which can then be used to assess the accuracy of reported energy intake in food diaries (as described above and recommended by Black, 2000); and secondly exploring the relationship between reported physical activity and the 6-minute run was an objective of the study. Previous studies with adolescents have demonstrated strong associations between fitness using the 20m shuttle test and physical activity levels (Ortega et al., 2008). While others have used the 6-minute run or walk (Fjortoft et al., 2011; Lammers et al., 2008; Li et al., 2005), its relationship with the physical activity levels of youth has not been reported by these studies. It is acknowledged at the outset of the current study that self-report, subjective measures of physical activity are inferior to objective measures in terms of accurately predicting physical activity levels. The primary barrier to the use of wearable monitors was resources - it was not possible to obtain the number of accelerometers and/or heart rate monitors required. The physical activity diary was preferred over the pedometry method because the diary facilitated the collection of data on different activities of varying intensities over the day. Although the diary imposed a higher burden on participants, it could be completed alongside the food diary, which was another advantage of using it.

Physical Activity Diary

A physical activity diary template, previously used with children was used for this study with the permission of the Human Nutrition Research Centre at the Medical Research Council, Cambridge, UK. Participants completed a 4-day activity diary on the same days as their food diary over 2 week and 2 weekend days. For the activity diary, each day

was broken into 15-minute intervals where participants recorded a code number that best represented their activity at each time point. This type of physical activity log has been used by Bratteby et al. (1997) with 15 year old adolescents, the same age as the current study, and found to provide close estimates of total energy expenditure for groups of adolescents. Fifteen minute periods are recommended as the ideal time epoch as any shorter renders it too high a burden for participants (Corder et al., 2008). Nine codes were supplied that represented sleeping, sedentary activities, light, moderate and vigorous intensity activities, and one to record a specific activity that did not fit into the other codes (See activity diary at the end of Appendix U). During the food diary workshop, students were also instructed on how to complete their physical activity diary. Participants practiced filling in their own activities from the previous 24 hours during this workshop and the researcher spoke with each student to ensure that they understood how to record their physical activity.

The nine codes on the diary each corresponded with an average metabolic equivalent (MET) value for the level of activity that were developed by Ainsworth et al. (2000; Tudor-Locke et al., 2009). MET values were multiplied by the number of minutes spent in each activity per day resulting in data of MET minutes/day for four days. MET minutes per week was calculated, with appropriate weighting for week/weekend days, and divided by seven days. The mean MET minutes per day was divided by 1440 minutes (minutes in 24 hours) to supply an average physical activity level (PAL) value for each participant. PAL values were compared to reference values for the adolescent population (FAO/WHO/UNU, 1985) and used as a measure of habitual physical activity in the sample. Low, medium and high PAL cut-offs defined from the WHO recommended energy requirements were previously used by Black (2000) to categorise habitual daily physical activity levels.

3.10 Statistical Analysis

3.10.1 Data management

Two quantitative datasets were created. The first contained participant characteristic, anthropometry, PAL and fitness level data. Raw data from these quantitative measures were manually entered into a Microsoft Excel file. Food consumption and portion size data for each meal over 4 days were manually entered into a nutritional software package NetWISP Version 4.0. A dataset containing the nutritional breakdown of school day lunches with one line per food item was exported to Microsoft Excel from NetWISP. The source of all meals were obtained from the original food diaries and manually entered into this new Microsoft Excel file to create the second dataset for analysis. The two datasets were imported to analysis software R for data cleaning, which was conducted using standard methods (de Jonge & van der Loo, 2013). The first step was to correctly name and label variables, and define types of data within variables (e.g. ordinal, binary, string). Once the dataset was 'technically correct' errors in the data were explored in a number of ways. For continuous variables summary statistics, scatter plots, histograms, and Q-Q plots were inspected in order to identify potential errors. The frequency distributions and modes of categorical variables were inspected for potential errors. Once satisfied that the data were consistent statistical analysis was conducted.

3.10.2 Statistical analysis Chapter 7: Anthropometry, physical activity and fitness levels

Statistical Package for Social Sciences (SPSS, IBM) Version 21.0 was used for data analysis. The 6-minute run results were normally distributed for boys and girls. To examine the impact of anthropometry and physical activity levels on performance in the 6-minute run, linear regression analysis was carried out with 217 participants for whom data for all three test measures were available. Participants with some missing data were excluded. The effects of known participant characteristics - stage of physical maturity, urban/rural dwelling, socio-economic status, school group, height, BMI, WC and PAL on fitness were first assessed individually, adjusted for sex and age. The α level for statistical significance was set at $p \leq 0.05$.

3.10.3 Statistical analysis Chapter 8: Food diary and school lunch analysis

Statistical package 'R' was used for data analysis of school day lunches (R Core Team, 2015: R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria). Participant weight and usual activity levels were used to assess the accuracy of their food records. Accuracy of food records were assessed using estimated energy intake (EEI) to estimated energy expenditure (EEE) ratio. Schofield equations were used to calculate basal metabolic rate (BMR) (Schofield, 1985). Each participant was assigned to low, medium or high physical activity level (PAL) values based on results of their 4-day physical activity diary (see next section), age and sex. Where the physical activity diary was incomplete, a medium PAL was assigned for EEE calculation as recommended by Black (2000). EEE was calculated as BMR*PAL. EEI is the mean daily kilocalorie intake over 4 days, weighted for weekday/weekend day records, from food diaries. Cut-offs from Black (2000) were used to define under-reporters, accurate reporters and over-reporters – EEI:EEE < 0.76, EEI:EEE 0.76-1.24, and EEI:EEE >1.24 respectively. Under-reporters were included in analysis to avoid introducing unknown bias into the dataset and eliminating participants who may be of greatest interest to the study question (Livingstone & Black, 2003). Just under half of students (48%) under-reported and 52% accurately reported their energy intakes, with similar findings for both sexes. The mean EEI:EEE ratio for under-reporters (n=135) was 0.62 (SD 0.09, range 0.41-0.76).

Independent samples t-tests were undertaken to compare the mean energy, macronutrient, and micronutrient content of school day lunches between under-reporters and accurate reporters identified from the 4-day food diary. No significant differences were observed with the exception of carbohydrate, which was significantly lower by 6g in under-reporters ($p<0.05$). In light of non-significant differences for energy and the remaining nutrients, this was assumed to be spurious and the school day lunches of under-reporters were included in the final analysis without adjustment. Four over-reporters were identified and included in the analysis.

Analysis objectives for school lunch data were (a) to compare mean nutrient intakes from home, school and external food outlet lunches; (b) to compare the nutrient density, as a measure of the nutritional quality, of lunches sourced at home, school and externally; and (c) to examine food group consumption by lunch source. Nutrient density for meal types is defined as the nutrient content of the meal (grams, milligrams, micrograms) per Megajoule of energy in that meal. Differences between lunch sources for various nutrients, nutrient densities, and food groups were investigated using analysis of covariance (ANCOVA) adjusted for gender, survey day and school. In order to examine where differences occurred between lunch sources (home, school and external), post hoc analyses were conducted using Tukey's Honest Significant Difference (HSD) test. P-values (at 0.05 significance level) for both tests and 95% confidence intervals (CI) for HSD tests are reported in the results.

3.11 Ethical Considerations and Application for Research

3.11.1 Ethical considerations

An important reason for introducing peer-led methods to a study with adolescents is that it aims to reduce the power imbalance that can exist when adults conduct research with child participants (Mayall, 2008; O'Kane, 2008). Peer-led focus groups, peer-led observations and photography in the school setting posed some potential challenges from an ethical perspective. For peer-led focus groups, potential issues with peer cooperation with the task were highlighted by members of the youth panel at the design stage. A solution to this was providing peer researchers with information, and the opportunity to practice handling difficult situations during their training for focus group moderation. It was also made clear to all focus group moderators and participants that they were free to leave or end the session at any time. In addition the researcher (S.B.) was always physically present on school grounds if needed during data collection. Another potential issue would be the disclosure of sensitive information by participants during focus groups. All peer researchers signed a confidentiality agreement, indicating that they would not share information they heard or saw involving another student during or after the study.

Protecting the anonymity of participants is part of the ethical requirements for this study. Students who were taking photos around the school environment, therefore, were asked to avoid taking photos that would identify any student faces. Photos that potentially identified students were destroyed and not used for presentation purposes.

Privacy for anthropometry measurements, particularly waist circumference, was important, but equally so, researchers could not be in a room alone with students. Three sided screens were erected in gyms so that participants were shielded during measurements. One researcher took the measurement and there was one researcher 'floating' between research stations if needed. Additionally students were asked to give feedback on their experience in order to evaluate protocols used.

As participants were asked to take part in a number of methods, high participant burden was an ethical consideration at the outset of the study. An opt-in approach to consent and assent was used so that participants could pick aspects of the study to participate in. It was hoped that this method would encourage most students to get involved in at least some aspects of the study. Music vouchers, as tokens of thanks, were given to peer researchers for their time and effort and a raffle for 2 tablet computers was offered to all participants at the end of the study period as an incentive to participation.

The methods in the study were considered low-risk for participants. None the less, the subject matter had the potential to veer into risky territories, such as disordered eating or body image discussions or distress during anthropometry measures. A protocol for dealing with distressed students and a child protection statement were developed for the project. Schools were made aware of study protocols and DCU had appropriate counselling services available to students if needed.

Adult participants including teachers and principals were provided with informed consent forms for their part in the study. These were read and completed before interviews and focus groups were conducted.

Data were managed according to DCU REC policy: all data were stored in locked cabinets, separate from information that would identify participants. Once focus group discussions were analysed, the audio-recordings were permanently deleted from all recording and computer devices. Paper records pertaining to participant data will be destroyed once data analysis and writing ceases.

3.11.2 Ethical approval for research

Study aims, objectives, recruitment procedures, methodologies and justifications, along with informed consent and assent forms, plain language statements and preliminary data collection tools were presented to the Research Ethics Committee at Dublin City University (DCU REC) in June 2012. The study methods were subject to changes

depending on feedback from youth panels and pilot phases. Any amendments were sent to DCU REC for approval. The initial study design and all subsequent amendments were approved by REC. Since the study contained numerous methodologies, REC recommended that each aspect of participation be on an opt-in basis. This provided participants, with their parents, the freedom to choose an individual level of participation. While participants would be 15-17 years old and competent to understand and decide their own level of participation, informed parental consent is required for all people under 18 years (DCU REC). Signed student assent was also required at recruitment stage. All those involved in the study had Garda Clearance issued through Dublin City University.

3.12 Participating Schools

School A: Male urban

School B: Female urban

School C: Male rural

School D: Female rural

School E: Mixed urban

School F: Mixed urban, DEIS

School A: Male Urban

School A is located in North suburban Dublin with 650-700 students. Students generally live within 1-3km of the school. The school offers an optional transition year programme with limited places for which interested students have to interview. There were two transition year classes in 2012/2013 with 55 students in total.

School B: Female Urban

School B is located in North suburban Dublin with approximately 700 students. It is a single story building located on a campus next to a convent and 20 minutes walk from a suburban 'village'. There were five transition class groups in 2012/2013 with 116 students in total.

School C: Male Rural

School C is a boys only school located in a rural town (population approximately 6000) with approximately 400 students. Students come from the town and up to a 15km rural radius. The school competes with one other school in the town – a smaller, co-educational community college. Transition year is an optional programme for all interested students and in 2012/2013 there were two classes with 46 students in total.

School D: Female Rural

This school was located in a rural town (population 6000) with approximately 600 students. Students come from the town and up to a 15km rural radius. The school

competes with one other school in the town – a smaller, co-educational community college. Most students take up the optional transition year programme and in 2012/2013 there were four classes with 78 students in total.

School E Community College: Mixed Urban 1

This large mixed gender school had 1200 students and is located 1.5km from a busy suburban village in North Dublin. The transition year programme is popular, with most students opting to do it and in the year of the study there were 209 students in total.

School F Comprehensive DEIS: Mixed Urban 2

This is a mixed gender school located in a suburban 'village' that is DEIS designated by the Department of Education and Skills. The school had 450 students and in 2012/2013 there were 80 students in three classes on the transition year programme in total.

3.13 Presentation of Findings and Discussion

There are five findings chapters (Chapters 4, 5, 6, 7, and 8) and one final discussion chapter (Chapter 9) in this thesis. Findings from student-led qualitative methodologies are presented in Chapters 4 and 5. The views of principals and teachers are explored in Chapter 6. In the remaining two findings chapters the quantitative results from anthropometry, physical activity and fitness (Chapter 7), and nutrient analysis of 4-day food diaries and school day lunches (Chapter 8) are examined. Each findings chapter will include a short introduction in order to provide the reader with a brief reminder of the methods, data source, and data analysis. Interim discussions are included in each findings chapter so that results pertaining to the particular methodologies employed therein can be explored in the context of similar peer reviewed literature and relevant policy documents. The final discussion chapter (Chapter 9) draws together key qualitative and quantitative findings to create a more complete picture of how school policies, practices and infrastructures were influencing students' behaviours and attitudes. Finally, the overall strengths and limitations of the study are discussed, as well as recommendations for future research and practice.

Chapter 4

4 Findings from students' photos

4.1 Introduction

Findings from the visual content analysis of students' photos within the school environment are presented in this chapter. The methodology used is described in Chapter 3, Section 3.6.1.1. To briefly summarise the method for the reader: twenty-eight students, working in pairs, in six schools were given disposable cameras to use over one school day between October and February. Students were asked to record images relating to food and physical activity at school and, where relevant, in the local environment. Visual content analysis was used to analyse the images as per Bell (2001) and described in Chapter 3 section 3.6.2. Analysis was supplemented with textual data recorded by students to support their photos, fieldwork notes and discussions with students after their data collection. Results are presented as dominant themes with the participants' photos used to illustrate themes.

4.2 Results: Food Photos

A total of 214 photos were taken by 14 students. After exclusion criteria were applied (see Chapter 3, Section 3.6.2, Table 3.2), 168 photos representing the food environments of six schools were analysed. Percentages in this section of the chapter are expressed as a proportion of 168 food photos unless otherwise stated. Each pair of students captured a mean of 24 photos (range 14- 43). Four dominant themes were identified from photo analysis including (1) Places and spaces, (2) Beverages, (3) Food items and (4) Food signage.

(1) Places and spaces

The majority of photos (79.2%) taken by students portrayed places and spaces where food was obtained or eaten and 75.6% were taken within the school grounds. Within school grounds 122 images captured indoor spaces and 15 images captured outside

spaces. Figure 4.1 shows the places and spaces represented in photos students took within the school environment.

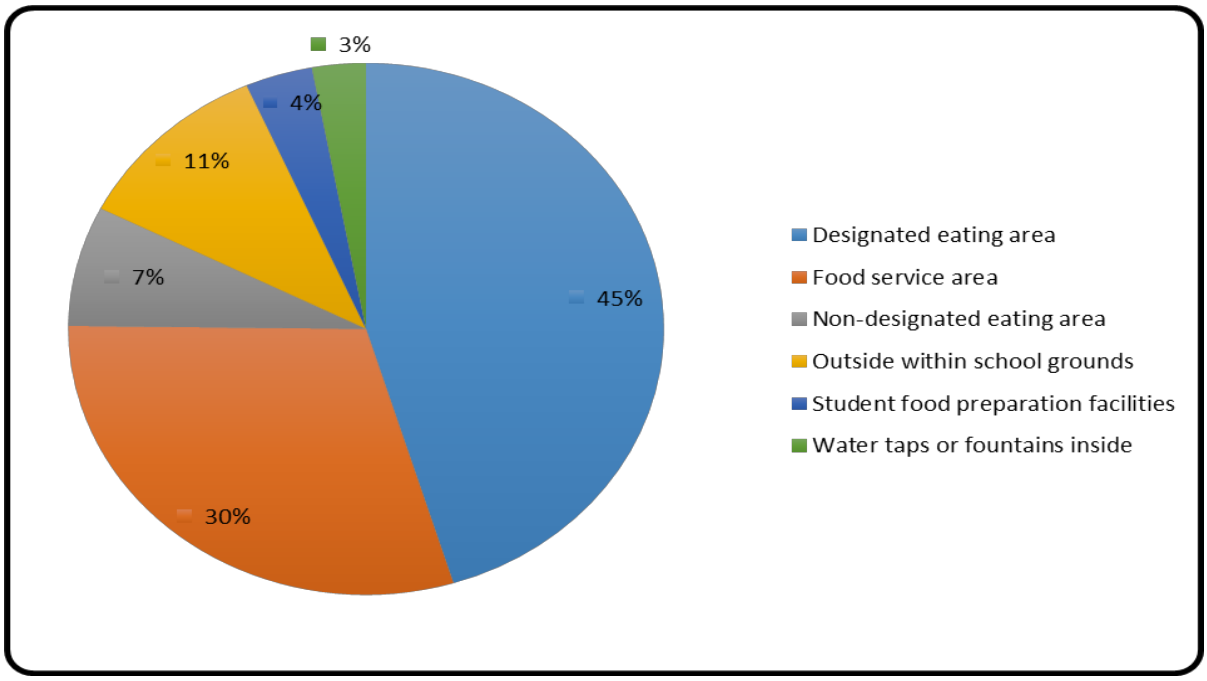

Figure 4.1 Pie chart showing the places and spaces within school grounds represented in photos taken by students in six post-primary schools over one typical school day. Percentages are based on the total food related photos taken within the school grounds (n=168).

The majority of spaces were designated dining areas, equipped with tables and chairs or benches, and during break times these spaces were highly congested as Photo 4.1 illustrates. To ease congestion one school had separated junior and senior year groups into different food service and dining areas. Students also demonstrated their use of alternative, less-congested non-designated dining spaces by capturing images of classrooms, halls, corridors, locker rooms, and outdoor spaces where small groups sat or stood at break times. While students also portrayed outdoor dining spaces, many of these areas were not in use on the day photos were taken, which may be explained by the winter season when the images were recorded (October to February).

Photo 4.1 "Canteen at lunch time"

4% of photos taken within the school grounds showed facilities that students could use to store and prepare food that included fridges, an oven, microwave, and electric kettle. Photo 4.2 shows a mini-fridge that students could use in their classroom to store milk for making hot drinks. This finding is in contrast to Shanley (2015) where 47% of surveyed schools reported having such facilities, however the types of equipment, student access and extent of the facilities is not clear from that study. While bringing packed lunches from home is common for school children in many countries (Misyack et al., 2015; Pearce et al., 2013), little attention has been paid in the literature to facilities that would improve students' dining experience such as providing fridges for storing perishable items, heating food or making hot drinks. Students as passive recipients of food and food facilities at school is incompatible with the view that young people should play an active role in decisions that affect their lives (James & James, 2004; UNRC, 1989). The health promoting schools ethos is guided by participatory theories that promote the enablement and empowerment of young people so they can be involved in making healthy decisions for themselves (Simovska, 2007; WHO, 1997). There is a clear gap in empowering students to take responsibility for their food choices during the school day in this study.

Photo 4.2 "Fridge in TY room".

31 photos were taken in local food environments where food and beverages were acquired by students at lunch time. Of these 31 photos, 48.4% related to chain convenience shops, 29.0% to independent convenience shops, and 22.6% to fast food outlets. All photos of chain convenience shops and fast food outlets were taken by students from urban schools, while images representing independent convenience shops were taken by students from both rural and urban schools. In their textual descriptions of local food outlets, students listed an average of 2.5 food outlets (range 1 to 4) typically frequented by students at lunch time. Distance and the time allotted for lunch break were the main factors determining what food outlets students frequented. The influence of distance is supported by international literature (Virtanen et al., 2015; Smith et al., 2013). With the exception of one convenience shop 20 minutes walk from School A, which had 60 minute lunch break compared to 40-45 minutes in other schools, students reported that they travelled no further than 10 minutes by foot to food outlets at lunch time. The influence of convenience shops concur with a recent Scottish study highlighting that supermarkets, sandwich shops, bakeries and newsagents, rather than fast food outlets, were the most popular source of foods for secondary school students outside of school at lunch time (MacDiarmid et al., 2015). Smith et al. (2013) observed an increase in convenience stores/grocers within 800m of schools in East London from 2001 to 2005, with no differences noted for takeaways, and there are an average of 6.7 shops located within 1km of Irish post-primary schools according to recent research (Callaghan et al., 2015). Local shops, therefore, may play a more central in dietary behaviours at lunch time than fast food outlets.

(2) Beverages

Of images taken within the school grounds 15.6% portrayed beverages and this figure was 19.4% for images taken outside school. More than one beverage type was portrayed in some of the images. Beverage types are categorised in Table 4.2. While bottled water was commonly portrayed, 61.4% of all beverage images in the school environment were sugar-sweetened beverages (including carbonated and non-carbonated sugar-sweetened beverages, and milk-based sugar sweetened beverages) with the remainder being bottled water and diet-carbonated beverages.

Table 4.1 Number and percentage of different beverage categories portrayed in photos taken by students over one typical school day in six post-primary schools, in both the internal and external food environments

Beverage Category	Inside School n (%)	Outside n(%)
Non-carbonated sugar-sweetened beverage	18 (40.9)	0 (0)
Bottled water	15 (34.0)	2 (28.6)
Carbonated sugar-sweetened beverage	7 (15.9)	5 (71.4)
Diet carbonated beverage	2 (4.5)	0 (0)
Milk-based sugar-sweetened beverage	2 (4.5)	0 (0)
Total	44 (100)	7 (100)

Photo 4.3 "Drinks fridge"

Sugar-sweetened beverages have been directly linked to excessive weight gain and obesity among children and adolescents (Malik et al., 2006). Removing sugar-sweetened beverages for sale in schools has been identified as an important and easily modifiable factor that would reduce students' intake of energy, free sugars and improve their consumption of healthier drinks, and fruits and vegetables, during the school day

(Council on School Health, 2015; Briefel et al., 2009; Malik et al., 2006). Callaghan et al. (2015) found that 51.8% of Irish schools sold sugar-sweetened soft drinks and 25.0% sold flavoured milk, which also contains free sugars, and almost all schools (89.3%) sold bottled water. The absence of milk and 100% fruit juice in images taken by students contrasts with current research indicating that at least half of schools provide these items (Callaghan et al., 2015). This disagreement may be explained by students' representation of what they actually consume versus what's available, which would be an important contribution of the current study. It is interesting to note that non-carbonated soft, or "juice" drinks were the most common, and while schools may recognise the high sugar content associated with carbonated soft drinks and avoid selling them, the majority of beverages portrayed were not appropriate alternatives. Sugar-sweetened beverages compete with healthier drinks like water and even though the second most common category of beverage captured by students was bottled water, there's a financial implication for students.

Seven images showed students' access to free water within the school grounds with 4 water fountains or taps inside and 3 images of taps on outside school walls. Two indoor fountains were located in student bathrooms and 1 in a gym shower area. Photos 4.4 and 4.5 illustrate two of the free water facilities captured by students.

Photo 4.4 "water fountain".

Photo 4.5 "tap outside in courtyard".

Free water sources in the dining areas of schools, where the students congregate to eat their breaks, is recommended in the building regulations for Irish post-primary schools (DES, 2008), and is a component of healthy school food standards in other countries (UK Department of Education, 2014; Patel et al., 2012). No Irish study that has reported on students' access to free water at school could be found for comparison. Research from the US suggests that student concerns about the taste, appearance and safety of water from fountains can be a barrier to using them (Patel et al., 2010), and students favour alternative dispensers such as taps or filtration units (Patel et al., 2012). An intervention has shown that the provision of free water in the food service area at school, in combination with promotion and education improves student consumption of water compared to non-intervention controls (Patel et al., 2011). The placement of free water dispensers in unhygienic environments, such as the toilets or refuse laden outside corners as portrayed by the participants, rather than visibly in the dining areas suggests lack awareness at local levels, or difficulties in the practical implementation of healthy drinks policies for students at school.

(3) Food items

Food items were captured in 90 images - 70 images taken in school and in 20 images outside school. The lower number taken outside school was explained by students as they were not as comfortable about photographing in these locations, and students were unsure if they needed permission from shop owners to do so. Of food images taken outside school 65% were of foods obtained in chain convenience shops, 25% from independent local shops and 10% from fast food restaurants. Figure 4.2 illustrates the frequency of food groups portrayed in images taken by students within and outside the school environments. The food group categories most commonly captured in the 90 images showing food items were rolls, wraps and breads (24.5% photos inside and 24.0% outside school), processed meat products (17.6% inside and 24.0% outside school), savoury snacks (14.3% inside and 24.0% outside school) and confectionery (13.2% inside and 16.0% outside school).

When asked about student participation in making the school a healthier place, most peer researchers alluded to student council representatives and student participation in recycling at school. Five students could recall being asked for suggestions on healthy options for their canteen in the past through a survey. One canteen encouraged student feedback and ideas through a suggestion box placed in the dining area, suggesting an interest in obtaining students' views to inform decisions about food provided at school. It was not possible from the current study, however, to determine if school canteens acted upon student suggestions.

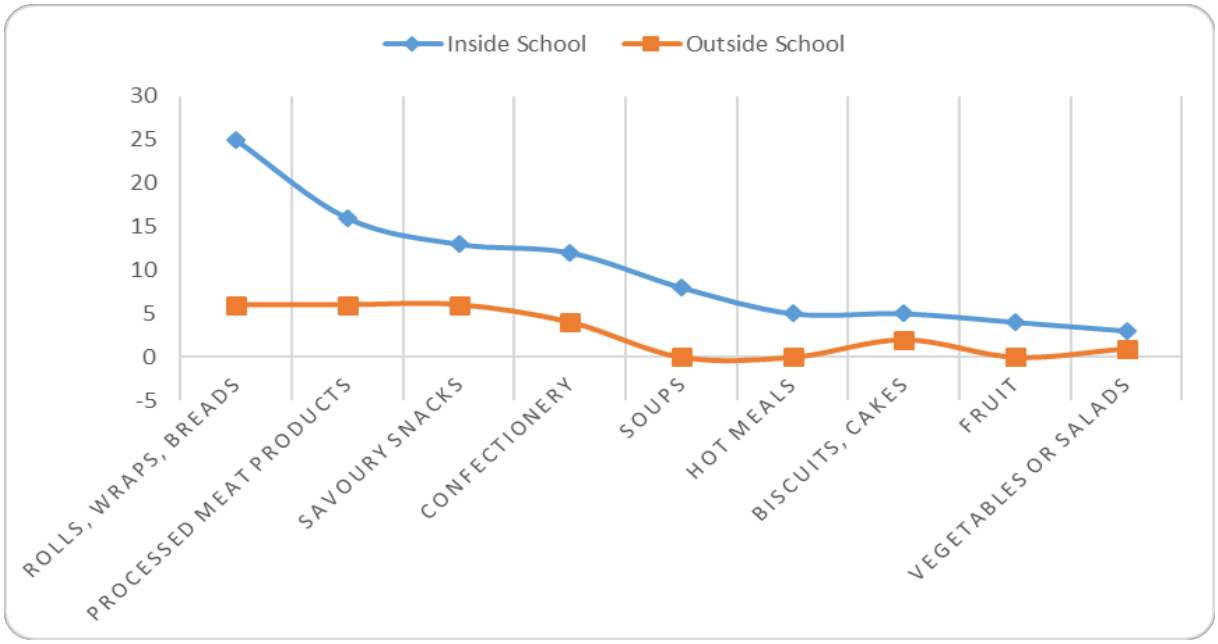

Figure 4.2 Line chart showing the frequency of food group items portrayed in photos taken by students within and outside of the school environment at break and lunch times on one typical school day in six post-primary schools

11.3% of images contained hot food items, with the majority portraying processed meat products and a smaller number showing soup and hot meals. Examples of the types of savoury hot foods captured by students at school (Photo 4.6) and outside school (Photo 4.7) are shown below.

Photo 4.6 "Hot food at school"

Photo 4.7 "Hot food in Centra"

One photo accompanying a hot meal showed a set of disposable cutlery, however the majority of foods were convenient to hold in the hand to eat, without the need for tables, chairs or cutlery. These findings are of cultural significance because meal patterns have shifted in society over the last number of decades to include more snacking, "grazing" and less structured meals that involve sitting down (Zizza et al., 2001). The absence of a state meal programme in Irish schools is also evident in the lack of plates and cutlery shown in food images taken by students. The general design guidelines for post-primary school buildings in Ireland (DES, 2008) recommend the provision of a *"kitchenette…used to prepare and dispense light refreshments … equipped with a cooker, a water boiler, a fridge, a dish-washer and a suitable sink…not intended to be a kitchen where food is prepared or cooked."* The same guidelines recommend that schools' general purpose/dining area should be *"the social heart of the school….should provide a sense of openness within the school, enhancing general circulation"* (Department of Education and Science, 2008). While these guidelines are most relevant for new school buildings or schools renovating existing spaces, it is clear that the provision of food by schools is not integrated into the current Irish education system. This position does not reflect current practices in Irish schools as the current study and others (Callaghan et al., 2015; Shanley, 2015; DES Lifeskills Survey, 2014) have shown that food in many schools is being prepared and cooked on site. These practices are

happening, therefore, in the absence of any state planning around school food and what's provided is decided at local levels by schools and private food operators.

There was a similar appearance of bland colours (white, tan brown) associated with hot convenient foods captured by students both within school and outside school as Photos 4.6 and 4.7 above illustrated. As a whole setting, however, local food environments displayed more colour in food photos through signage (discussed below), packaging and the availability of salad items (see Photo 4.8).

Photo 4.8 "Deli in Centra"

(4) Signage

Food related signage was portrayed in 17.6% of images taken within (8.1%) and outside (9.5%) school. Signs displayed information about foods, beverages and snacks available and costings. Signs containing price information were lunch or snack deals which promoted 2 or 3 item combination deals and three examples of these are shown in Photos 4.9 and 4.10. Lunch deals typically consisted of a filled bread roll, wrap or sandwich with crisps and a beverage for ranging in cost from €2 to €4. Sugar-sweetened beverages were the dominant option in these deals, both within and outside school.

Photo 4.9 "Chicken fillet roll meal deal"

Photo 4.10 "Meal deal at school"

Signage images represented food and beverage marketing messages that influenced students' purchasing behaviours. Value for money was important and multiple items for €2 to €4 were hooks that influenced them. The signage also demonstrated that school canteens and shops were replicating the food environments outside of the school, particularly in terms of lunch specials, processed meat products and sugar-sweetened beverages. This is not surprising given that food operators in schools were independent and at least three also operated food businesses in the local area. Colour differentiated the signage between school and local food outlets, however, where the latter signs were more colourful and contained pictures of foods. The use of colour demonstrates a more sophisticated food marketing environment in local food outlets, since certain colours and images have been shown to influence young people's preference and perceptions about taste (Enax et al., 2015; Letona et al., 2014). Students' attitudes to marketing, special offers and value-for-money are expanded further in their focus group discussions in Chapter 5.

4.3 Results: Physical Activity Photos

A total of 138 photos representing physical activity were taken by 14 students. After exclusion criteria were applied, 100 photos representing the physical activity environments of six schools were analysed (see Chapter 3, Section 3.6.2, Table 3.2). Percentages in this section of the chapter are expressed as a proportion of 100 physical activity photos unless otherwise stated. Thirty-three photos were taken in male only schools, 25 in female schools, and 42 in mixed gender schools. Themes emerging from visual content analysis of physical activity photos included (1) Facilities and resources, (2) Old versus New (3) Student activities, (4) Transport

(1) Facilities and resources

Almost all the photos were taken within the school grounds (92%), with students from 3 schools taking photos (8%) of local facilities that the school used regularly for PE and extra-curricular sports that included grass pitches, an astro pitch, and an all-weather pitch. 33% of physical activity photos were taken indoors and 67% outdoors.

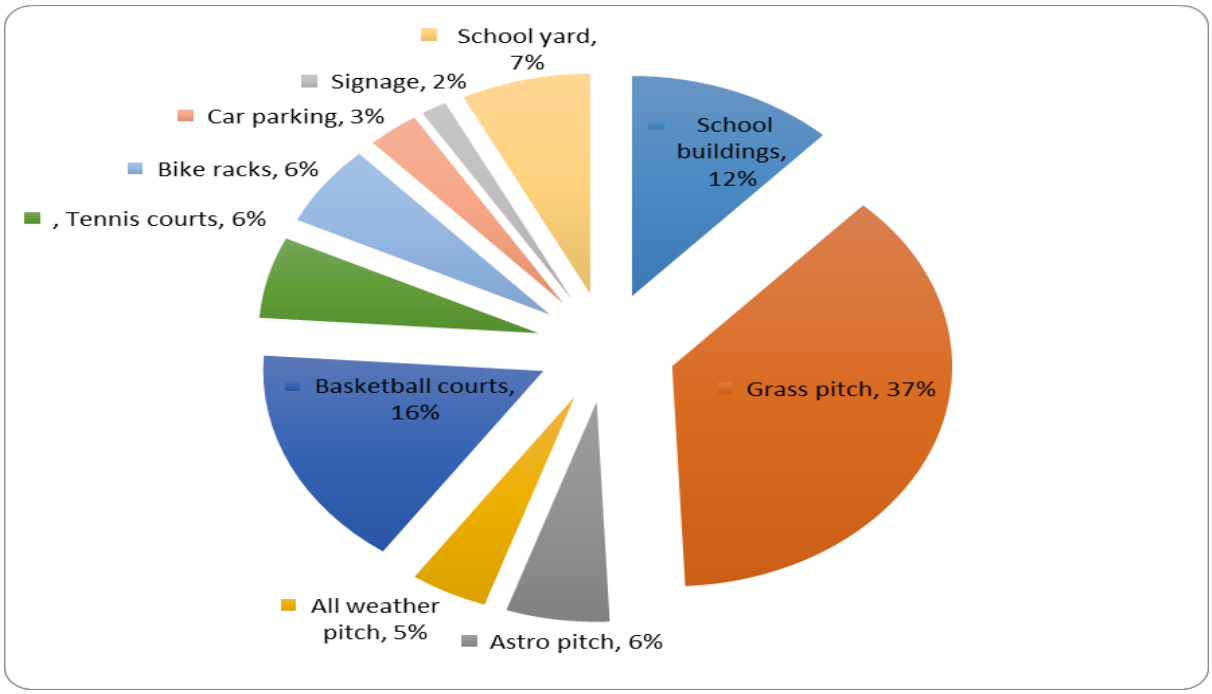

Figure 4.3 Pie chart showing the categories of physical activity facilities and resources captured in outdoor photos taken by students over one typical day in six post-primary schools. Percentages are based on the number of outdoor images only (n=67)

The categories of outdoor images are illustrated in Figure 4.4. Team-based sport facilities including grass pitches, basketball courts, astro pitches and all-weather pitches were the dominant spaces outside. There was a noticeable absence, with the exception of tennis courts, of outdoor activities for individual level sports. Current design guidelines for Irish post-primary school buildings specify the following physical activity spaces: indoor PE hall, changing rooms, showers, toilets, teacher's office, equipment stores, balcony area, fitness suite (separate to the PE hall, generally within balcony area), an outdoor hard play area marked as basketball courts, and outdoor playing pitch (DES, 2008). With the exception of one school (School C), all schools had large indoor and outdoor physical activity facilities. The facilities are consistent with the most popular sports in Irish post-primary schools including Gaelic games, soccer and rugby (Woods et al., 2010). This is also consistent with research on school physical activity environments in the UK whereby PE halls, playing fields, basketball courts, and shower facilities are available in most schools (Kirby et al., 2012).

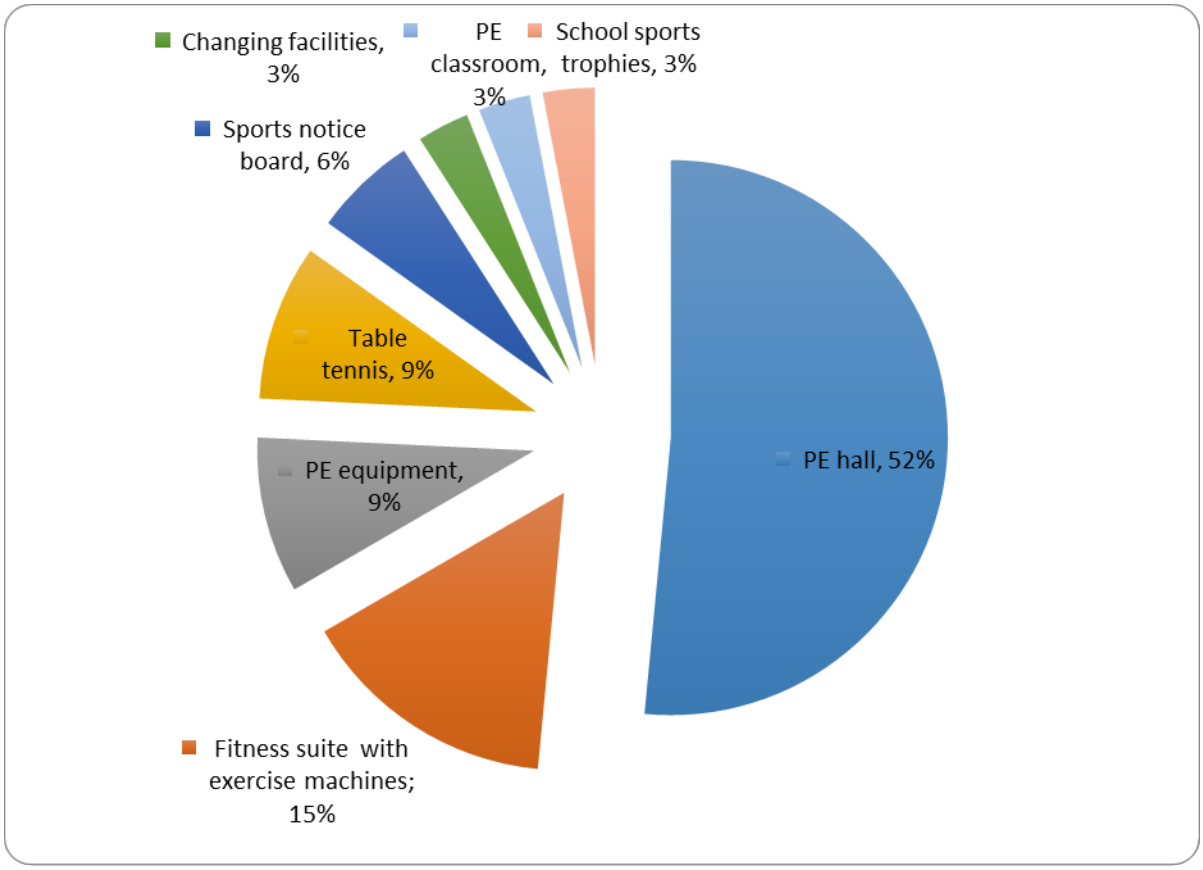

Figure 4.4 Pie chart showing the categories of facilities and resources for physical activity captured in indoor photos taken by students over one typical school day in six post-primary schools. Percentages are based on the number of indoor images only (n=33)

The categories of indoor images are illustrated in Figure 4.3. Exercise machines in fitness suites included treadmills, exercise bikes and weight benches, and while they were the most commonly depicted facility after the PE hall, discussions with students revealed that their access to this equipment was restricted during the school day as unsupervised use was not permitted. A 'fitness suite' is a modern addition to post-primary schools in Ireland, and design guidelines recommend their placement on the balcony overlooking the PE hall (DES, 2008). While they appear to be an ideal choice for unstructured student activity (Gorman et al., 2007), this was not an option in most schools here. The issue of restricted access even extended to PE classes in School B, for example, because the teacher was unable to supervise a small number of students using machines on the balcony when he/she was in the main PE hall. School F had a scheme

whereby students could use the supervised fitness suite after school for €2. The use of the school facilities by students after hours is recommended (WHO, 2016; Dobbins et al., 2011; Ward et al., 2006), however it was not clear from the data how many students in School F availed of this. Other photos depicting individual-level facilities indoors showed table tennis tables, two notice boards advertising golf and a triathlon, and one Photo showing an indoor climbing wall. The provision and promotion of alternative indoor activities like dance, yoga, Pilates, fitness, kickboxing, walking, pedometer use, weight training and self-defence at school can increase participation among non-sporty and female students (Gorman et al., 2007; Ward et al., 2006), however there was no evidence of these spaces or facilities for students. This was another example of how young people are passive recipients of the 'usual' physical activity facilities designated for schools. Both indoor and outdoor environments were not catering for students who may benefit from alternative, non-team spaces to be active.

(2) Old versus New

There were obvious differences between the condition of facilities attached to old and new school buildings. Concrete and tarmac surfaces featured in the yards of all schools, with the exception of School E. From photos and knowledge of fieldwork sites it was clear that there were more grass surfaces in the areas close to the school doors compared to others, and there were features that could encourage students to use their outdoor spaces such as the wooden archway leading to a walking trail shown in Photo 4.11. While it was not clear from the photos if students were using the trail or grass areas, green spaces like these have been shown to improve casual physical activity among school students (Dyment & Bell, 2007; Gorman et al., 2007). Walking trails, for example, can even be introduced to existing outdoor spaces and can act as a running circuit and also connect smaller environments such as field space for frisbee or other informal activities (Gorman et al., 2007). A Norwegian study found that the provision of informal outdoor activity areas for students in post-primary schools is poor compared to primary schools, however students in post-primary schools where additional facilities were present were significantly more likely to be active at break times (Haug et al., 2010). In focus groups, young people have reported that nothing to do at lunch-

times and limited accessibility to sports equipment at break times is a barrier to being physically active, and that more activities around the school grounds would encourage them to be active (Hohepa et al., 2006). Students showed a preference for outdoors in the number of photos they took here, however their use of these spaces include activities other than physical activity and will be discussed further below.

Photo 4.11 "Walk to garden"

Outdoor basketball courts were a feature of four out of the six schools. The contrast between the conditions of the facilities between schools is illustrated in Photos 4.12 and 4.13. The poor conditions of spaces designated for students' use conveys a message that physical activity is not highly prioritised within school. PE teachers raised the issue of priority in relation to time allocated to PE in their focus groups and the potential impact of this on students' attitudes is discussed further in Chapter 6.

Photo 4.12 "Basketball courts outside"

Photo 4.13 "Basketball court"

(3) Student activities

Students were present in only 16 images and 10 (62.5%) of these portrayed students taking part in structured PE classes and 6 portrayed non-structured activities at break times. Structured activities included Gaelic games, soccer, basketball, and table tennis and non-structured activities included soccer, basketball, walking and "hanging around". There are a number of possible reasons for the absence of students in most of the photos, which are discussed in the limitations section at the end of this chapter.

While outdoor basketball courts were part of the school yard in most schools, their use for basketball was only evident in one Photo. Most outdoor basketball courts had poor surfaces and no nets in the hoops. The inclusion of basketball courts in school environments appear to be a result of school design recommendations (DES, 2008)

rather than responding to students' space needs because only one photo showed students playing basketball at break time. Students in the current study demonstrated their alternative uses of the basketball court spaces including standing around socialising, and playing football as Photo 4.14 shows. In Australian children Dyment et al. (2009) have shown that paved sporting courts in the school yard attract the highest level of sedentary behaviours at break times, which suggests that young people don't necessarily view them as spaces to be active. Barron (2011) has demonstrated that children will transform space and objects to suit their own social and recreation needs. While this is positive because young people find ways to use spaces provided to them, current Irish design guidelines (DES, 2008) are in direct contrast with positive outdoor school spaces and architecture that can play a role in promoting physical activity (Dyment & Bell, 2007; Gorman et al., 2007). Gorman et al. (2007) describe weather-protected spaces such as porches, overhangs or covered courts on the borders of indoor and outdoor spaces, which may be used by students who normally avoid activity on fields and basketball courts. Covered outdoor facilities mentioned above would be particularly useful in Ireland as students attend school during autumn, winter, spring and early summer when most rain falls. Beyond the PE hall there was no evidence of indoor spaces in which students could be active by themselves during the school day.

Photo 4.4 "lads playing football on yard at break time"

There was also a clear gender bias in the students who were active in photos – with the exception of one photo of girls playing Gaelic football during PE class, the remaining

structured and unstructured activity photos portrayed boys. This is not surprising given the strong body of literature demonstrating girls' disengagement with physical activity during adolescence (Sullivan & Nic Gabhainn, 2013; Woods et al., 2010; Sallis et al., 2000). One signage image (see Photo 4.15) taken outdoors in a girls school was particularly pertinent, as the message forbade unsupervised use of the grass pitch, and provided an example of student's experience of restricted access to physical activity facilities. Further discussions with students revealed that boys, but not girls, were permitted and encouraged to use school sports equipment such as footballs and pitches at break times.

Photo 4.5 "sign: pitch cannot be used without authorisation"

Because boys typically engage more than girls with competitive, team based sports that demand large spaces it has been suggested that school physical activity spaces are "gendered" (Bocarro et al., 2012). Lynch and Lodge (2002) provide evidence of strong sporting cultures in single gender boys' schools, that isn't there for girls in Irish schools. The absence of girl's portrayed active at school in this chapter would concur with the literature, that girls are not well supported to be physically active at school. Individual sport options including athletics, cross-country running, golf and judo were listed in the textual inventories students compiled about extra-curricular sports at their schools. The only evidence of these activities in students' photos were on paper - there were no photos of running tracks or trails, long-jump facilities, gymnastic equipment, hurdles, or golf putting greens to name a few possible facilities. Discussions with students and staff revealed that these types of activities were more niche, limited to a small number of interested students and certain training and competition times during the year. The literature, however, would suggest that it is the visibility and active promotion of alternatives to traditional team-based sports that is required in the school setting (Trudeau and Shepherd, 2005). It is not clear why schools are not promoting alternative activities or limiting them to very interested students. One possible explanation is an historic, socio-cultural approach to physical activity at school that has not changed sufficiently to support alternative and new space concepts for young people of all interests and abilities to be active.

It should also be acknowledged that girls value school breaks as a time to meet and talk, while boys tend to be more interested in socialising through sports or being active (Haug et al., 2010). When questioned on break time activities students in girls and mixed gender schools explained that hanging out with friends was the most common activity, and even if they went outside it would be sit or stand around in groups. This is another explanation for the absence of girls portrayed being active in photos, and also a factor that deserves consideration by schools when developing lunch-time strategies to encourage physical activity participation among girls.

(4) Transport to school

Four images portrayed bike racks for students to lock bicycles at school, with no facilities shown for two schools. As a proportion of the students in the school, the number of bicycles parked in these areas for three schools was very small as Photo 4.16 illustrates.

Photo 4.14.6 "bike rack"

Peer researchers carried out their own transport survey with a subsample of students by approaching one class of students for each year group (1st to 6th years) in the school. Students were asked to name their dominant and usual mode of transport to school and results are shown in Figure 4.5. Overall car (46.1%), walking (24.2%) and bus (16.8%) were the most common means of travelling to school. Various national surveys have reported 24-43% of post-primary school students walking or cycling to school (Department of Children and Youth Affairs, 2012b; CSO, 2011; Woods et al., 2010), and 35.5% of students actively traveling to school in this study is consistent with these figures. School level differences were apparent, especially the proportion of students walking in School F and those cycling in School A. School F was a DEIS school situated in a densely populated suburban 'village' where students had short distances to travel to school and did so by foot. Walkable distances is a known facilitator of active school transport (Kerr et al., 2006) and this is a possible factor explaining the lower walking

rates in urban schools B and E, who both reported wider catchment areas than urban schools A and F. Over 50% of students surveyed in School A cycled and student's photo of the bicycle rack confirmed a large collection of bicycles compared to other schools. Although boys are more likely to cycle to school than girls, this practice was unlike all other schools, and national averages as it has been reported that only 9.4% of Irish boys cycle to school (Nelson et al., 2010). According to students, teachers and the principal this was a unique culture where environmental and social factors, including adequate bicycle racks, school encouragement and support, and peer norms played a role. Social norms, social modelling and social supports have been described as important factors in promoting active transport among older adolescents (Verhoeven et al., 2016), which findings for School A would agree with. Data collection during the winter months may also explain low numbers of bicycles parked in other schools, however time and distance, and not weather, are the primary barriers reported for active school transport in Ireland and internationally (Wong et al., 2011; Woods et al., 2010; Nelson et al., 2008).

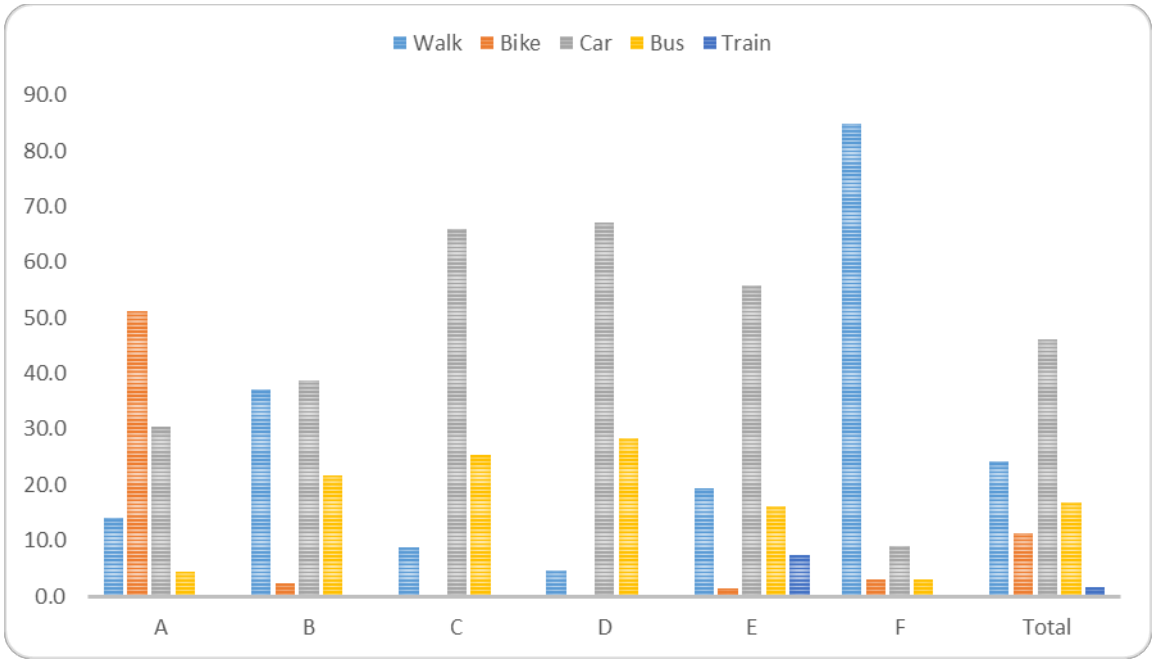

Figure 4.5 Bar chart showing results of peer researcher's survey with a subsample of 1st to 6th year students in their schools on the dominant modes of transport to school. Results are presented as a percentage of students surveyed in each school (Schools A male urban, B female urban, C male rural, D female rural, E mixed gender urban, F mixed gender urban DEIS) and as a percentage of the total number students surveyed across 6 schools.

Although the provision of bicycle racks is recommended, this facility is currently optional for post-primary schools in Ireland (DES, 2008). The provision of one car parking space per teacher plus three per 100 students, however, is mandatory (DES, 2008). Creating environments that support physical activity is one of the cornerstones of health promotion theory, and indeed health promoting schools (DoHC, 2013). Green Schools for Travel, part of an environmental education programme (www.greenschools.org), represents Ireland's state sponsored programme for increasing active transport to school. While a recent report shows increases in active transport and reductions in inactive modes of transport to school, only 7% (n=18) of participating schools are currently post-primary (An Taisce, 2015). Lack of engagement with post-primary schools, in combination with poor environmental designs to promote active transport, were very evident in students' photos whereby 17% contained car parking, 16% showed students being active and 4% portrayed bicycle racks. Students share their school space with adults, however there was a clear domination of teacher rather than child transportation to school.

Summary: School food and physical activity environments

Findings from the visual content analysis of students' photos indicate that schools in the study were abdicating responsibility for the provision of food and beverages to students during the school day in a number of ways. External companies decided on the provision of food via canteens, shops and vending machines, free water was not accessible to students in a convenient and hygienic manner, and students were not enabled to take control over the storage and preparation of their food within the school environment. The foods and beverages sold to students were typically high in fat, salt, and sugar and low in fibre and micronutrients. There was an absence of more nutritious items such as milk, fresh fruit and vegetables/salads, wholegrain breads, fruit juices and low-calorie beverages and snacks. One might have expected the school environment to be healthier than local food outlets, however this was not the case. The implementation of widespread recommendations (WHO, 2016; DES, 2015; DoHC, 2008;

DoHC, 2005) to make the healthy option the easy option at school was not apparent in participating schools.

Findings for physical activity show lack of diversity and creativity in the spaces, design and architecture in school environments to support physical activity and active school transport. School spaces in this study were designed to promote team based sports and did not cater for individual or small group activities. This also inflicts a gender bias whereby typical boys' activities are supported while girls' interests are not sufficiently catered for. Although the majority of photos showed outdoor spaces, there was a poor depiction of participation in physical activity in these spaces, and this was particularly pronounced for girls.

Strengths

When asked about the advantages and benefits of taking part as a peer researcher, students' responses were categorised into (1) awareness raising, (2) skill development, and (3) fun. Learning more information about their school and behaviours of peers was the aspect peer researchers enjoyed the most. It made them take notice of healthy/unhealthy practices in their school and some students reflected on their own eating and physical activity behaviours as a result: *"I realise I should eat healthy and exercise more after my experience" (Lisa)*. It is interesting that increased awareness was the most common feedback point from peer researchers because the literature emphasises that identifying problems through participatory research is the first step in creating conditions for the generation of solutions and social action (Carlsson & Simovska, 2012; Duckett et al., 2010). This finding also indicates that before the research began students were unaware of important health promotion elements within their school environment. This concurs with recent evidence showing poor progress in integrating the health promoting school ethos into Irish post-primary schools (Moynihan et al., 2016), and lack of student consultation at school (Horgan et al., 2015). Students in the current study were offered a brief opportunity to explore their own everyday environments and they learned new information as well as new skills. Learning how to research and observe were the skills student felt they gained most

during the process. The fun aspects for students were missing class and spending time with friends during the process: *"I liked working with friends for the good of research"* (Kevin).

Limitations

Students captured a 'snapshot' of their school spaces, facilities and peer use of them over one typical school day. The discrete time frame was convenient for schools and facilitated student participation in the study, but limited the possibility of capturing a 'full' picture. This was noted in feedback from students responsible for exploring physical activity. It is one explanation for the low numbers of photos from local food outlets, and photos portraying students active at school. Two additional factors also contributed to lack of student activity in photos – the first is that students were taking care to respect non-participants privacy and identities by not photographing students' faces. Although peer researchers were advised on ways to manage this (e.g. photographing from a distance), more time for guiding students on the practical aspects of achieving photos with students may have been required in the training workshops. Secondly, all photos were taken between October and February, and a replication of data collection in later spring or summer months may have yielded more outdoor activities. An alternative approach to this method would be to provide students with cameras for a longer time frame. Students were expected to give up their time before school, during mid-morning and lunch breaks for data collection, and they also needed to miss classes in order to capture some activities. These were drawbacks for a small number of peer researchers in their written feedback. Negotiations with schools and students on these commitments would need consideration if data were collected over a longer period.

There were some tasks that made students feel nervous, including asking canteen staff for information and asking permission from local shop managers to take photographing on their premises. Ultimately photographing outside the school grounds posed an issue for students, as only a small number of photos were taken at local food outlets compared to school. This is an important learning outcome of the method and more

attention to photographing protocols and obtaining permission from local food outlets could have been addressed in training workshops for students.

4.4 Signpost to Next Chapter:

In the next chapter, findings from interviews and focus groups, conducted by transition year students with their peers will be reported and discussed.

Chapter 5

5 Findings from peer-led focus groups with students

Objective: To capture the views of the students about food and physical activity practices in their school and the wider factors that affect their food and physical activity choices

5.1 Introduction

Findings from focus groups facilitated by peer researchers in six schools are presented in this chapter. The school context within a broad range of factors influencing diet and physical activity knowledge, attitudes, and behaviours among adolescents were explored by peer researchers. Results from evaluation of the peer-led method are also described. The methodological, evaluation and analysis procedures for peer-led focus groups are outlined in Chapter 3, Section 3.4. To briefly refresh the reader: peer researchers attended training to learn how to conduct a focus group. Focus groups in the school setting were facilitated by peer researchers, without the presence of an adult. The researcher transcribed audio-recordings of the sessions verbatim, and peer researchers highlighted important comments in the text. Content analysis was used to identify dominant emerging themes (See Section 3.6.2 for systematic analysis procedure used). Quotes included in this chapter were chosen by the researcher to represent dominant emerging themes and they were selected when analysis was complete. Combined findings from focus groups were presented to students at school, during which time they were free to give their opinions which are discussed in the results. Peer researchers filled out an evaluation questionnaire (Appendix J) about their experience at the end of the focus group sessions. More detailed information on focus group training for peer researchers and questions used are in Appendices G, H and I.

5.2 Participants

Seventeen students, 8 boys and 9 girls, between 15.2 and 16.8 years (average age 16.0 years) participated as focus group moderators. In each school two or three students worked in groups to conduct focus groups with their peers. One focus group per school was conducted, with the exception of the largest school where two focus groups were conducted on the request of students. One group of students in this school developed their own questions for use in the focus group, while all other peer researchers opted to use the standard questions developed during the design and pilot stages of the study. Twenty-seven boys and twenty-seven girls took part as focus group participants with an average of 7.71 participants per group. Two male only, two female only and three mixed gender focus groups were conducted.

5.3 Dominant Emerging Themes

Dominant themes arising from focus group discussions are presented under seven main headings that are: (1) knowledge and understanding; (2) *"it depends on who you're with":* the influence of the peer group and parental responsibility; (3) *"see boredom is kind of a big thing"*: boredom & mood; (4) *"if apples tasted like chocolate bars..."*: taste, fantasy and fun; (5) everyday environments: school, the locality and marketing environments; (6) body image; and (7) physical activity.

Knowledge and Understanding

Participants in all groups displayed knowledge of healthy eating and physical activity recommendations. The importance of eating fruit, vegetables, high fibre foods, and reducing *"fatty", "sugary"*, or *"junk"* foods, as well as being active every day were discussed extensively and knowledgably in the main. Ian, for example, displays his knowledge of portion control: *"anything dairy like cheese is healthy, just if you eat too much of it you're going to grow fat."* Physical activity was frequently discussed in terms of the importance of attaining or maintaining a healthy body weight.

There were some misunderstandings, however, about food in relation to body weight and physical activity. While many talked about the importance of finding a balance between healthy and unhealthy foods and sufficient exercise for health, there were differing interpretations of moderation and balance. Liam's view that *"everything's alright in moderation though like, once a week"* seems sensible. For others, particularly girls, "binges" on the wrong foods would be acceptable if it was followed by compensatory exercise.

Lauren	*yeah like it's ok to have a binge night, but not every night*
Emily	*yeah but you have to exercise to kind of like*
Lauren	*yeah to balance it out*

For some, having a healthy body weight, exercising regularly or not putting on weight easily removed the necessity for a healthy diet as evident in Evelyn's response as to why healthy food is not important to her: *"well not personally for me no, because I eat all the time, like crappy food, but like I don't put on any weight so it doesn't mean anything to me."*

Participant knowledge about overweight and obesity, its presence in society and how it impacts on the health and well-being of people their age was limited. In the following comment Hannah explains levels of overweight and obesity to her group who are debating what the terms mean: *"there's bein' a bit heavy and then there's bein' fat and then there's just bein' absolutely large and then there's obese. If you are a bit heavy, like then it's alright, if you're fat you're fat…"* Liam's observation, *"if you look around at the other people in the school, like you'd see that no one else is like badly overweight",* highlights that some groups didn't see a major issue with obesity among their peers. In addition participants generally equated obesity with morbid obesity. In a number of discussions obesity was linked to reality TV programmes that depict weight loss and morbid obesity for entertainment purposes as evident in the conversation below.

Olivia	*I love that one 'I used to be fat', have you ever seen that? I love that it's so funny*
Lucy	*or what's the one and they like, oh my god, hold on…*
Ellie	*Obesity or disabled? You're just like 'oh god' (laughter)*

Nutrition knowledge and understanding came from various sources. For general healthy eating knowledge, parents and primary school were cited as early and important nutrition educators. Messages at home are conveyed through role modelling and exposure to healthy foods as described by Clara: *"if you're brought up with something on the plate you just eat it. It's sort of easier when you're all doing it".* Parents were seen to be trustworthy because they are motivated by a genuine interest in the health of their children.

> *Brian: …your parents, they want what's best for you so they'd be the main people who'd feed you. Like they give your dinners and they'd make sure your dinners are healthy … and your parents love to see you be fit, so they don't want to see you get fat and stuff*

Primary school provided education and food policies. Many participants recalled the primary school nutrition programme 'Food Dudes', which aimed to increase fruit and vegetable consumption, as well as healthy lunch box policies. In post-primary school, home economics influenced nutrition knowledge for girls, with boys more likely to cite science and SPHE.

Coaches were an important source of information for individuals involved in sports teams and clubs. Nutrition advice from the coach to improve performance would be respected as described by Lucy: *"…the team want to be the best they can so if the coach is saying…'eat pasta' or something before a match to give everyone the most energy they can have, you're gonna do it, so you kind of respect them and listen to them".* Additionally, sporty individuals, particularly boys, were more likely to be interested in nutrition information for fitness and to gain muscle mass.

Participants attain knowledge and attitudes about nutrition from other sources too. Lucy's comment *"everyone's just kinda drilling it into you 'eat healthy, eat healthy'"* illustrates that young people feel that they are constantly exposed to nutrition information. The media and the internet provide more diverse nutrition messages than more traditional sources already discussed. Both boys and girls seek out exercise videos online and girls discussed being drawn into body image and diet-related advertisements or posts on social media sites. For them the internet is not always trustworthy but it is convenient, accessible and free.

> Eoin: *It's (the internet) the quickest and easiest way to get the information and there's loads of different sources as well, instead of just talking to a dietitian or a doctor*

"It depends on who you're with": situation specific eating behaviours

As a group, adolescents identify different situations their eating behaviours depend on. Influential people most frequently and extensively discussed were the peer group and parents.

***The influence of the peer group:* "You just hop on the bandwagon"**

Situations outside of home, mainly with friends, were associated with unhealthy foods. Many described activities with friends, both planned and unplanned, that involve food. Social eating – eating occasions with friends or eating for the sake of it because friends are eating – is an important pastime. Fast food places, take-aways, shops and outdoor areas are the most popular spaces to go together and young people don't tend to frequent places that sell healthier foods as reflected in Ellie's words *"teenagers are less*

inclined to go 'oh right, we'll go to town we'll go to a café' like no, you go to McDonalds or like Burger King or something." Eating for the sake of eating is part of fitting in with the peer group as Darren described: *"if you're in town with a group of lads and they all want something to eat in the chipper or something, you kinda eat it for the sake of eating it."* Buying healthy food when socialising with friends seemed absurd and unusual. Elaine's comment: *"imagine going to the shop and buying an apple when you're with your friends!?"* was followed by agreement and laughter from other group members. In all groups participants felt there was an accepted unhealthy eating norm at their age that only a minority of peers might deviate from. In the following quote Ian outlines why healthy options wouldn't be popular with students at school:

> *…'cause it won't sell, it just won't, they want money. What sells? Chocolate and bars and crisps and chicken fillet rolls...I don't think I've ever actually seen anyone walk up to the shop 'sorry do yous have any apples on yez?' It's like, 'no, give us a sausage roll, Capri sun and there you go'. (Ian)*

Reasons put forward for the unhealthy eating norm were lack of interest in the content of food, taste and price as illustrated in the following quotes:

> *Christopher: a lot of teenagers don't look what's inside the food like, they just eat it. If it's cheap, they'll eat it.*
>
> *Hannah: Unless the thing's going to give you foot and mouth, you don't really care.*

When spending their own money, value was described in terms of food being filling, tasty, and convenient; and pooling money with friends to avail of good deals was common. Buying healthy food away from home would be considered poor value for money by these criteria, as Natalie's comment implies: *"I don't know cause you wouldn't waste money on healthy fruit or whatever."*

The activity levels of friends emerged as both a facilitator and barrier to physical activity. Some participants discussed experiences of being encouraged to join something new if friends were involved while others opted out of activities if their friends were not interested. For those who identified themselves as 'sporty', meeting up with peers to be active is viewed as a much-valued and fun social occasion. Loyalty

to a team of peers, especially from a young age, acts a motivator to train and perform. Lack of commitment was viewed as a barrier to individual activities because without team dependents, it was too easy to opt-out as illustrated in Gavin's quote: *"…it'd be a bit of craic, like cause if you were playing something on your own you mightn't want to, like it wouldn't be as much fun cause you'd just be on your own."*

Both boys and girls thought they were less likely to become involved in a sport if they felt their skills would let them down in front of peers. They gain social standing and admiration for displaying skill in their chosen sport. Boys, in particular, looked to successful sporting peers as role models. This is highlighted by Brian from School A, who was influenced by the public recognition of students' sporting achievements in his school: *"yeah like over the intercom, the secretary announces all the awards students have won and stuff and it'd make you want to 'oh I'd like to be announced on the intercom for winning something.'"*

Positive peer pressure was evident for healthy eating in a more hypothetical sense, in that some participants thought they would probably be more likely to eat healthily if their friends did so as Emily described: *"…if your friends are eating healthy you're more likely to be like, 'ah I want to be like them'".* These sentiments were not as extensive or frequent as peer pressure to eat unhealthily.

Parental Responsibility

Home and family were associated with certain food routines. Parents were viewed as the people with primary responsibility for choosing, buying and preparing food within the home. Most thought that home was the place they ate healthiest and shared family meals exposed them to *"proper wholesome food"* (Olivia). Family meals were enjoyable and seen as a time to relax and take a break from busy schedules as reflected in Lucy's comment: *"and like you're wrecked as well so dinner is just like a break, just sit down and have dinner, it's real nice and relaxing or something."*

Where unhealthy foods were available at home, parents were endorsing their consumption. The following comment from Anna illustrates that young people do not see themselves as responsible for their food choices at home, even outside of shared meals: *"if mammy does the shopping and she brings home sweets and everything and then when it's in the press you have to eat it you know...if she doesn't bring it home, then I won't eat it and I'll probably eat fruit more you know."* Participants also expressed an unwillingness to take time or "effort" to prepare healthier options:

> *"When someone else makes it might be tomato, lettuce and ham and when you make it yourself you might just get a slice of ham, that's what I do anyway" (Lauren)*

While parents are expected to make complete meals, adolescents are more likely to make something that's easy, *"anything that only takes 7 or 8 minutes to cook in the oven like frozen pizza that kind of stuff"* (Dylan).

Parents and older siblings can be positive role models for physical activity behaviours. 'Sporty' individuals discussed having a parent or parents who encouraged them to be part of a team or club from a young age. This included bringing them to training and also parents being involved in activity themselves. In the following quote, Lucy alludes to her mother as a role model to become and stay involved GAA: *"GAA … you start when you're 4 or 5 and then you play right up til, you could be like 30. Like my mom played til she was 30."*

"See boredom is kind of a big thing": *Boredom & Mood*

Eating by mood or out of *"boredom"* were common reasons given for snacking or grazing on unhealthy food. "Boredom" eating was related to lack of routine and sedentary activities like watching TV. Jessica describes snacking associated with watching TV: *"like when you're bored and you're watching telly you just go, like at the ads instead of sitting there watching them, you go 'oh I'll get a biscuit or I'll get a bar or something".* Unstructured days and lack of routine during the summer holidays were a negative influence on dietary habits, as Nathan explains: *"cause you're not in school and you don't really have anything to do … I'd eat healthier when I'm in school probably and*

then in the summer it'd be all like chocolate and chippers and currys, pizzas." Getting bored or *"sick of"* healthy or everyday foods was put forward by some as a reason to break out and buy something unhealthy.

Mood and feelings were used by girls to explain cravings for certain foods. Natalie's quote illustrates how bad moods were associated with *"bad"* foods: *"sometimes like you're in the mood and you're having a bad day so you just wanna eat like chocolate or whatever".*

For both boys and girls, positive moods and feelings were related to physical activity. 'Sporty' individuals talked with great passion about their *"love of the sport"* and the enjoyment they got from it. For some a life without sport or activity would lose meaning as Christopher described: *"if you're not staying active there's eh, there's no real, there's no real purpose of anything."* Being active made people feel good about themselves in terms of having fun, socialising, achievement, mood and doing something good for their health.

Ciara	*does exercise not make you happier, it sends off endorphins or something?*
Maria	*yeah it does, it's good for your brain*
Evelyn	*yeah that's why they tell you, you know when you're studyin', 'go out for a walk'*

"If apples tasted like chocolate bars…": *Taste, fantasy and fun*

Taste is the strongest sense attracting young people to *"bad foods"*, with smell and sight triggering the temptation. The sensual aspects of favourite and hated foods were discussed at some length in all groups. Chocolate, confectionery, savoury snacks and fast food all fall into the addictive and/or tempting categories. The health symbol of an apple versus the bad-but-good symbol of chocolate was extensively present in discussions. Responses to the question 'what would make it easier to eat healthily?' were frequently fantastical in nature, such as making apples taste like chocolate. Abbey's rhetorical question: *"Why would I want to get an apple when there's so many bars?"* was reiterated by many of her peers. The fun side of junk foods was associated with advertising, product placement, food packaging and special offers. These were

described as elements in the appeal of *"bad foods"* that ultimately lead to a taste reward. Despite price being frequently cited as an important predictor of food choice, where healthy food was the same price as unhealthy food, many thought taste would be the deciding factor as illustrated in the following conversation:

Noel:	*even if they sold the good food cheap, people'd still buy junk food*
Alex:	*it just tastes better*
Declan:	*it's more addictive like than, just say like fruit and vegetables*

Everyday environments are unhealthy: School, the locality, and marketing

School

Many observed the shift from significant food policing in primary school to little or none in post-primary school. This had a direct impact on food choice as this quote from Dylan illustrates: *"you come into first year and you start to eat worse cause there's novelty involved with the breakfast rolls."* Food practices at post-primary school contradict theoretical nutrition education as reflected in Kaitlyn's comment: *"they always go on about eat healthy, they give out to us to eat healthy and then down in the canteen they're not doing it."* A healthy eating policy at School D did not have a positive impact on students' view of school food: *"there's a healthy eating policy in our school but yet there's like chocolate muffins in the canteen"* (Julia).

Students feel tempted by the close proximity of junk food in school and healthy options were absent or not appealing. Some students were cynical about the money generated from the sale of unhealthy foods. This quote from Justin, "*the school won't get rid of vending machines cause vending machines are the money makers, the school are stingy",* indicated a lack of trust in the school to act in the best interest of students that was present in other discussions too. The experiences of students in their respective post-primary schools to date has led to a common view that nutrition is addressed *"education-wise, yeah but food no, not at all"* (Ryan).

It was difficult for students to envision an alternative scenario for school food as they thought that their peers "would just complain", wouldn't avail of healthy options and

shops or canteens wouldn't take the risk as they needed to make a profit. In some cases experience of discontinued healthy options at school informed this view:

Kaitlyn *2 years ago they used to do chicken Caesar salad, it was so nice and they stopped it*
Jennifer *say you were the only one who thought it was nice*

There was some acknowledgement, therefore, of the role of students in sustaining the current situation in school canteens or shops by being willing (and perhaps demanding) consumers of unhealthy foods. As a whole, however, an unhealthy school food environment did not fit comfortably with them. They felt the school should lead by example in terms of the foods offered to students. Attitudes about school approaches to physical activity were mixed. There were no complaints about extra-curricular activities offered at school. Study workloads during exam years were reported as a barrier to being active and some gave up sports in the previous year at school for this reason. Many thought that PE times were too short to have an impact on their physical activity levels. Boys liked PE at school while girls thought that the content was generally uninteresting as depicted the following conversation.

Kaitlyn *PE is crap*
Ryan *some of it's good*
Jennifer *not for girls though*
Anthony *PE's good*
John *but the sport at school is good*
Kaitlyn *yeah it's after school but the actual PE is not*

Local environment

With the exception of one school, students were permitted to leave the school grounds at lunch time. They buy food in local shops and take-aways, often in addition to having eaten food from home: *"well like I do bring my sandwich and I eat that at break and then I go down town I get my crappy food at lunch, that's really me every day"* (Evelyn). Special offers, that fit with their budget individually or through pooling their money with friends, were frequently mentioned:

Brian *they've lots of deals on as well, they sell loads of junk food real cheap so*

Declan *and you can just like share them with someone else, they have a full basket of chocolate with 5 packs for €1 and that just seems real tempting to you and you go 'yeah, I'll buy that'"*

The food outlets in close proximity to school - within 5-10 minutes walking distance - make unhealthy eating convenient. Daniel observes how proximity and amount of fast food restaurants in their rural town impacts on consumption: *"cause there's so many fast food restaurants like all over the town, that's the downfall really cause you know if they're near, they're handy, people will eat them."*

Marketing environments

Food marketing environments were both virtual and tangible for students. The following conversation illustrates exposure to new types of food advertisements online and how this is perceived:

Brian *yeah like there's people like who put pictures of pizza and stuff up on Facebook*
Thomas *yeah like dominos and all that stuff*
Brian *it would make yeah hungry, it would make you want to eat a pizza*
Thomas *yeah if everyone's say 'oh Nandos' and stuff like that, or KFC or I'd love a McDonalds' or something, then you're sorta like, 'oh I actually might get a McDonalds' and all*
Christopher *yeah it puts the thought in your head like*
Declan *it could be a random ad say for Burger King and it would just make you hungry for Burger King*

Message sharing via friends on social media, as well as online advertisements, are part of the marketing environment young people live in. It was evident that this integrates with more traditional forms of marketing like TV advertisements and celebrity endorsements. The reinforcement of advertising through exposure in everyday environments was evident in conversations. Simple marketing strategies, like placing confectionery and special offers at the front of the shop, were regarded as influential by participants. Food packaging was deemed influential where attractive, eye-catching packaging sends a message that the food or beverage tastes good as Elaine pointed out: *"a lot effort went into it, you're going to like, why would they put effort into something that's not good?"* Boys, in particular, were drawn to images of beverages with

endorsements by sports celebrities as illustrated in the following quote from Thomas: *"... when you go in a shop and you see like a celebrity as a picture, like Messi with a can of Pepsi, you'd be attracted to that cause you wouldn't see like, Messi holding a bag of oranges or something like that."*

Body Image

Discussion about how body image influences eating habits was present but not fully explored in these focus groups. The following exchange is an example of how girls use nutrition knowledge to enhance physical appearance:

> *Ciara oh you'd look for the protein cause that makes your hair grow*
> *Maria it also helps muscle development*
> *Ciara well that's not why I'm eating protein!*

Girls in one group noticed that dieting and fitness regimes had become popular among peers in the year of and the year before the study (i.e. 15-16 years), but they were guarding details, which weren't probed, as reflected in Maria's comment: *"because I don't know, cause a lot of people in our year started going on diets now, everybody's trying to watch themselves more, they're trying to be a bit more, you know?"* In a mixed gender group girls said that dieting becomes more popular *"coming up to summer",* but again the details about what a diet meant were not explored.

Body image and fitness were closely connected for boys as Brian's comment shows: *"you want to look in the mirror and think 'yeah, I'm fit.'"* Boys looked up to peers, older students and sports or TV celebrities with well-built muscle mass because of the associated fitness. In contrast, obesity was described as a social disability because it negatively affected physical activity participation and, therefore, something they wished to avoid.

> *Declan "and plus like, I'm not being bad but there are some really big students in the school and they can't like run anywhere, and it makes you kinda think 'I don't want to end up like that'"*

When feedback was provided to students about themes presented in this chapter at a later stage, both boys and girls were surprised about the poor detail relating to body image and food choice. They felt it was a gap in the results. The following points are

what participants said at the feedback stage of the study. Alison suggested: *"maybe people were just embarrassed to say that they wanted to look well",* as a reason for lack of extensive discussion on diet and body image. Healthy or *"clean"* eating and fitness had become very *"trendy"* for many after the Junior Certificate in school. For girls, images of peers on phone applications for social media sites like Facebook and Instagram influence their idea of the perfect body. Common lifestyle changes for weight loss were *"cutting out carbs",* reducing sugary foods, fast food, sweets, eating lots of healthy food and going to the gym. They thought only a minority would try extreme dieting or exercise measures.

Physical Activity

Physical activity was discussed in terms of feeling good and being or getting healthy. There were a number of links between physical activity and eating behaviours. As described earlier, some individuals thought that adequate physical activity allowed for the consumption of more unhealthy foods because one could *"burn it off".* More positive was the finding that sporty individuals had an interest in nutrition information to enhance performance. This was evident for both girls and boys. For boys, performance enhancement was related to muscle mass, which was a strong motivator for them to change their diet, especially if they were serious about going *"further in the sport."* The motivation to improve performance was related to the high priority given to sport in their lives.

Factors that influenced physical activity participation included perceived skill, social interaction, playing from a young age, loyalty to a team or club and peer pressure. Barriers to being active included busy lifestyles, lack of interest, inadequate PE times at school and study during exam years.

5.4 Results: Evaluation of Peer Researcher Method

All peer researchers thought that the focus groups with their peers 'worked'. The main reason given was that the small group discussions, without the presence of an adult allowed people to open up comfortably. The peer researchers felt the information was accurate because participants gave examples of personal experiences and they could relate to what they were hearing as reflected in Sophie's comment: *"They opened up and confessed some thoughts to us and maybe more than usual because we're all equal"*
The training sessions were described as *"interesting", "uncomplicated*" and *"enjoyable".* Peer researchers reported that the training prepared them and gave them confidence for the task.

> *"It was simple and easy but definitely necessary so we could prepare for the group so we knew how to do it right, I don't think I could have done it properly without it" (Kieran)*

Some challenges encountered while facilitating the focus groups included lulls in conversation, taking accurate notes, and people talking over each other. Although some reported feeling nervous before the focus groups, most said they felt confident once the conversation started and they found the experience interesting and enjoyable. Peer researchers enjoyed the role because they learned new skills that included research, facilitation, listening and social skills and many felt they gained confidence through the process. Matthew, for example valued *"learning when to listen more and take in information people feel strongly about."*

In training, peer researchers were asked not to share their own opinions as it might give the impression there were 'right' answers. Some found it difficult not to share their own opinion and this was a drawback for them. There were a small number of examples where leading questions or ill-timed interruptions by peer researchers served to limit discussion between focus group participants, which highlighted the rationale for discouraging this style of interviewing. In the following example, it is the moderator, and not the participants who lead the conversation, and he encounters a poor response:

> *Moderator* *so would the way your activities are, or your way of life, would that influence the way you'd eat?*

Some agreement

Moderator	*If you're doin' more activities, would you try and eat more healthy?*
	no response
Moderator	*Would you all agree with that?*
	some agreement
Moderator	*John, do you agree with that?*
John	*yeah!*
Moderator	*why have you changed the way or how you eat?*

In this case the moderator may be correct in his assumption that peers who are involved in sport are interested in healthy eating, however the idea has come from him and when participants don't pick up discussion on the topic, he searches for consensus so that he can move on to the next question. Potentially, this type of interaction could reduce trust between the peer researchers and focus group participants, which would undermine a key feature of peer moderation. In the main, however, leading questions, moderator assumptions and inappropriate probing or consensus building were isolated compared to the majority of productive discussions facilitated by peer researchers.

There were many more examples where peer researchers used their insider knowledge in a natural way to advance or deepen discussions, and this benefited the study. For example, in the following conversation the moderator expands on a conversation about *"boredom eating"* by asking about school/holiday routine, which elicits discussion among four group participants.

Moderator	*say it was summer holidays, would the summer holidays be completely different to what you eat in school?*
Michael	*yeah I eat more in the summer holidays cause you're not in school and you don't really have anything to do*
Hannah	*yeah so do I*
Moderator	*cause yous have a routine or do yous just eat healthier in the summer cause you do what you want basically?*
Gillian	*no eat healthier when in school*
Michael	*I'd eat healthier when I'm in school probably and then in the summer it'd be all like chocolate and chippers and currys, pizzas*
Hannah	*yeah and ice-pops*
Michelle	*and you'd say you'd walk it off and then you just get lazy and sit on the chair*

While the unbiased facilitation of discussion is the traditional approach for focus groups (Morgan, 1998), there is a case for a different approach with peer moderators. Because

focus group members were aware that peer researchers had been to training, it was important that they did not impart the idea of right or wrong answers to questions posed. However, more scope for sharing opinions or using leading and probing questions could have been emphasised in workshops for peer researchers. One approach would be to advise peer researchers in advance of the dangers of making assumptions and leading discussions in one direction, but encourage them to participate naturally where they feel inclined to do so.

Developing their own questions for the focus group was an option for peer researchers in all schools; however six groups preferred to use the questions that had been developed and refined at the pilot stage of the project (Appendix I). One group in a mixed school developed their own set of questions (Appendix I). This was the school where two focus groups were conducted, therefore one group used the standard questions and one used their own set of questions. One student in particular was very interested in the research process and the role of focus group moderator and he led his peers in making this decision. The questions generally dealt with the same topics as the standard questions, with the addition of a few new topics:

- ☐ *Do you think teenagers ever go on a diet?*
- ☐ *Does sleep affect the way you eat?*
- ☐ *How could we change food in school?*

More closed, rather than open, questions were used, however peer researchers were advised on probing questions to use after a closed question so they felt adept at expanding discussion when necessary. Interestingly this group asked directly about dieting, which is a topic that was not explicitly asked in standard questions. There was recognition, therefore, of the importance of this topic and students chose to deal with it clearly and directly with their peers. Like other groups, however, the topic was not extensively discussed and this suggests that a different forum or more nuanced approach may be required to elicit discussion on the topic of body image, dieting and exercise with adolescents. The question 'how could we change food in school?' was another interesting addition, which showed that students were interested in bringing their research towards the action stage. While there was no action stage as part of the

current study, this interest from a small number of students demonstrates their agency to participate in the generation of solutions to problems that affect their lives, behaviours and health.

Peer researchers demonstrated good critical thinking skills in their responses to the question of what they would change if they were involved again. Answers reflected difficulties they encountered in their own groups. The suggested changes involved group composition (e.g. make group smaller/larger, having single rather than mixed-gender, getting a mix of 'sporty' and 'non-sporty' people) and re-phrasing of certain questions to make them clearer and avoid repetition. The students who developed their own questions displayed a self-confidence and interest to be involved in as many stages of the research process as possible. The questions provided some additional information about the capabilities of adolescents in research. The resulting focus group elicited discussion that was as extensive and useful to the results as other groups and the approach confirmed the wide roles young people can and should play in collaborative research. This approach is one which could be developed further in peer-led focus groups in future.

5.5 Interim Discussion

This chapter reveals results from peer led focus groups and situates students' views of food and physical activity at school in the context of their general diet and activity behaviours. While having a healthy body weight was important to young people, they associated obesity with morbid obesity and disability, which was perpetuated by reality TV shows, and they did not view overweight or obesity as a major issue among their peers. In light of ongoing national campaigns to raise awareness about childhood obesity and behaviour change (www.littlesteps.eu), this finding is important because it suggests that young people do not identify with media reports. It was clear that health was not a key motivator of diet and physical activity behaviours despite their ability to articulate knowledge about healthy eating and being active. Results would concur with other studies showing that lack of education is not the primary barrier to these health-related behaviours (Tannehill et al., 2015; Fitzgerald et al., 2010; Woods et al., 2010; Share, 2008; Stevenson et al., 2007; Smith & Parr, 2007; Croll et al., 2001; Neumark-Sztainer et al., 1999). The influence of early educators, including parents and primary school, were consistently acknowledged by participants and influences on current behaviour included individual factors (taste preferences, mood, boredom), social factors (peers, family, sporting groups), environmental factors (school, local environments), and cultural factors (marketing environments).

Many of the findings were consistent with existing literature. Taste is one of the most commonly cited factors influencing unhealthy eating among adolescents in qualitative literature (Fitzgerald et al., 2010; Share, 2008; Stevenson et al., 2007; Neumark-Sztainer et al., 1999). Social eating with peers, which emerged as an important part of extra-family life agrees with research by Fitzgerald and colleagues (2010) who reported that eating more with peers is one of the distinguishing features in the lives of adolescents compared to children. The negative influence of everyday environments on food choices has been reported by other studies with young people (Share, 2008; Neumark-Sztainer et al., 1999). In an Irish school study, Share (2008) described the negative impact mixed messages can have on young people's attitudes when the reality of school food and the theory of health education don't match. The various media and marketing

strands influencing the lives of young people are well described in the literature, particularly for food promotion. Food promotion to young people is known to focus on five key areas: pre-sugared breakfast cereals, soft-drinks, confectionery, savoury snacks and fast food (Cairns et al., 2013; Henry & Story, 2009; Montgomery & Chester, 2009). In students' discussions it was clear that the promotion of these particular foods was impacting purchasing and eating behaviours, which is supported by numerous studies as a review by Boyland et al. (2015) has shown. Marketing was one element of the social and environmental factors contributing to a normative association with unhealthy eating among adolescents found in the current study.

Montgomery and Chester (2009) describe the interactive nature of food and beverage marketing in the digital age, which students in this study alluded to. The current study contributes to the literatures by showing that young people generated their own discussion that demonstrated an understanding of the complex nature of integrated marketing environments, and how these related to their attitudes, behaviours and everyday lives. They could identify their exposures to effective marketing from online social media, print media, and TV to real life product placement, packaging, colour usage, signage, celebrity endorsement and special offers. Adolescents are a particular target market for food companies selling high fat, sugar and salt products at present because of their strong presence on social media, and the potential for social media sites to create personal profiles for users that are subsequently targeted for personalised marketing messages (Freeman et al., 2014). The media literacy and knowledge adolescents possess does not translate into healthy individual responses or stronger resistance to the marketing of unhealthy food. The nature of how food is promoted (through multiple media, taste, fun, and fantasy rather than nutrition and health) (Cairns et al., 2013) may explain certain attitudes found in this study. *"If apples tasted like chocolate bars…"* (we'd eat healthier) exemplifies a commonly expressed fantasy and while *"bad"* food was known to be unhealthy, it was also linked to temptation, fun and lack of control.

Students were very aware of their role as consumers of unhealthy foods to generate profits for food outlets, including those at school. A distinct differentiation between the school and local food environments was made by students, however, whereby schools had responsibility for student welfare, but the exposure to unhealthy foods in the school environment damaged the efforts of health education and generated cynicism among students. In this way, students themselves were focusing attention on the inadequate response by the education sector to persistent calls over the last decade or more to make 'the healthy choice the easy choice' at school (WHO, 2016; EU Action Plan on Childhood Obesity 2014-2020, 2014; DoHC, 2005). Two main findings of the current study – the importance of social eating with peers in adolescence and unhealthy food environments – point to a reality that is completely out of sync with visions for school health promotion. School and local environments, in which young people are permitted to spend time together, offer all the foods they are told to limit. School food environments, shops and fast food hang-outs seem to then reinforce an unhealthy eating norm on a daily basis. For students, this affected their feelings of control, with a negative impact on self-efficacy to eat healthily. While the modification of local, privately owned food environments presents major challenges, state school food environments can be successfully changed through national policies as research from the UK and other jurisdictions shows (Fung et al., 2014; Mensink et al., 2013; Adamson et al., 2013). Results here indicate that students were clearly describing a lack of environmental (rather than educational) interventions that supported healthy eating at school.

Students' physical activity discussions were not as extensive as their food discussions, and given the equal weight ascribed to the topics at the outset of the study, this is a surprising outcome. One explanation emerges from the students themselves - the suggestion by some peer researchers to organise participants by sporting identity in order to provide a better picture of each type of lifestyle suggests the important influence of physical activity on identity and peer relationships at this age. Separation of 'high active' and 'inactive' individuals into separate focus groups was a method Belton et al. (2014) used. The rationale was that students were more likely to

contribute to discussions about physical activity if grouped according to routine participation levels (Belton et al., 2014). In the current study, sporty and non-sporty identities were evident among participants, and sporty individuals talked with great passion about the important role sport played in their lives. The associations between physical activity and peers, fun and enjoyment are also reported by others (Tannehill et al., 2015; Belton et al., 2014; Fitzgerald et al., 2012). Achievement and performing well in front of peers, however, play an equally important role in participation and may be a considerable deterrent for non-sporty individuals. Strong 'sporty' voices within groups may have discouraged less active students to talk about this area of their lives because participation in general is more challenging for non-skilled individuals (Smith & Parr, 2007). Smith and Parr (2007) found that PE enjoyment was related to personal sporting identities and participation was easier for sporty individuals. In the current study, a gender bias was also clear in that girls spoke more negatively than boys about PE at school, which agrees with literature in the area (Scurr et al., 2016; Neumark-Sztainer et al., 2010; Barr-Anderson et al., 2008; Trudeau & Shepherd, 2008; Brooks & Magnusson, 2006). Compared to the food discussion, where both boys and girls agreed about deficiencies within the school environment, only girls in this study believed that school fell short on providing adequate opportunities for being active.

In light of students' confidence regarding knowledge about diet and physical activity recommendations for good health, it was interesting to observe the emergence of misconceptions about the role of physical activity for some individuals. Rather than contributing to overall health, some girls simply saw exercise as a means of balancing out bad eating and maintaining a desired body weight. In separate active and inactive focus groups with Irish adolescents, Belton and colleagues (2014) reported that inactive students linked food only to health, while active students saw a link for both food and physical activity. The finding that sporty individuals were more interested in nutrition would concur with this. It is not clear from discussions if students with misconceptions about physical activity were inactive. Given that sporty individuals cited coaches as an influential source of nutrition information, however, this is a potentially important gap in education for adolescents not involved in sports teams or clubs.

Taking all findings together, there was little attention to positive outcome expectations for health except for the benefits of physical activity to sporty individuals. There was also little evidence of young people having personal, health related goals. This may be expected given literature showing alternative priorities in youth (Neumark-Sztainer et al., 1999), and their dependence on adults to take responsibility for health related behaviours (Stevenson et al., 2007). Young people, however, can define the meanings of health for them in its many facets. A study by O'Higgins et al. (2010) explored the terms 'health' and 'happiness' with adolescents and found holistic views on the meanings of health with strong links between mental and physical health. Mental health was not specifically explored in the current study, which is a known priority for youth and youth related services. Questions linking mental health to diet and physical activity behaviours may be an interesting avenue for future, peer-led research.

A limitation of results here is the lack of exploration of how food and physical activity behaviours are influenced by body image and vice versa. Feedback from students indicates it is a gap in the findings here, and literature would support this (Callaghan & Nic Gabhainn, 2013; Neumark-Sztainer et al., 2012; McConnon et al., 2009; Griffin, Younger & Flynn, 2004). While some students noted more dieting among peers in the previous year, the literature indicates that body image concerns and dieting behaviours begin much earlier. An Irish study found that approximately half of 11-12 year olds perceived their body weight incorrectly from line drawings on a questionnaire and over a quarter expressed a desire to be thinner, which was considerably higher in girls (39%) than boys (17%) (Griffin, Younger & Flynn, 2004). Qualitative studies with adolescents show that weight loss behaviours are not dominant themes in discussions about everyday food and physical activity choices (Fitzgerald et al., 2012; Stevenson et al., 2011; Share, 2008; Neumark-Sztainer et al., 1999). However, given the feedback from students in this study about a gap in the results, perhaps it is a topic that is discussed more comfortably in other contexts. Eating less fatty foods and doing more exercise were the predominant behaviours children reported for weight loss in an Irish study, with a smaller number reporting skipping meals (Griffin, Younger & Flynn, 2004).

While weight loss desires or behaviours were more commonly reported among overweight children, they were also prevalent in one third of healthy weight children. Studies have shown positive associations between body satisfaction and levels of physical activity in adolescents, independent of BMI (Kantanista et al., 2015; Neumark-Sztainer et al., 2004). Physical activity may be an antecedent to and/or a consequence of body image, whereby adolescents with a positive body image see fewer barriers to displaying their bodies publicly, or physical activity gives rise to greater confidence in body image as a result of physical changes and peer interactions (Kantanista et al., 2015). However, there is insufficient data to know in what ways and how strongly body image influenced the behaviours of participants here. In light of the overall aims of this study, how body image issues unfold in the school environment would be an interesting topic to explore with students in future. It is also acknowledged that physical activity and inactivity discussions may have been under-developed in focus groups, and peer researchers' suggestion to organise groups by sporting identity would also be worth exploring through peer-led methods in future.

The strengths of this study are that it adds the peer-led facilitation methodology to current literature on the topic and increases our understanding of why young people as a group identify with unhealthy eating and inactivity. Peer-led facilitation of discussions led to honest conversations that explored the complexity of food and physical activity behaviours. Peer researchers and participants successfully explored the issues in this study and displayed a willingness to be part of the conversation. Peer researchers gained skills, confidence and a greater understanding of issues relating to food and physical activity behaviours. Participants acknowledged the challenges in changing student behaviours. The costs associated with personal responsibility for healthy eating and physical activity – such as effort, price, time, being different from peers – seem, in general, to be unwanted burdens when weighed against positive outcomes. A combination of socio-environmental factors, including marketing environments, explained the link between their age group and unhealthy behaviours. Perceived facilitators of healthy eating were home and parents, and self, peers, marketing, school, and local food environments were viewed as facilitators of unhealthy

eating behaviours. Peers acted as both facilitators and barriers to physical activity participation, as did self-perceptions about sport, competence and skill. The treatment of PE at school was viewed as a barrier to participation by girls only.

5.6 Signpost to Next Chapter:

In the next chapter findings from interviews and focus groups, conducted by the researcher, with school principals and teachers will be reported and discussed.

Chapter 6

6 The role of food and physical activity in Irish post-primary schools: Views of principals and teachers

Objective: To capture the views of the teachers and principals about food and physical activity practices in their schools

6.1 Introduction

This chapter explores the views of teachers and principals with regard to the role of the school in healthy eating and physical activity promotion. Findings from focus groups with teachers and one to one interviews with principals are presented. Protocols for data collection and analysis are described in Chapter 3, Sections 3.4.1, 3.4.2, and 3.7.2.1. To provide a brief recap for the reader: members of the teaching staff were asked to volunteer to take part in focus groups. Principals were invited to be interviewed individually. Questions for focus groups and interviews are available in Appendices L and N. Dominant emerging themes were identified using content analysis (see Section 3.4.3 for full description of systematic approach to data analysis). Participant names used to identify quotes and names used by participants within quotes are pseudonyms, which were assigned at the analysis stage.

6.2 Results

Participants

Five teacher focus groups and five principal interviews were conducted in five schools. Twenty-seven teachers participated, of which 12 were male and 15 female. There was an average of 5.4 participants per group (range 5 to 7) and discussions were typically conducted during one class period lasting 40 to 45 minutes. Subjects taught by teachers taking part in focus groups varied in each school. Five principals, of whom 4 were female, took part in 30-40 minute one to one interviews.

Dominant Emerging Themes

Dominant themes from interviews with principals and focus group discussions with teachers include: (1) Home and society (2) Current Scenario: A balancing act (3) Time and resources: common barriers to change and (4) Future Scenario: education and policy. Themes arising from teacher focus groups only were (5) Nutrition knowledge deficits among boys (6) The influence of factors other than health and (6) Body image issues at school

Home and society

"It starts at home"

Teachers and principals felt that, for the most part, example and education about healthy eating and being active was the responsibility of parents. They also thought primary school practices and policies had been a positive influence. Principals, in particular, saw the role of the school as supporting the efforts of parents, and where necessary, supplementing deficits from home.

> *Peter … I suppose there are parents out there who don't have the time or the knowledge behind it so if we can fill in gaps, I'm all for it but I don't think it should be our kind of sole responsibility, you know it has to be a joint effort really… (Principal)*

Schools assessed deficits from home based on their own student body. Two principals, for example, felt there wasn't a huge demand for extra-curricular activities because

parents could afford to take their children to other places and the local community provided a lot of opportunities in terms of clubs and facilities. In the following quote the principal in a girls only school, which had a lot of sports facilities, describes a low demand for after-school activities:

> *Andrea: "I suppose there is the fact too that the children, their parents can afford to buy in that extracurricular, there isn't a need so because there wasn't a void it hasn't been filled…" (Principal)*

This may be just one factor, however, since one of these principals also recounted feedback from parents about a lack of awareness of available extra-curricular sports in school, and requests for more information about them. In contrast, community links with GAA helped to support physical activity in a boy's only school, where local coaches gave time to training school teams. Teachers and the principal in a mixed school felt they had no issues with overweight and obesity, which reflected students' middle class family backgrounds.

> *Ciara and we don't, in fairness we don't have massive obesity problems in this school and they're middle working class so I mean it's, it must be education, it must be coming from the homes I think (teacher)*

In contrast, a principal in another school noticed a rise in obesity, which was not related to socio-economic backgrounds:

> *Andrea: yes, well I would be worried about the number of girls that are severely overweight and I think even in the 6 years that has got worse…well when I came here first from a DEIS school I would have noticed that the girls there were fatter than here whereas I can see the same influence happening here now." (Principal)*

Societal and family changes

A common thread between interviews was the influence of changing patterns at family and society levels. Two parents working outside the home, lack of family meals, parents not monitoring foods eaten, living between two houses if parents were separated and lack of food preparation are factors contributing to unhealthy eating habits.

> *Diana I see the students that I'm teaching especially in biology where I've more of chance talking about food and appetite that they just don't have time because … they're not sitting around the table anymore as a family, eating dinner*

as much as say, I would have had as a child. It's grab it and take it when you want it. It's not a set time that you have to sit down with no TV and have a chat and eat proper food. There's none of that anymore. (Teacher)

As a result, teachers are concerned about students skipping meals and consuming convenience foods and soft drinks at school. A small number of teachers cited economic reasons for students skipping breakfast or having no food during the school day. For others, busy parents provide money for students to buy food rather than bring it from home. All but one principal commented that changing home and society situations has led to new demands on schools to provide convenient and affordable food for students. In the following quote a principal explains some of the factors the school considered when providing food to students:

Andrea …I suppose then you have to marry 40 minutes, what's the most efficient way of getting some food to the kids, that is relatively healthy... value for money, you know feeding kids as such, the rolls, the sandwiches, it is hard to know what's a cheap way of getting sort of a certain amount of calories into kids that will keep them going, balancing that you know some of them haven't eaten anything, that they have come to school quite hungry… (Principal)

Current scenario: A balancing act

School principals and teachers generally felt a strong duty of care to provide healthy food and opportunities to be active at school. They held this view, despite being unhappy about schools being tasked to deal with *"every ill in society".* They see the school as being a potential for good in this area as reflected in Barry's comment: *"well not that it's our obligation as a school, cause I know everything's put on us as teachers, you know but we have access to the kids and we have possibly an influence on them so we should be able to use that" (teacher)*

The following quote from Principal Mary highlights the strong duty of care conflicting with a busy school agenda:

Mary …So there's a lot of conflicting things whereas in my head I feel that exercise is so important, I feel diet is so important but maybe I'm not doing enough…like the canteen is something separate almost, I'm running an educational establishment and yet, of course this is important because if they're not healthy, nothing else matters in a way… (Principal)

Staff in each school described some of the unique health promotion activities they run for students. The principal in a girls school, for example, encouraged senior students to 'walk with the principal' at lunch time, a mixed school ran a 'Fit for Life' physical activity week and a boys only school publicly rewarded physical activity achievements in order to encourage more students to get involved. A nutrition policy within a girl's school banned the sale of soft drinks, crisps and chocolate at school and the principal in a boy's only school took an active role in talking to junior students about reducing their sugar consumption. These can be described as elements of the *"hidden curriculum"* that schools provide outside of the formal or required curricula. They were usually related to personal interests of individual principals or teachers and therefore stood as unique practices and cultures within each school. Despite these activities, four out of five principals interviewed thought that the current scenario in their school was not good enough in terms of supporting healthy eating and being physically active. Two principals stated that staff members avoid student canteens because the food on offer is not good and lunch time is *"…not a very civilised experience…"* (Principal). Many teachers felt very strongly about the poor food environments provided for students at school as reflected in Karen's comment:

> *"…no it's not addressed at all, as Dorie said it's shocking, in primary school it's strict, there's absolutely nothing coming in here that's bad for you like and it's so frowned upon and yet no mention is made of it for incoming first years, there's no policy in place, there's no, there's nothing done about it. Absolutely nothing" (teacher)*

While the principal in one school viewed a new school canteen as positive, some teachers saw it as a negative influence because they've observed students eating more and exercising less at break times as Barry describes:

> *Barry I've seen guys walk to the canteen with their sandwiches made from home and they're still going up for a few sausage rolls… it's negative because we had 11 o'clock break, always 10 minutes, guys went outside had their apples, had their sandwiches, had whatever they brought in (teacher)*

All principals had a preference for keeping students, particularly junior students, on school grounds at lunch-time. In most cases, however, the school was not set up to cater for the whole student body at lunch time. Principals felt the school shop or

canteen needed to compete with the prices and choice on offer in local shops. School B was the only school where fourth year students could not leave the school grounds and lower prices in the school shop were an important factor in keeping this arrangement in place: *"the rolls are less than the cost in Centra you know so the children don't need to ask to go out"* (principal). Other schools felt pressure to provide some unhealthy foods such as *"chicken fillet rolls".* Weekly *"treat"* days were common where sausage rolls, muffins or chips were allowed.

> *Pauline I know we do have kind of an eating, a healthy eating policy in the school, we have our canteen but for instance we'll say they do a chip day on a Friday and aw, it's a sell-out altogether (principal)*

Treat days boosted sales for companies working on low profit margins and seemed to be negotiated with principals at some point during the life of the school shop or canteen as the following quote indicates:

> *Mary They're trying to make a profit, we have chips only 1 day in the week but that's the day the kids nearly kill each other to get to the canteen… (Principal)*

Large student numbers, short lunch times, and lack of dining space were some other reasons cited for poor food choice.

While unhealthy foods sold well in school, experiences with failed attempts at healthy options were described in all interviews. Requests often came from students and student councils, but these seem to have reflected what the "real enthusiasts" wanted and not the wider student body. As a result of poor sales healthy options were often phased out without discussion. Even in School D, where salads were still served with hot meals, teachers noted that it was staff and not students interested in this option and Terry observed*: "well I know the principal has asked them to have the healthier foods as well but what I've also seen is the lettuce, the peppers and the whatever, you know it's just left there." (Teacher).*

There were signs of conflict between principals and PE teachers in terms of how PE is timetabled. PE teachers felt that the time devoted to the subject was not enough to maintain an interest in physical activity for non-sporty students. In extra-curricular

sports, teams had *"the cream of the crop"* and for these students, PE participation is enjoyable. For students who've lost an interest in sport, particularly after the junior cycle, *"one PE class or a double PE class in a week isn't going to keep them up"* (Patrick, PE teacher). In the schools with girls, PE teachers and principals find a *"negative attitude towards PE"* among many senior students. Some teachers described using alternative activities like gym, toning, fitness and running to increase participation among senior students. While these activities were popular, timetabling can be a major barrier to participation. When groups are only allocated one 40 minute PE class, students don't see the point in changing clothes and participating. Squeezing PE on the timetable has an impact on students' attitude towards the subject as Shauna describes:

> *"the resources are skewed, everything is just not as it should be …with 2 single classes and double time-tabling, there's only so much of that that can be done and you know, if the kids feel that PE class isn't as it has been for them for the last few years, their interest is going to start going down and it just it has a negative impact on their participation in the class" (Shauna, PE teacher)*

With regard to extra-curricular sports, male teachers from boys' schools were actively involved training teams and the expectation to become involved was something they were aware of before commencing employment there. The principal in a mixed school, however, pointed out a conflict that arises as a result of teachers volunteering to train school teams. In addition to students missing class for training or inter-school competitions, teachers also miss their classes and complaints have come from parents about this. This was not evident in other schools, but is worth noting as a potential barrier to developing and expanding extra-curricular school sports.

Time & resources: common barriers to change

Peaks and troughs of energy devoted to addressing school based health promotion were evident in most of the interviews. The troughs, or moves away from desired practices, seemed unavoidable in busy schools with ever increasing demands. Principals feel overwhelmed by packed formal and extra-curricular education, including health and social agendas. Currently formal healthy eating and physical activity guidelines are taught in Social and Personal Health Education (SPHE) during the Junior cycle and physical activity participation through weekly PE classes for all students. Home

economics and science teach additional nutrition information but not all students opt for these subjects and boys in single sex schools did not have access to home economics in their schools. Some more options are available to transition year students, with boys taking cooking classes in nearby girls' schools and more PE allocation. For subjects open to all students – PE and SPHE - teachers felt class allocation times limited what could be taught as reflected in Dorin's experience of SPHE:

> *"You're kinda filling in all the gaps in the curriculum from relationships and sexuality to safety in the home to alcohol abuse to making decisions, peer pressure, bullying, you're filling in all those gaps in one 40 minute and I haven't done a class on healthy eating this year, I don't think I got to that point but if I do it'll be one 40 minute quick class" (teacher)*

Schools had no additional resources for health promotion and depended upon teachers to facilitate and run a wide range of initiatives outside of the formal curriculum. While there tended to be strong cultures of extra-curricular physical activity training by teachers in these schools, other initiatives were ad-hoc and dependent on passionate and interested teachers to drive them.

> *Maire …I would suggest that the school should probably take a bigger interest in it but do you see the time constraints in secondary school is massive, the time constraint is the biggest thing, who's going to take it on? (Principal)*

Finding the time and personnel required to enforce or monitor a healthy eating policy would be difficult, according to principals. Students are free to bring in food from home or local shops. Some thought another rule would just add another, unwanted conflict between students and staff.

Future Scenario: Education & Policy

Teachers and principals saw a role for longer healthy living education courses during junior and transition years. They envisioned this fitting into the proposed new structure for the junior certificate from the Department of Education and Skills where schools will run short courses or modules. This type of approach is already offered in many transition year programmes. Other rationale for choosing the early to mid-years of post-primary school related to time available and also early intervention. Some felt

that transition year would be more appropriate as students were more mature and perhaps more interested in the content at this stage.

> *Matt they're still very immature at that age whereas you really see at transition year the level of maturity, it goes up exponentially nearly during transition year and … if there was some kind of a package for schools…that's a good year for them to take it in… I just think, a lot of it will go over their head when they're younger… (Teacher)*

Teachers with an interest in physical activity discussed the importance of engaging non-sporty students through alternative activities like yoga, dancing, boxercise, running and athletics. They also identified the need for more time allocation to PE, particularly for senior students.

> *Shauna … for me PE is about getting them involved in as many sports as possible or activities so that they use or get involved in sports and activities later on. For me PE is not about making them do laps to see what their fitness is … it's more about skills and things like that (PE teacher)*

Many teachers felt strongly that there was no place for the sale of unhealthy food in the school and providing choice was inappropriate. While a few felt that a strict nutrition policy to ban unhealthy foods entirely from the school grounds would be important, most teachers viewed total food bans as unrealistic. A major barrier identified was the inability to police foods brought from other places.

> *Pauline …but then you look at children's lunch, students lunch boxes and sure there's rubbish there or the seniors can go down town and you see them coming back with the crisps and the coke and that so what can you do? You can only enlighten and educate but you can't impose (principal)*

Some principals would welcome government policy on school food that provided clear guidelines for schools. In one school without designated dining facilities, the principal thought funding for a student dining space would enhance the food environment of their school.

Nutrition knowledge deficits among boys

Teachers felt there were knowledge deficits and immaturity leading to unhealthy food choices and practices among boys. In a boy's school, for example, teachers expressed concern about the use of nutritional supplements for building muscle. Teachers in the

two male schools teachers thought that students did not fully understand the health risks associated with high calorie, savoury convenience foods that are widely available in both school and local environments as reflected in this conversation:

Aine *y'know I know they know that the rubbish the crisps are unhealthy the chocolate's unhealthy and that, but I think sometimes they don't know y'know*

Carol *sure I'm having chicken what does it matter whether its deep fat fried?*

Aine *I know exactly or a sausage roll – it's savoury, it's not sweet so it's not rubbish. I think sometimes they don't really know that if it's cooked food that it can still be unhealthy (teachers)*

One teacher believed that unhealthy foods are too tempting and students cannot make rational or healthy decisions when faced with healthy and unhealthy choices.

Vanessa *well if you have teenagers and you've sausage rolls and fruit,… it's temptation you know it's like the sweet counter at the check-out, very basic marketing, and they're just not old enough or mature enough to be making healthier choices themselves (teacher)*

Factors other than health influence behaviours

Teachers are privy to students' opinions through class discussions and believe students make decisions regarding food for reasons other than health. Because obesity is now a global and topical issue, the theme arises in many subjects as this language teacher describes:

Karen *It comes up in languages as well, certainly at senior level anyway, they would have a lot of thematically issues to deal with and obviously it's one of the big ones and it's come up a number of times over the years. It's been the question of obesity linked with various topics like computer usage amongst the young and even in the prevalence of cooking programmes on television and so on and you'd find they'd have plenty of opinions on it but it doesn't stop them sitting in front of the computer. They'll openly admit that they're sitting in front of the computer sometimes for 3 hours a night, online, on Facebook and what not and they'll openly admit, 'no I'm very lazy, I don't do sport' … (teacher)*

This quote highlights that while the awareness and critical thinking is there, student behaviours are driven by factors other than knowledge. According to teachers, taste, convenience, the lure of sedentary activities and peer norms were the most influential factors in food and activity behaviours.

Body image issues at school

Teachers thought that appearance and body image would motivate young people to change their eating or exercise habits ahead of any health reasons. They notice a higher interest in body image, fitness and diet among senior students, *"post Junior Cert."* The following quote from a PE teacher is a description of what can happen after the junior cycle at school:

> *Patrick I think that maybe post Junior Cert they've decided one way or another if they're going to be sporty at that stage you know. If they're into sport, they're into sport and if they're not into sport at that stage, they tend to drift away and they start looking at well, you know, 'am I starting to put on weight and how will I avoid it cause I'm not into sport, I'm not into going to the gym or I'm not into doing that kind of thing', they would start looking at how they're eating. I think that area, kind of transition year yeah, they start becoming more aware of it (teacher)*

Teachers and principals from schools with girls expressed concern about excessive water consumption among students – *"they're guzzling water like, 3,4, 5 litres of water every day...that seems to be their food, like water is going to take away the hunger"* (teacher) – because it seemed to be related to appetite suppression and skipping meals. Some teachers would be fearful of discussing diet, exercise and body weight with students. The following comment from Aoife reflects her fear of contributing to body image anxieties among students: *"so you have to be very very careful too when you're speaking about overweight, you know…you'd be afraid you'd trigger off something, somebody."* Experiences with bullying, eating disorders and assumed teenage body image sensitivities contributed to their concern. In one male school, a teacher described bullying instances when students called out the names of overweight students during class discussions about obesity. Oliver, in a girls school, related experiences with weight-related bullying and food disorders with older students:

> *"I think at 12, 13 the puppy fat and that's kind of acceptable and then suddenly there's the bullying about weight issues and we've seen a number of girls in this school drop weight incredibly quickly and I've no doubt some of it is brought on by comments that are made and I don't know if they're diagnosed but they certainly look anorexic or bulimic, they look unhealthy" (teacher)*

6.3 Interim Discussion

Results from the interviews reveal both common and unique food and physical activity practices among five schools. Changing family and society structures are having an impact on schools in terms of increasing demands for affordable, convenient food provision. Principals struggled with these demands, as they are dependent on private food operators to provide catering at school. In terms of positively influencing students, staff members believe an important window exists during junior and transition year stages at school. Unique extra-curricular initiatives to improve food and physical activity at school were present in each school, with activities dependent on in-house leaders. While there were strong opinions on the need to promote healthy eating and physical activity at school, time and resource limitations were common to all schools, affecting both formal and informal curricula. Optimism about current projects existed, however principals and teachers felt limited by failed initiatives such as healthy food trials in the canteen. Obesity is widely discussed as a topic of social importance within subjects at school, however, not all teachers felt equipped to have open discussions about body weight and health with their students because of body image issues.

The time and resource constraints on public schools are well documented in the literature (Nic Gabhainn et al., 2010; Woods et al., 2010). In this study time limitations within formal curricula were referenced in relation to SPHE and PE classes. The relationship teachers highlighted between students' poor attitude towards PE and the space and resources it is allocated at school is important. As described in Chapter 5, female students certainly had a negative perception of PE, which was influenced by the content of the classes. Students did not discuss SPHE in their focus groups extensively, however teachers felt one class period devoted to healthy eating on the SPHE curriculum was insufficient. The low priority given to non-exam subjects including PE and SPHE is a point previously described in the literature (Moynihan & Mannix-McNamara, 2012; Nic Gabhainn et al., 2010; Woods et al., 2010). In exam years, for example, students are often expected to change, exercise, shower, and change again within a 40-minute period before returning to their next class on time. Senior students in one school could opt-out of PE and according to the principal 60% of them did, taking

a study class instead. Shorter PE times with fewer students took pressure off the timetable as a whole, as well as small PE departments within schools, which concur with previous research (Woods et al., 2010; Boyle et al., 2008). This situation represents a major barrier to students obtaining sufficient physical activity during the school day and indicates the lack of progress given that 90% of schools still struggle to provide 120 minutes of PE per week for students, with the exception of transition year (DES Lifeskills Report, 2014; DoHC, 2009). While governmental assessments and correspondence consistently acknowledge the issue, there is no evidence of a viable solution (DES, 2015; DES Lifeskills Report, 2014; DoHC, 2009), and this position was also clear from conversations with principals and teachers. Instead interviews revealed that, in recognition of the importance of health promotion, they were involved in voluntary extra-curricular activities and local projects. Jourdan and colleagues (2016) observed that teacher involvement in health promotion outside of the classroom is *"mostly based on personal motivation and the perceived relevance and/or compatibility of the initiative with their professional philosophy."* Findings in the current study concur with this view, where teachers with an interest or passion took on projects beyond the classroom, which was acknowledged by principals. The education system, therefore, relies on the good will of teachers to volunteer outside of the formal curriculum (DES, 2015), and this is particularly true for extra-curricular sports in Ireland (Woods et al., 2010). While these activities are a vital element of school communities and culture that typically contribute to health promotion (Jourdan et al., 2016; Woods et al., 2010), dependence on local voluntary activities outside of the formal curriculum is an inadequate response from the education sector to the current public health issue of childhood obesity (DES, 2015; DoHC, 2009).

An important example of the time and resource pressures schools face was the inadequate attention school principals felt they could give to addressing school food. Results revealed that teachers and principals felt unhappy about current food practices in their respective schools. Currently, post-primary schools are encouraged to write their own healthy eating policy using an online template (DoHC, 2008), and in a recent survey, approximately half had one in place, and only a minority were actively

promoting healthy options at school (DES Lifeskills Report, 2014). Principals were clearly struggling with their undefined responsibilities to provide healthy food, even if the school had a policy. While health was a factor for principals, company sales and profits had strongly guided decisions about the content of school shops, canteens and/or vending machines. There was no evidence of schools working to create a positive experience of school food for students, with *"….a cheap way of getting a certain amount of calories into kids that will keep them going….."* more likely to be the scenario. What is quite revealing in this study is that while adults make the decisions about what food is sold at school, and where it is consumed by students, staff would not consider buying or eating food in the same spaces. In this context it is unsurprising that students were cynical about their schools' role in promoting unhealthy foods as discussed in Chapter 5. Students were correct in their assessment that cost and profits were key factors driving decisions about the food they are offered at school. In light of the fact that three schools in the study had relatively new, well-equipped cooking facilities (Chapter 4) there appears to be missed opportunities in terms of influencing an evolving food system for Irish schools. There was little or no emphasis on the health, social and community benefits of eating at school, and no vision for how environmental changes could contribute to students' education and behaviour. Selling unhealthy foods and promoting 'treat' days to boost profits is clearly an inappropriate situation in public schools, and principals could not see a way to adequately tackle it. This is an important finding to highlight from the current study, as many Irish post-primary schools depend on out-sourced catering (Shanley, 2015).

A notable divergence between the views of staff and students, already alluded to on the topic of SPHE, was the requirement for more education. Teachers and principals envisioned extensive education modules at junior level as the appropriate response from the education system to effect behaviour change, while students made little reference to their lack of education. In fact, students felt that they had enough knowledge about healthy eating from many sources, and instead focused on the responsibility of schools to provide healthier, more supportive environments. The stance of school staff is somewhat expected as their traditional role in the school is that

of educators (Jourdan et al., 2010; St. Leger, 1998). A question mark hangs over the lack of nutrition education boys are exposed to because they don't have access to or don't choose home economics as a subject. Although boys didn't articulate this lack of knowledge, the point is noteworthy because girls reported learning most of their nutrition information from home economics, and teachers felt boys lacked knowledge to make good food choices in the face of unhealthy food environments. These diverging views will be explored further in the context of all findings in the final discussion, Chapter 9.

The response by teachers and principals to suggest more education is all the more interesting in view of the fact that, in general, they felt students' had a good understanding of the issues. This suggests that they were narrowing their views in line with the traditional role of the school in providing formal education rather than on the health promoting schools ethos that has been developed over the last number of decades. References to cross-curricula health behaviour discussions with students, although not put forward as an educational solution, actually highlights an important aspect of health education as per the health promoting schools framework. Moynihan et al. (2016) recently reported that cross-curricular approaches to health education were only evident in 18% of Irish schools surveyed. Findings here would indicate that discussions about the topic of obesity and health behaviours are happening, but perhaps they are not formally recognised as health promoting activity within schools. Additionally, many unique health promoting activities were present in participating schools, yet none had formally accessed the health promoting schools programme. This is consistent with current evidence showing that over half of Irish secondary schools identify as 'health promoting' but only a minority have formally been through the health promoting schools programme (Moynihan et al., 2016). While existing local health promotion activities should be acknowledged, the formalisation of such work may help schools to define and take a 'whole school' approach.

The recruitment process for teachers in this study represents a potential source of sample bias. Teachers volunteered and this may mean that those with strong interest in, or views on, diet, physical activity and health promotion at school were more likely to come forward. Alternative means of obtaining the views of teachers would be to conduct short one to one interviews with a wider range of staff members using one or two focused questions. This approach, however, would not benefit from the sharing of views among colleagues in the same school setting, which was a reason for choosing focus groups here. Another limitation of the findings presented in this chapter is that teachers and the principle in School F, DEIS urban school did not participate. This limits what is known about this school, and differences, if any, that might have emerged from such interviews.

Interviews with principals and teachers highlighted some well-known issues with school health promotion and revealed important contrasts between the views of staff and students. While time is consistently an issue for schools, there were also clear deficiencies in tangible supports that would allow schools implement elements such as minimum PE times for students and healthy food environments. The lack of discussion among principals and teachers with regard to the value of healthy, attractive, inviting food environments for students may be linked to the more traditional educational role of school and absence of an historic school food culture. This view however, is in complete disagreement with how students see it.

6.4 Signpost to Next Chapter

This chapter presented the findings from focus groups with teachers and interviews with school principals. It concludes the qualitative findings chapters (Chapters 4, 5, 6).

In the next chapter, Chapter 7, the first of two quantitative findings chapters, results from anthropometry, fitness and physical activity level diaries with transition year students are presented and relationships between these variables are explored. These methods were conducted with a larger sample of transition year students in five schools.

Chapter 7

7 Anthropometry, fitness and physical activity levels of students

Objectives:

1. To measure the anthropometry of students.
2. To examine students' fitness levels and physical activity levels.
3. To investigate associations between anthropometry and physical activity levels and fitness.

7.1 Introduction

The purpose of this chapter is to present results of anthropometry, the 6-minute run fitness test and physical activity levels (PAL). Protocols for measures in this chapter including anthropometry, the 6-minute run fitness test, self-report physical maturity assessment, and self-report physical activity levels are described in Chapter 3, under Section 3.7.3. To provide a recap for the reader a short summary of methods and analysis used in this chapter are briefly described in this introduction. Anthropometric measures including weight, height and waist circumference were measured directly. The International Obesity Task Force BMI age and sex specific charts for children and adolescents were used to classify underweight, healthy weight, overweight and obese participants in the sample (Cole et al., 2000). The UK waist circumference (WC) percentile charts were used to categorise health risks associated with WC measurements for participants (McCarthy et al., 2001). Cardio-respiratory fitness was assessed using a 6-minute run test. A separate study to validate the 6-minute run with a sub-group of participants was undertaken at the School of Health and Human Performance at DCU (see Appendix Q for details). Regression equations from the validation study were used to estimate VO_2max in the sample and assess levels of fitness using reference charts for adolescents (The Cooper Institute, 2013). Students' physical activity levels were estimated from self-report physical activity diaries, using methods described in Section 3.7.1.3 (see Appendix U for activity diary template). To examine the impact of anthropometry and physical activity levels on performance in the 6-minute run, linear regression analysis was carried out with 217 participants for

whom data for all three test measures was available. The final regression models for the 6-minute run, adjusted for age and sex, included variables with significant effects from univariate analysis.

7.2 Results

Participants and Response Rates

In six post-primary schools 584 students in fourth year classes were eligible to participate in this study. There was a 15% response rate in School F (mixed gender urban, DEIS), therefore testing did not proceed in this school. The reasons for the poor response were not explored with students and this limitation is discussed later. Response rates to the quantitative measures in this chapter varied by school and are presented in Table 7.1.

Table 7.1 Student response rate to self-report physical maturity, physical activity diary, anthropometry and 6-minute run fitness test methods for each school group

School	Eligible Students n	Self-report Maturity n (%)	Physical Activity Diary n (%)	Anthropometry n (%)	Fitness 6-minute run n (%)
School A Boy urban	55	26 (47)	20 (36)	40 (73)	39 (71)
School B Girl urban	116	81 (70)	74 (64)	94 (81)	90 (78)
School C Boy rural	46	35 (76)	38 (83)	41 (89)	36 (78)
School D Girl rural	78	56 (72)	63 (81)	66 (85)	56 (72)
School E	209	66 (32)	98 (47)	116 (56)	78 (37)
Mixed Urban	106 M	20 (19)	32 (30)	42 (40)	28 (26)
	103 F	46 (45)	66 (64)	76 (74)	50 (49)
School F DEIS Mixed Urban	80	0	0	0	0
Total	584	264 (45)	236 (40)	359 (62)	299 (51)

The main reasons reported for non-participation in other schools were absenteeism, followed by lack of interest or "too much effort". A small number of non-participants in girls schools reported feeling uncomfortable about taking part. The lower participation in the self-report maturity questionnaire compared to anthropometry, which took place on the same day, suggests some discomfort or misunderstanding about this measure.

Anthropometry, 6-minute run, Physical Activity Levels (PALs) and Estimated VO_2max

Results for anthropometry, the 6-minute run, PAL values and estimated VO_2max for boys and girls are described in table 7.2. Twenty percent of boys and 20.9% of girls were overweight or obese as defined by BMI; however waist circumferences indicated a higher prevalence of overweight for girls, while the opposite was observed for boys. Only 15.5% of boys had WC above the 91st percentile, while 35.1% of girls did.

Figure 7.1 shows the percentage of boys and girls who had low, medium and high physical activity levels based on the results of their 4-day activity diary. Using formulae from the validation study, results from the 6-minute run were used to estimate participants' VO_2max. The mean result for boys 57.5ml/kg/min corresponded with a high cardio-respiratory fitness, and for girls 38.8ml/kg/min corresponded with an average level of cardio-respiratory fitness. Just over half of the female sample (n=104) who completed the six-minute run were within low or 'needs improvement' fitness categories according to their estimated VO_2max. The results for boys, whereby 100% of the sample were within the 'healthy fitness' category according to their estimated VO_2max, confirmed an issue with the validation study. This was not a true result since wide variation was observed in the 6-minute run results, and 44.83% of boys reported low PAL (see Figure 7.1). In order to validate the use of the 6-minute run to estimate cardio-respiratory fitness among adolescent participants, a sub-sample of low, medium and high performers were invited to participate in a test that would directly measure of VO_2max in the laboratory (See Appendix Q for methodology and results). The validation study was carried out after school-based data collection. The issue with the validation study was that, owing to a poor response rate from boys who had achieved a low 6-minute run result, a laboratory measurement of VO_2max for boys was conducted with a sub-sample of medium to high performers only. This resulted in an equation for boys that could not be used to accurately estimate VO_2max for the whole sample. This issue did not occur for girls, therefore while it was possible to categorise girls cardio-

respiratory fitness levels from the 6-minute run accurately, it was not possible to do the same for boys in this study (See Table 7.2).

Table 7.2 Anthropometry, physical maturity, fitness, physical activity level measures and participant characteristics for boys and girls from transition year in five post-primary schools

	Boy Participants							Girl Participants						
	n	Mean	SD	Median	IQR	Percentiles		n	Mean	SD	Median	IQR	Percentiles	
						5th	95th						5th	95th
Age	123	16.0	0.4	16.0	0.7	15.3	16.8	236	16.0	0.4	16.0	0.6	15.4	16.6
Anthropometry														
Weight (kg)	123	66.7	10.2	65.8	13.0	49.3	85.6	236	60.2	9.0	59.7	13.3	47.5	76.5
Height (cm)	123	176.2	6.7	176.2	8.8	164.5	188.3	236	165.3	5.9	165.1	7.7	155.6	175.4
BMI (kg/m^{-2})	123	21.4	2.9	21.0	3.6	17.0	27.1	236	22.0	3.0	21.9	4.3	17.9	27.2
Waist circumference (cm)	123	74.7	6.7	74.3	6.6	65.1	87.6	236	70.8	6.6	70.0	9.1	62.0	83.0
Physical Maturity Score	81	8.3	1.0	8.0	1.0	6.1	10.0	183	7.4	1.2	8.0	2.0	5.0	9.0
Fitness														
6-minute run (m)	103	1343	185	1359	225	1015	1647	196	1032	171	1035	207	752	1297
Est. VO_2max (ml/kg/min)	103	57.5	3.9	57.0	4.7	49.8	63.1	196	38.8	3.1	38.8	3.8	33.7	43.6
Physical Activity Diary														
Physical Activity Level (PAL)	90	1.73	0.23	1.73	0.30	1.38	2.17	203	1.64	0.21	1.61	0.27	1.35	2.08
Overweight n (%)	23 (19.2)							44 (18.8)						
Obese n (%)	1 (0.8)							5 (2.1)						
WC 91st-98th percentile (%)	15 (12.2)							46 (19.7)						
WC >98th percentile (%)	4 (3.3)							36 (15.4)						
Fitness categories (VO_2max)														
Low fitness %	0							15						
Fitness needs improvement %	0							38						
Healthy fitness %	100							47						
Residing Urban/Rural (%)	79/21							81/19						
SES (%) 1/2/3/4/5/6	4/23/46/22/5/0							4/30/42/21/3/0						

Physical maturity score – composite measure from two questionnaires with maximum score of 10 (See Appendix R(a) and R(b))
Overweight & Obese assessed using International Obesity Task Force adolescent BMI age- and sex-specific cut-off values (Cole et al., 2000)
WC – waist circumference percentiles: UK age- and sex-specific percentile categories (McCarthy et al., 2001)
Fitness categories – derived from estimated VO_2max values using FITNESSGRAM performance standard cut-offs (The Cooper Institute, 2013)
SES 1/2/3/4/5/6: very affluent/affluent/marginally above average/marginally below average/disadvantaged/very disadvantaged (Haase & Pratschke, 2012

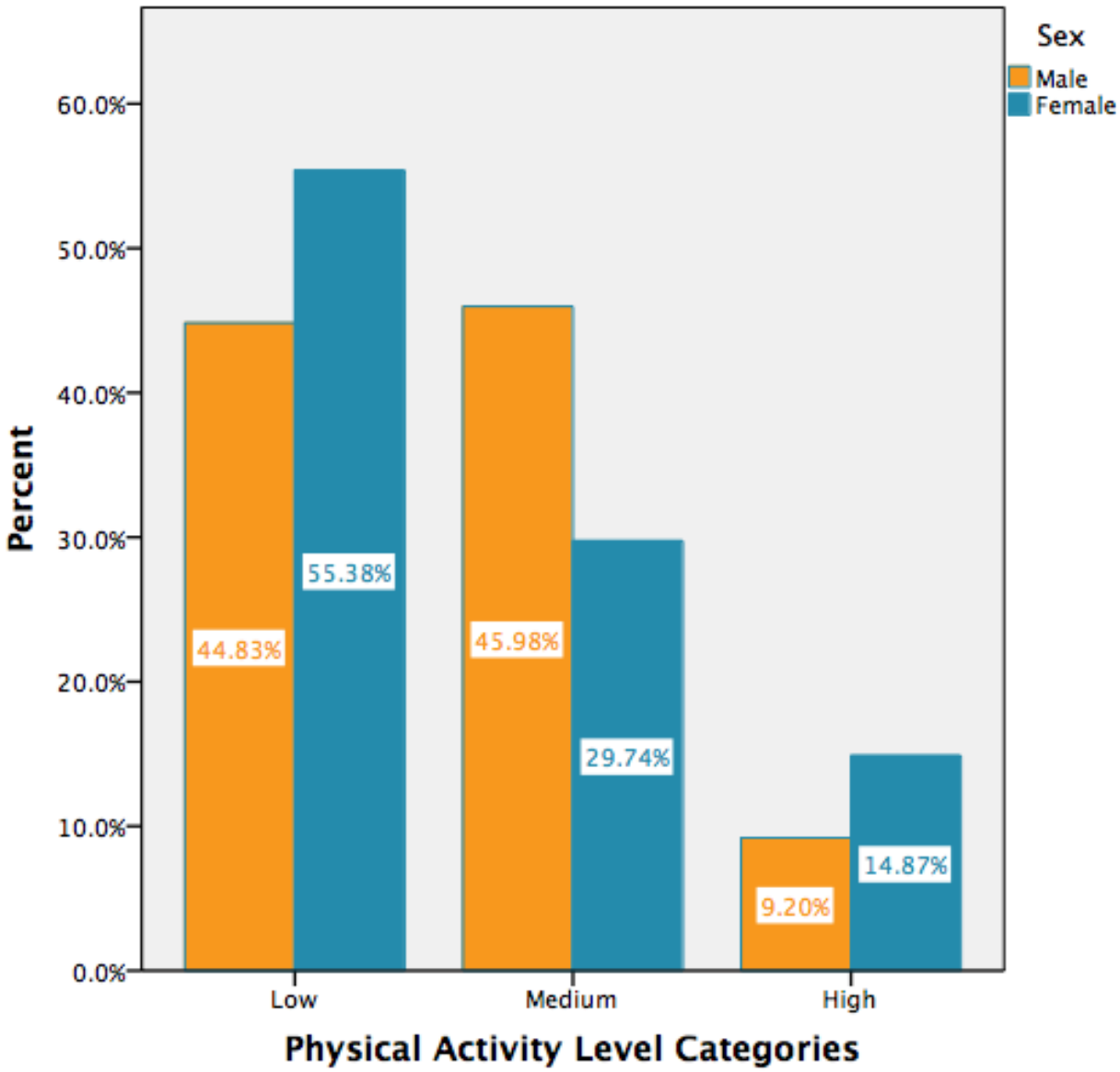

Figure 7.1 Bar chart showing physical activity levels (PALs) estimated from self-report physical activity diaries for 15-17 year old male and female participants from five post-primary schools categorised into low, medium and high PAL

Age and sex cut-off values categorised from individual PALS: Low PAL 1.5 girls, 1.55-1.6 boys; Medium PAL 1.75 girls, 1.85 boys; High PAL 2.0 girls, 2.15 boys (FAO/WHO/UNU, 1985).

The influence of anthropometry and physical activity levels on students' performance in the 6-minute run

More overweight or obese students opted-out of the 6-minute run as numbers in Table 7.4 illustrate. This observation is interpreted with caution for girls because many girls who did not participate in the 6-minute run also opted out of anthropometry (but did participate in other aspects of the study – food diaries and focus groups for example).

Results for school group, anthropometry and PAL variables from univariate linear regression analysis are presented in Table 7.5. Significant gender differences were observed for anthropometry, fitness and PAL variables. As gender was the strongest predictor in all models, interactions of gender on variable effects were assessed, with no significant effects found for height, BMI, WC or PAL. The final models for the 6-minute run, adjusted for age and sex, included variables with significant effects from univariate analysis. These included BMI, WC and PAL and are presented in Table 7.6. Since BMI and WC were strongly correlated, they were entered with PAL into two separate models. After gender, reported PAL was the most significant predictor of the 6-minute run in the final model. BMI and WC both had a significant, negative association with the 6-minute run.

Table 7.3 Median and interquartile range (IQR) values for anthropometry and physical activity levels, and overweight and obesity prevalence for fitness participants and non-participants for 15-17 year old boys and girls from five post-primary schools

	Fitness Participation											
	Did not complete fitness						Completed fitness					
	Boys 26			Girls 42			Boys 97			Girls 194		
	Missing	Median	IQR	Missing	Median	IQR	Missing	Median	IQR	Missing	Median	IQR
Weight (kg)	4	68.1	16.8	22	63.0	13.9	6	65.6	13.2	2	59.3	13.4
Height (cm)	4	178.4	8.8	22	165.4	5.9	5	176.1	8.6	1	165.0	8.0
BMI (kg/m^{-2})	4	21.2	5.1	22	22.7	3.3	6	20.9	3.3	2	21.7	4.4
Waist Circumference (cm)	4	74.3	10.5	22	71.0	9.9	6	74.3	7.3	4	70.0	8.9
Physical Activity Level (PAL)	8	1.77	0.32	17	1.60	0.23	35	1.72	0.25	40	1.61	0.28
Overweight or obese n (%)		28			27			18			20	
WC >91st percentile n (%)		27			45			12			33	

Physical Activity Level (PAL) from self-reported activity diaries
Overweight & Obese assessed using International Obesity Task Force adolescent BMI age- and sex-specific cut-off values (Cole et al., 2000)
WC – waist circumference percentiles: UK age- and sex-specific percentile categories (McCarthy et al., 2001)

Linear Regression Analysis: Factors influencing 6-minute run performance

Table 7.4 Univariate regression analysis results for the 6-minute run, including B, standard error, significance level, and 95% confidence intervals for B for 217 15-17 year old male and female participants in fitness testing in five post-primary schools

	6-minute run (metres)				
	B	Standard Error	P	95% Confidence Interval for B	
				Lower	Upper
Sex	-348.56	21.51	<0.001	-390.89	-306.22
Age	-7.87	26.19	0.764	-59.41	43.67
Height	0.223	1.66	0.893	-3.045	3.491
BMI	-10.43	3.46	0.003	-17.23	-3.63
WC	-5.44	1.57	0.001	-8.53	-2.34
PAL	269.85	50.16	<0.001	170.99	368.70

BMI (body mass index), WC (waist circumference),
PAL (reported physical activity level)
n = 217 (PAL, fitness or anthropometric data missing for 142 participants who were excluded from analysis)

Table 7.5 Final regression models for the 6-minute run with BMI and Physical Activity Levels (PAL) in model 1 and waist circumference (WC) and PAL in model 2

	6-minute run				
	B	Standard Error	P	95% Confidence Interval for B	
				Lower	Upper
Model 1					
BMI	-14.55	3.58	<0.001	-21.61	-7.49
PAL	302.71	49.25	<0.001	205.62	399.79
Model 2					
WC	-5.86	1.66	0.001	-9.13	-2.59
PAL	290.11	49.70	<0.001	192.14	388.07

BMI (body mass index), WC (waist circumference),
PAL (reported physical activity level)
n = 217 (PAL, fitness or anthropometric data missing for 142 participants who were excluded from analysis)

7.3 Results: Student Experience with Anthropometry

Eighty-five percent (304/359) of those who participated in the anthropometric measures of the study completed the feedback questionnaire at the end of the study. For 88% it was a positive experience, with 18% saying it was neither positive nor negative and 2% finding it a negative experience. Comments from participants who had a positive experience fell under three themes: (1) students had an interest in finding out their measurements, (2) the manner of the researchers and study protocols (e.g. privacy) contributed to a positive experience and (3) taking part was enjoyable. Comments from those that found it 'neither positive or negative', indicated that either (1) they had no strong reaction to the experience of being measured or (2) the experience of being measured was ok but there were some drawbacks for them such as being unhappy with their body. Being unhappy with their weight or height was the reason 7 students reported a negative experience with being measured (n=7).

7.4 Interim Discussion

Overweight and obesity prevalence in the study sample of 20% for boys and 20.9% for girls is lower than 26% currently estimated for Irish adolescents (Keane et al., 2014; DCYA, 2012; Whelton et al., 2007). While the Growing up in Ireland study reports higher overweight and obesity prevalence among girls (DCYA, 2012), this difference was not observed for BMI in the current study. Waist circumference measurements, however, indicated that considerably more girls than boys had WCs above the 91st (19.7% and 12.2%) and the 98th percentiles (15.4% and 3.3%). BMI is an indicator of weight status and overweight or obesity, but does not provide information about the distribution of adiposity in the body (McCarthy & Ashwell, 2006; Saava et al., 2000). Using waist circumference percentile charts (McCarthy et al., 2001), McCarthy and colleagues (2003) have previously categorised WCs above the 91st percentile as overweight and over the 98th percentile as obese for British adolescents. They observed substantially larger increases in waist circumferences compared to BMI among nationally representative UK samples from 1977 to 1997. Their results indicated that body compositions are changing, and that higher abdominal fatness is one indicator of a shift from muscle to fat, which BMI alone is failing to identify (McCarthy et al., 2003). The finding that 35.1% of female WCs in this study were categorised above the 91st percentile is comparable to the 38.1% reported among British females of the same age (McCarthy et al., 2003). However, results for males (15.5% above 91st percentile) were considerably lower than the UK (28.5%). The National Teen Food Survey (www.iuna.net) measured WC but has not reported WC percentile categories for Irish adolescents that are comparable with data here. More recent data for Ireland comes from the COSI study which reported 22.9% and 35.2% combined overweight and obesity for waist circumferences among 11 year old boys and girls, respectively (Heinen et al., 2014).

WC has been shown to be a better predictor of cardiovascular disease risk factors than BMI in studies with children and adolescents (Zhang et al., 2016; McCarthy et al., 2005; Savva et al., 2000). A recent study with 38,310 Chinese children and adolescents found that participants with low BMI but high waist circumferences (defined as >75th percentile) were at high risk of elevated blood pressure (Zhang et al., 2016). Results

here indicate that, for WC, the female sample reflects the national picture more closely than the male sample. It is also notable that WC for boys in this study indicated lower levels of overweight and obesity than their BMI results (15.5% WC and 20.0% BMI), which disagrees with other studies (Heinen et al., 2014; McCarthy et al., 2003). A possible explanation for this is that some BMIs were higher as a result of participation bias of leaner, athletic boys with greater muscle mass, which is a body composition type described in the literature (Witt & Bush, 2005). It is also very possible that more obese students of both genders opted not to participate in the study. Nationally BMI obesity prevalence for adolescents has been reported at 8% of girls and 5% of boys (DCYA, 2012) which is considerably higher than the 2.1% and 0.8% observed here. Only 5% of participants were from disadvantaged, and none were from very disadvantaged neighbourhoods. Obesity prevalence is higher among children from low socio-economic backgrounds (DCYA, 2012), therefore the poor response from students in DEIS School F may explain the low rates of obesity observed. While this study may not provide a representative picture of weight status for adolescents, the gender and BMI/WC differences observed here do provide further support for the need to measure and report alternative measures to BMI. This has been recommended for some time (Prentice & Jebb, 2001), and is particularly relevant in light of recent evidence showing that adolescents with 'healthy' BMIs but central adiposity have increased risk of high blood pressure (Zhang et al., 2016).

A unique contribution of the study is the views of adolescents about having their anthropometry measured in the school setting. While routine anthropometric monitoring has been established for children and adolescents (Heinen et al., 2014; DCYA, 2012), consultation with young people about the procedures has not been extensively reported. Weight screening programmes have been introduced in many countries for the purpose of monitoring, allocating resources to, and planning interventions for childhood obesity (Ikeda et al., 2006). In the US consultation with parents who received BMI report cards for their children has been described in the literature (Kubik et al., 2007; Kubik et al., 2006; Chomitz et al., 2003). Parents are generally supportive of BMI measurement as long as privacy and confidentiality of results can be respected, which participants here

echoed. Some concerns about weight stigmatisation exist, and parents of overweight children were more likely to feel uncomfortable about receiving BMI feedback (Kubik et al., 2007; Kubik et al., 2006). Only seven students in the current study had a negative experience because of their body size or height, which indicated that the majority of overweight participants had either a positive or neutral experience. Overall, participants reported that being measured by a communicative, trained health professional and obtaining feedback were positive aspects of being measured. Providing feedback presents a further challenge when carrying out anthropometry with young people because the importance of appropriate follow-up for students with positive results (i.e. overweight) has been highlighted (Ikeda et al., 2006). For students who disliked being measured, and for the greater number of overweight students identified, there was a short coming in procedures in the current study that exists widely in anthropometric research. While onward referral and treatment of overweight and obesity was not an aim of the study, feedback from students has prompted awareness about the communication process. Kubik and colleagues (2006) have suggested that a private and professional weight screening protocol is an opportunity for young people to discuss their weight with a trained health professional, and results here indicate that adolescents agree with this stance.

A high proportion of girls reporting low PALs are not surprising given the evidence that exists for low physical activity participation among mid-adolescent girls (Belton et al., 2016; Harrington et al., 2014). A recent Irish study showed that 77.8% of girls compared to 58.6% of boys did not meet 60 minutes per day of MVPA (Belton et al., 2016). The lower proportion of boys compared to girls reporting high PALs in the current study was unexpected as boys are usually involved in more vigorous activities (Belton et al., 2016). Proportionally, more boys than girls opted out of or returned incomplete physical activity diaries (which was combined with the food diary – see Chapter 8), which may explain why PAL values do not represent a typical group of male adolescents. The physical activity diary involved high participant burden and an objective method such as accelerometry, which does not require participants to record multiple daily diary entries, is considered the gold standard for assessing PAL (Trost et al., 2000). Accelerometry or

pedometers would have been superior to diaries for this age group, but as outlined in the methodology chapter the equipment required was beyond the resources for the study. The strong, positive relationship between reported physical activity levels and the 6-minute run, however, provides some validation for this self-report measure. An association between adequate physical activity (i.e. 60 minutes per day of moderate to vigorous physical activity) and fitness is reported in the literature (Martinez-Gomez et al., 2010; Ortega et al., 2008). The validation study (Appendix Q) demonstrated that the 6-minute run was a good predictor of cardio-respiratory fitness for girls, however further research is required to validate it for boys. The 6-minute run has previously been validated with 12-16 year old Chinese males and females (Li et al., 2007), and Lammers and colleagues (2008) devised normal values of a 6-minute walk in younger children. A published study validating the 6-minute run with European adolescents could not be found. The 6-minute run was an easy to administer fitness test in the school setting that offers potential for self-monitoring of personal physical activity levels. While a measured shuttle distance and timed 'bleep' recording are required for the 20 metre shuttle test, a time-piece and a means of measuring distance travelled (widely available on mobile phones) would be the only required equipment for the 6-minute run. It is a tool young people could be encouraged to use to improve their personal fitness levels over time in many environments. Rather than comparing themselves to other people their age, adolescents could be encouraged to work on personal, realistic goals that have been recommended to emphasise their capacity for changing individual health-related behaviours (Neumark-Sztainer et al., 2010).

The finding that BMI and WC were significantly associated with the 6-minute run was expected. Both BMI and WC are frequently reported to be negatively associated with physical activity levels and cardio-respiratory fitness (Buchan et al., 2015; Martinez-Gomez et al., 2011; Ortega et al., 2008). These have been reported from studies using the 20metre shuttle test, which is a higher intensity fitness test than the sub-maximal test used in this study. This may explain the small effect of BMI and WC observed here compared to other studies. In addition, a number of overweight students opted out of the fitness test, which may have reduced the influence of BMI/WC on outcomes. The aim of

using the 6-minute run instead of the 20 metre shuttle run was to set a fitness test that would be appropriate for all levels of fitness, where students could keep their own pace. It is unfortunate that overweight students were still less willing to partake in this aspect of the study. The study was an artificial scenario where all students came to the gym in classes to be 'tested' and for this reason, it's understandable that many students who may be uncomfortable about their body, skills or performance opted out. This issue was highlighted as a barrier to PE and physical activity participation at school in focus groups with both students and teachers.

This chapter described the study sample in terms of anthropometry, physical activity levels and fitness. Girls' WC reflected the national picture of over one third showing high abdominal adiposity, however, according to BMI there were less obese boys and girls compared to national prevalence rates. Low levels of physical activity were reflective of typical adolescent behaviours, and for 53% of girls this translated into low cardio-respiratory fitness. The main limitations encountered with quantitative aspects in this chapter were (a) an insufficient response from students in DEIS School F, (b) lower fitness than anthropometry participation levels, (c) a poor response to physical activity diaries, particularly among boys and (d) an incomplete male validation study. Issues relating to recruitment and response rates for the whole study will be discussed further in Chapter 9. Physical activity during transition year is different to other year groups because students are offered at least 120 minutes per week of PE, as well as new and interesting opportunities. Results here would indicate that this factor did not appear to result in higher physical activity and fitness levels compared to what is known about adolescent from the literature; however it would be interesting to compare the effect between year groups in Irish post-primary schools. Students' views on anthropometry, the discrepancies observed between BMI and WC definitions of overweight and obesity, and the validation of the 6-minute run with girls are the strengths of findings in this chapter.

7.5 Signpost to Next Chapter:

Chapter 7 described the anthropometry, physical activity levels and fitness of boys and girls from transition year classes in five schools, and students' experiences of taking part in anthropometry measures. In the next chapter findings from the nutritional analysis of school day lunches for the same study sample will be presented. Chapter 8 is the final findings chapter and results are purely quantitative.

Chapter 8

8 The nutrient consumption of students and nutritional quality of lunches from home, school and external sources

Objective: To examine the nutritional intake of students, and the food and nutrient content of school day lunches.

8.1 Introduction

Results in this chapter can be divided into two sections – in the first the average energy and nutrient intakes from 4-day food diaries are examined. In the second section, energy and nutrient intakes from school day lunches were analysed. Of interest was the nutritional quality of foods from three main sources – (1) home prepared lunches, (2) lunches purchased at school and (3) lunches purchased in external food outlets. External food outlets were any source other than home or school, including shops, fast food restaurants, cafes, delis and restaurants.

A full description of the protocols followed for food diaries was described in Chapter 3, Section 3.7.3.4. To briefly refresh the reader on methods and analysis strategy used: self-reported food and beverage consumption from 4-day food diaries were entered into nutritional software NetWISP version 4.0. From here two datasets were exported to Microsoft Excel. The first dataset contained one line per participant showing average daily energy, macronutrient and micronutrient intakes. The second file contained one line per food item for each participant for four days with the actual nutrient content of each item, to which contextual information about food source was added for each line. Food codes from NetWISP (n=886) were further condensed into 33 food groups adapted from McGowan & McAuliffe (2013) (See appendix T for full food group descriptions).

Files were imported to statistical package 'R' for further analysis. Descriptive statistics were conducted with the mean daily nutrient dataset in order to present participant characteristics and mean daily intakes. Descriptive data are presented as mean with standard deviation (SD) or median. Estimated average

requirements (EAR) for micronutrients for adolescents from the UK Department of Health values (Department of Health UK, 1991) were used as cut-offs to define inadequate consumption in the current study, as recommended by Carriquiry (1999). EARs are defined as daily intake values estimated to meet the requirements in 50% of a life stage or gender group. EAR cut-offs provide an estimate of the prevalence of inadequate intakes as the proportion of the sample with usual intakes below the average requirement. Independent samples median Mann-Whitney tests were used to compare differences between groups – e.g. BMI of under-reporters compared to accurate reporters.

For school lunch analysis the objectives were (a) to compare mean nutrient intakes from home, school and external food outlet lunches; (b) to compare the nutrient density, as a measure of the nutritional quality, of lunches sourced at home, school and externally; (c) to examine food group consumption by lunch source; and (d) to show the percentage contribution made by the average of each lunch source to overall energy and nutrient intakes. Differences between lunch sources for various nutrients, nutrient densities, and food groups were investigated using analysis of covariance (ANCOVA) adjusted for gender, survey day and school. Tukey's Honest Significant Difference (HSD) post-hoc analyses tests were conducted to examine where differences occurred between lunch sources. P-values (at 0.05 significance level) for both tests and 95% confidence intervals (CI) for HSD tests are reported in the results.

8.2 Results

Participant Response Rates

Table 8.1 Student response rates to food and physical activity diaries for each school group

School	Eligible Students n	Complete Food Diary n (%)	Diaries Excluded* n	Physical Activity Diary n (%)
School A Male Urban	55	21 (38)	3	19 (35)
School B Female Urban	116	85 (73)	1	73 (63)
School C Male Rural	46	37 (80)	2	36 (78)
School D Female Rural	78	60 (77)	5	57 (73)
School E	209	102 (49)	1	98(47)
Mixed Urban	106 M	34 (32)	0	32 (30)
	103 F	68 (66)	1	66 (64)
School F DEIS Mixed Urban	80	0	NA	0
Total	584	305 (52)	12	282 (48)

* Food diaries excluded as they were incomplete – i.e. less than 4 days complete

393 students took part in various quantitative aspects of the study, representing an overall response rate of 67%. Of those, 305 returned a complete food diary, 12 returned an incomplete food diary (these were excluded from analysis), and 47 decided to opt-out during data collection and 28 did not opt-in at the consent stage. As per Chapter 7, because of an initial consent rate of 15% in School F DEIS quantitative measures, including food diaries did not proceed in this school. The poorest responses to food diaries were from boys in urban Schools A and E. Students in these schools reported "too much effort", "too busy" or "not interested" when they were asked why they did not complete or participate in the food diary. No significant BMI or WC differences between food diary participants and non-participants were observed (Mann-Whitney, $p>0.05$).

School day lunches were defined by students during the food record stage, or if it was unclear students were asked for clarity when the researcher checked and collected the diaries. Sixty-nine students sourced their lunch from the same source on both school days. The remaining students obtained their lunch from

more than one source on different school days and some consumed a packed lunch from home or school purchased lunch at mid-morning break time, followed by a school or 'out' purchased lunch at midday break. All lunches were included in analysis, therefore for the remaining participants two (n=181 students), three (n=47 students), or four (n=8 students) lunches were included in different categories. The decision to include meals defined by students as lunches but eaten at earlier break-times was made as a means of representing available data fully in order to investigate the nutritional content of lunches by their source. Eighteen lunches were excluded from analysis because they were consumed on a day when students were absent from school. The majority of lunches were recorded by students on Thursday and Friday (38.4% and 41.2% of lunches respectively), while 12.3% of lunches were consumed on a Monday, 7.1% on a Tuesday and 1.0% on a Wednesday.

Table 8.2 Participant characteristics, median anthropometry values, and overweight and obesity prevalence for Body Mass Index (BMI) and waist circumference (WC) for 15-17 year old male and female students who took part in the food diary method in 5 schools

	Male n=92	**Female n=213**
	Median (IQR)	**Median (IQR)**
Age (years)	16.1 (0.5)	16.1 (0.5)
Physical maturity score	8.0 (1.0)	7.0 (2.0)
Socio-demographics	**%**	**%**
Residing Urban/Rural	79/21	81/19
SES 1/2/3/4/5/6	4/23/46/22/5/0	4/30/42/21/3/1
Anthropometry	**Median (IQR)**	**Median (IQR)**
	n 92	**n 190**
Weight (kg)	66.4 (13.4)	59.6 (13.4)
Height (cm)	176.1 (8.6)	165.2 (7.6)
BMI kg/m-2	21.1 (3.5)	21.5 (4.2)
Waist circumference (cm)	75.1 (7.5)	70.0 (8.9)
Overweight / Obesity	**n (%)**	**n (%)**
BMI overweight or obese	16 (18.6)	37 (19.5)
Overweight	15 (17.4)	33 (17.4)
Obese	1 (1.2)	4 (2.1)
WC >91st percentile	13 (15.1)	63 (33.1)
91st – 98th percentile	11 (12.8)	39 (20.5)
>98th percentile	2 (2.3)	24 (12.6)

Reporting accuracy

Of 305 who fully completed their food diary, 23 provided an incomplete physical activity diary, therefore medium PAL values were assigned to these participant in order to calculate accuracy of energy intake as described in the methods Chapter 3, Section 3.7.3. This is recommended by Black (2000) as an alternative to using individual PAL values. As the calculation was only used to identify inaccurate reporters, it was not anticipated it would impact further analysis conducted with food consumption datasets. Anthropometry was available for 275 food diary participants (See tables 8.2 and 8.3). Of these, 48% under-reported and 52% accurately reported their energy intakes, with similar findings for both sexes. The mean EEI:EEE ratio for under-reporters (n=135) was 0.62 (SD 0.09, range 0.41-0.76). Independent samples median tests (Mann-Whitney) showed significantly lower BMI and WC in accurate compared to under-reporters (difference of 2.0kg/m^{-2}, $p<0.001$ and 3.5cm, $p<0.001$, respectively between median values).

Nutritional Supplements & alcohol intakes

86 participants reported taking a nutritional supplement (27% of females and 28% of males). Supplements were not included in the nutritional analysis. Most commonly reported supplements were multi-nutrient preparations, fish or cod liver oil, vitamin C, iron (females only), and B-vitamins. Four males reported taking protein or muscle building supplements and one taking creatine. There were no significant differences in mean nutrients derived from food between supplement users and non-users for calcium, iron, zinc, selenium, vitamin D, vitamin E, vitamin A, thiamine, riboflavin, folate, and vitamin C (independent samples Mann-Whitney U test, all $p>0.05$).

57% of participants reported that they never drank alcohol, 25% reported some monthly alcohol consumption and 18% left the question unanswered. Results were similar for the sexes with 24% girls and 26% boys reporting some alcohol consumption. Thirteen participants (8 males, 5 females) reported some alcohol consumption on the days of the food record (mean alcohol intake: 12.2g, SD 10.4). Alcohol was not included in the nutrient analysis.

Table 8.3 Mean, SD, median and percentile values of daily energy, macronutrient, vitamin and mineral intakes for all, male and female students in transition year classes in five post-primary schools

	All (n=305)					Males (n=92)					Females (n=213)				
	Mean	SD	Median	Percentiles 5th	95th	Mean	SD	Median	Percentiles 5th	95th	Mean	SD	Median	Percentiles 5th	95th
Macronutrients & Fibre															
Energy (kcals)	2032	547	1926	1274	3004	2418	589	2378	1596	3416	1865	433	1845	1212	2759
Protein (g)	77.0	23.8	72.4	44.8	119.8	96.1	24.9	93.0	62.1	139.0	68.7	17.8	67.2	43.1	100.0
Fat (g)	84.4	27.6	78.4	47.5	132.8	99.8	31.0	97.6	55.1	166.3	77.7	23.0	74.0	46.0	122.6
Carbohydrate (CHO) (g)	257	75	251	149	383	303	88	303	153	460	238	58	235	145	337
Total Sugars (g)	96	40	89	42	180	109	50	97	45	194	91	34	88	42	153
Free sugars (g)	64	37	60	16	140	74	46	60	9	161	59	31	55	17	117
% total energy from protein	15.3	3.0	15.2	10.8	21.0	16.1	3.0	15.9	11.3	22.3	14.9	2.9	15.0	10.2	19.4
% total energy from Fat	37.1	5.3	37.4	28.3	44.8	37.0	6.2	37.2	27.5	45.7	37.2	4.8	37.4	29.3	44.7
% total energy from SFA	13.6	3.0	13.4	8.8	18.6	13.6	3.1	13.3	8.6	18.9	13.5	3.0	13.5	8.8	18.4
% total energy from PUFA	6.7	2.0	6.4	3.4	10.4	6.5	2.0	6.3	3.3	10.2	6.7	2.0	6.5	4.0	10.6
% total energy from MUFA	12.3	2.3	12.3	8.7	15.9	12.5	3.0	12.2	8.4	16.4	12.3	2.0	12.3	9.0	15.6
% total energy from CHO	50.8	6.3	50.5	41.7	61.0	50.0	7.8	50.0	37.2	60.6	51.1	5.5	50.7	42.4	61.3
% total energy from total sugars	18.9	5.8	18.4	10.2	29.2	17.6	5.7	16.6	9.7	29.1	19.5	5.7	19.0	10.7	29.3
% total energy from free sugars	12.3	5.7	11.7	3.8	22.6	11.9	6.1	11.3	2.3	23.9	12.5	5.5	11.8	4.4	22.4
Non-Starch Polysaccharides (g)	12.0	4.1	11.6	5.9	20.3	14.0	4.6	13.7	7.0	23.6	11.1	3.5	10.8	5.8	17.0
Dietary fibre (g)	16.6	5.4	15.7	8.3	26.4	19.1	6.0	18.1	10.2	31.2	15.2	4.7	15.0	8.2	23.5

	All (n=305)					Males (n=92)					Females (n=213)				
	Mean	SD	Median	Percentiles 5th	95th	Mean	SD	Median	Percentiles 5th	95th	Mean	SD	Median	Percentiles 5th	95th
Vitamins															
Retinol (ug)	283	184	240	68	627	315	179	293	63	669	270	185	228	72	600
Carotene (ug)	2273	2062	1713	230	7062	2374	2024	1816	283	7590	2230	2082	1672	218	6729
Total Vitamin A* (ug)	662	405	571	182	1515	710	410	606	242	1714	642	402	563	145	1479
Vitamin D (ug)	1.81	1.45	1.48	0.38	1.18	2.03	1.58	1.67	0.46	4.38	1.71	1.39	1.38	0.34	4.33
Vitamin E (mg)	6.94	3.07	6.28	3.04	12.48	7.55	3.97	6.63	2.51	13.8	6.68	2.56	6.12	3.11	11.5
Thiamine (mg)	1.67	0.76	1.57	0.74	2.79	2.13	0.85	2.12	0.94	3.32	1.47	0.63	1.39	0.68	2.60
Riboflavin (mg)	1.58	0.70	1.42	0.69	2.81	1.91	0.77	1.86	0.79	3.23	1.43	0.61	1.31	0.65	2.72
Niacin (mg)	22.9	10.1	21.3	10.6	38.7	29.9	12.4	29.1	16.0	45.5	19.9	7.0	18.7	9.2	32.6
Potential Niacin (mg)	15.2	4.7	14.4	8.8	24.1	18.9	5.1	18.3	12.0	28.1	13.7	3.5	13.6	8.5	19.6
Vitamin B6 (mg)	2.00	0.85	1.83	0.98	3.36	2.49	1.08	2.32	1.24	3.92	1.78	0.61	1.69	0.89	3.00
Vitamin B12 (mg)	4.00	2.00	3.77	1.59	7.31	5.02	2.20	4.93	2.04	8.34	3.61	1.75	3.38	1.48	6.30
Folate (ug)	216	93	203	96	376	274	101	268	115	465	190	76	177	91	331
Biotin (ug)	23.8	13.1	21.3	11.1	42.0	29.8	16.8	26.3	13.5	53.2	21.2	10.1	19.5	10.8	37.0
Pantothenate (mg)	5.33	2.42	4.88	2.46	9.97	6.63	2.85	6.23	3.05	13.06	4.77	1.97	4.32	2.34	8.82
Vitamin C (mg)	70.0	48.6	54.6	17.6	161.8	76.7	54.4	61.1	18.6	187.5	67.1	45.6	53.3	17.4	157.7
Sodium (mg)	2827	1118	2555	1358	4972	3660	1244	3699	1731	5706	2467	835	2358	1328	4032
Minerals															
Calcium (mg)	789	325	726	380	1380	935	342	904	440	1497	726	296	672	364	1314
Magnesium (mg)	232	71	222	135	359	277	76	268	169	411	213	59	209	128	306
Iron (mg)	11.32	4.63	10.49	6.10	19.85	14.23	5.72	13.12	7.41	23.93	10.07	3.39	9.33	5.81	17.31
Copper (mg)	1.13	0.62	0.97	0.59	2.87	1.25	0.60	1.11	0.67	2.97	1.09	0.63	0.91	0.57	2.87
Zinc (mg)	7.99	2.79	7.59	4.33	13.50	9.99	2.97	9.58	5.91	15.0	7.12	2.21	6.68	4.06	11.40
Selenium (ug)	39.6	19.4	36.4	18.0	68.4	52.0	25.6	50.3	25.8	86.0	33.8	12.1	31.7	16.4	57.7

* Retinol Equivalents

Nutrient Results

Nutrient data for food diary participants are presented in Table 8.3. Two thirds of boys and girls had fat intakes above the upper recommended 35% of total energy, with a mean total fat as a percentage of total energy of 40% for both genders in this group. No significant BMI or WC differences were found between the low and high fat groups ($p>0.05$). Under- and accurate-reporters were represented equally in the high fat intake group. Carbohydrate and protein intakes were adequate for both sexes, at 50-51% and 15-16% of total energy intake (TE) respectively. Ideally saturated fatty acids and added sugars would each contribute less than 10% of TE (WHO, 2003). 90% of boys and 88% of girls had SFA intakes above 10% of TE, with an average of 14% saturated fat of TE among high consumers. Free sugars include table sugar, syrups, fruit juice and sugars added to foods (e.g. cakes, biscuits, confectionery, breakfast cereals, yogurts, jams, puddings). Fifty-eight percent of boys and 64% of girls had free sugar intakes above 10% of TE, with free sugars having an average contribution to TE of 16% among high consumers for both genders.

Recommended dietary fibre for this age is 20-22g/day (requirement is age+5g, FSAI, 2011) and while the majority of participants failed to consume 20g of fibre/day (79%, n=242), dietary fibre intake was particularly poor among girls with low intakes for 87%, who consumed an average of 14g of dietary fibre/day. At present sodium recommendations for the adolescent populations are similar to adults where daily consumption should be lower than 6g salt or 2.4g sodium. Almost all boys (84%) and 47% of girls had intakes above 2.4g sodium. For high consumers, 4.0g (SD 1.1g) and 3.1g (SD 0.7g) were the average intakes for boys and girls, respectively.

Dietary adequacy

Table 8.4 shows participants with inadequate micronutrient intakes. Over two-thirds of girls did not meet average iron requirements. Approximately one third of boys and girls failed to meet calcium or Vitamin A requirements. Boys and girls had low magnesium intakes, with 79% of girls failing to meet the EAR for magnesium. An EAR is not available for Vitamin D. The FSAI (2011) currently recommend 5ug/day Vitamin D, which almost no participant met through dietary means with average intakes of 1.8ug for boys and 1.5ug for girls.

Table 8.4 The percentage of girls and boys with mean daily intakes below the estimated average requirements (EARs) for selected micronutrients with mean daily intakes and standard deviations for inadequate consumers presented by gender

Food/ Nutrient	EAR Male 15-18 yr. old	Males Inadequacy (%) Mean (SD)	EAR female 15-18 yr. old	Females Inadequacy (%) Mean (SD)
Calcium (mg)	750	32% 589 (112)	625	39% 493 (92)
Iron (mg)	8.7	13% 7.8 (0.5)	11.4	68% 8.1 (1.6)
Zinc (mg)	7.3	21% 6.4 (0.7)	5.5	23% 4.5 (0.7)
Magnesium (mg)	250	41% 213 (28)	250	79% 191 (35)
Vitamin A (ug)	500	39% 351 (91)	400	31% 280 (94)
Thiamine (ug)	1.0	5% 0.8 (0.1)	0.9	16% 0.8 (0.1)
Niacin (mg)	12	1% 10.3 (NA)	11	7% 8 (1)
Vitamin B6 (ug)	1.1	3% 0.9 (0.3)	1.0	7% 0.8 (0.1)
Vitamin B12 (ug)	2.0	4% 1.4 (0.7)	2.0	13% 1.5 (0.4)
Folate (ug)	150	9% 117 (24)	150	35% 119 (23)
Riboflavin (mg)	1.0	8% 0.8 (0.1)	0.9	18% 0.7 (0.1)
Vitamin C (mg)	25	10% 19 (3)	25	15% 17 (6)

EAR source: Department of Health UK, 1991

School Lunches

Six hundred and fifteen light lunch meals from two school days were analysed (189 male lunches and 426 female lunches), with 61% from home, 19% purchased at school and 20% purchased externally in the local environment. Sixty-nine students sourced their lunch from the same source on both school days. The remaining students obtained their lunch from more than one source on different school days and some consumed a packed lunch from home or school purchased lunch at mid-morning break time, followed by a lunch purchased at school or externally at midday break. All lunches were included in analysis, therefore for the remaining participants two (n=181 students), three (n=47 students), or four (n=8 students) lunches were included in different categories. The decision to include meals defined by students as lunches but eaten at earlier break-times was made as a means of representing available data fully in order to investigate the nutritional content of lunches by their source in line with the aim of the study. Eighteen lunches were excluded from analysis because they were consumed on a day when students were absent from school.

Significant gender differences were observed for mean food weight, and absolute intakes of energy, protein, total fat, carbohydrate, saturated fat, starches, total sugars, free sugars, sodium, iron, calcium, and folate, with boys consuming significantly more than girls (all $p < 0.0001$). No gender differences were observed for mean intakes of dietary fibre ($p=0.175$), Vitamin A ($p=0.30$) or Vitamin C ($p=0.981$). A different pattern of gender differences was observed for the nutrient density of lunches, with boys consuming significantly more total fat ($p=0.037$), less carbohydrate ($p=0.011$), and less dietary fibre ($p=0.002$) per Megajoule of food, with no significant gender differences for lunch quality in terms of other macro- and micro-nutrients (all $p>0.05$).

Figures 8.1 and 8.2 illustrate the significantly lower energy density of foods sourced at home compared to school and externally ($p<0.0001$). Water was the most common beverage brought from home, accounting for the differences seen in Figure 8.2.

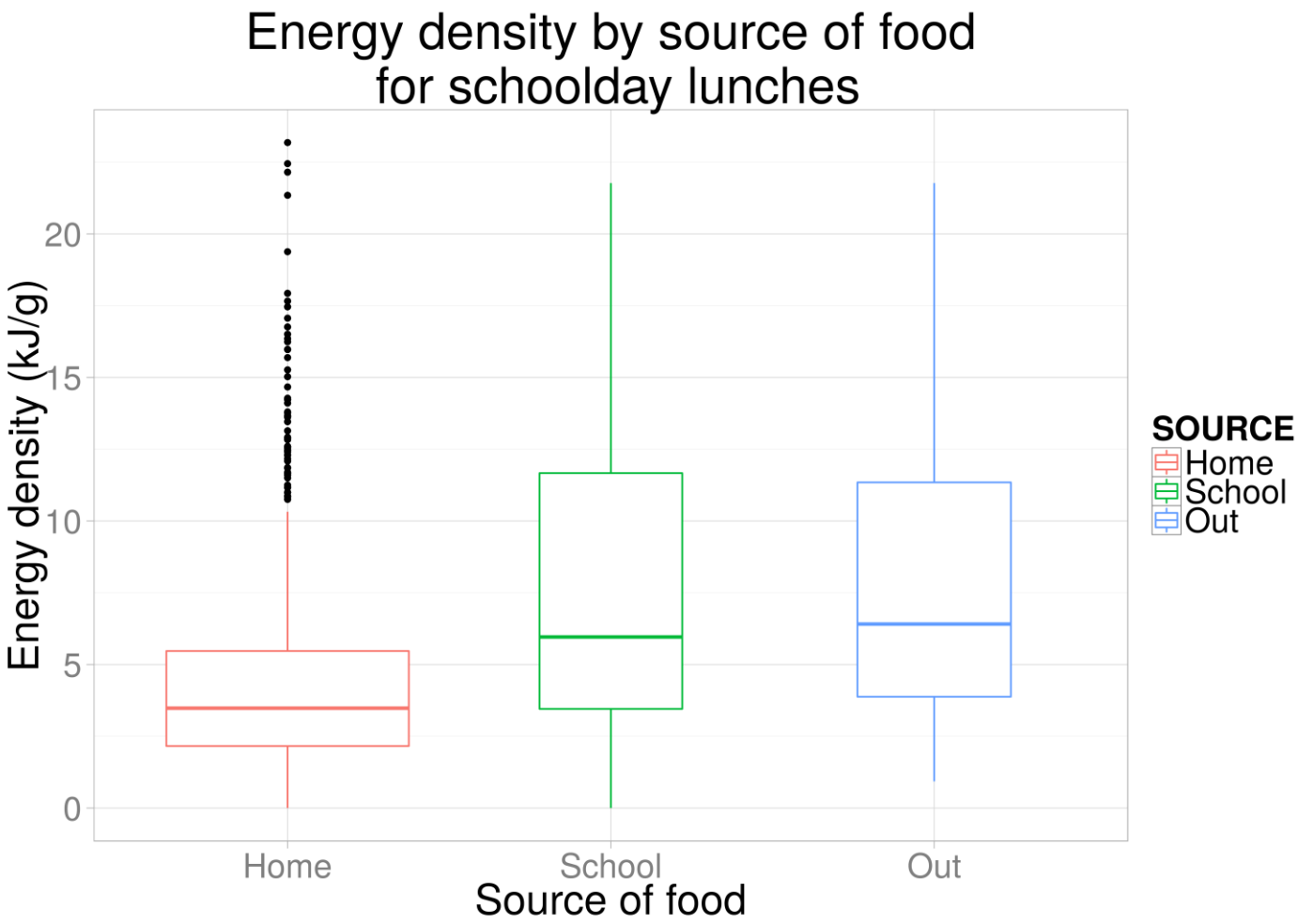

Figure 8.1 Box-and-whisker plots of energy density (kilojoules/gram) of lunch foods sourced from home, school and from external food outlets on school days

Figure 8.1 Box-and-whisker plots of energy density (kilojoules/gram) of lunch foods sourced from home (packed lunches brought to school from home), school (foods purchased in school and consumed at break or lunch time) and externally sourced lunches (foods purchased in external food outlets i.e. shops, fast food and other restaurants, cafes and delis) on two school days among male and female 15-17 year old in five post-primary schools. The width of each box is proportional to the number of observations (lunches from each source); the horizontal line within the box represents the median value; the bottom and top edge of the box represent the 25th and 75th centiles, respectively; the ends of the bottom and top whiskers represent the minimum and maximum values, respectively; and black bolded points are outliers. P value from ANCOVA: <0.0001. P values from Tukey's HSD post hoc analyses test show that energy density of lunch foods from both school (P<0.0001) and externally (P<0.0001) was significantly greater than that of lunch foods from home.

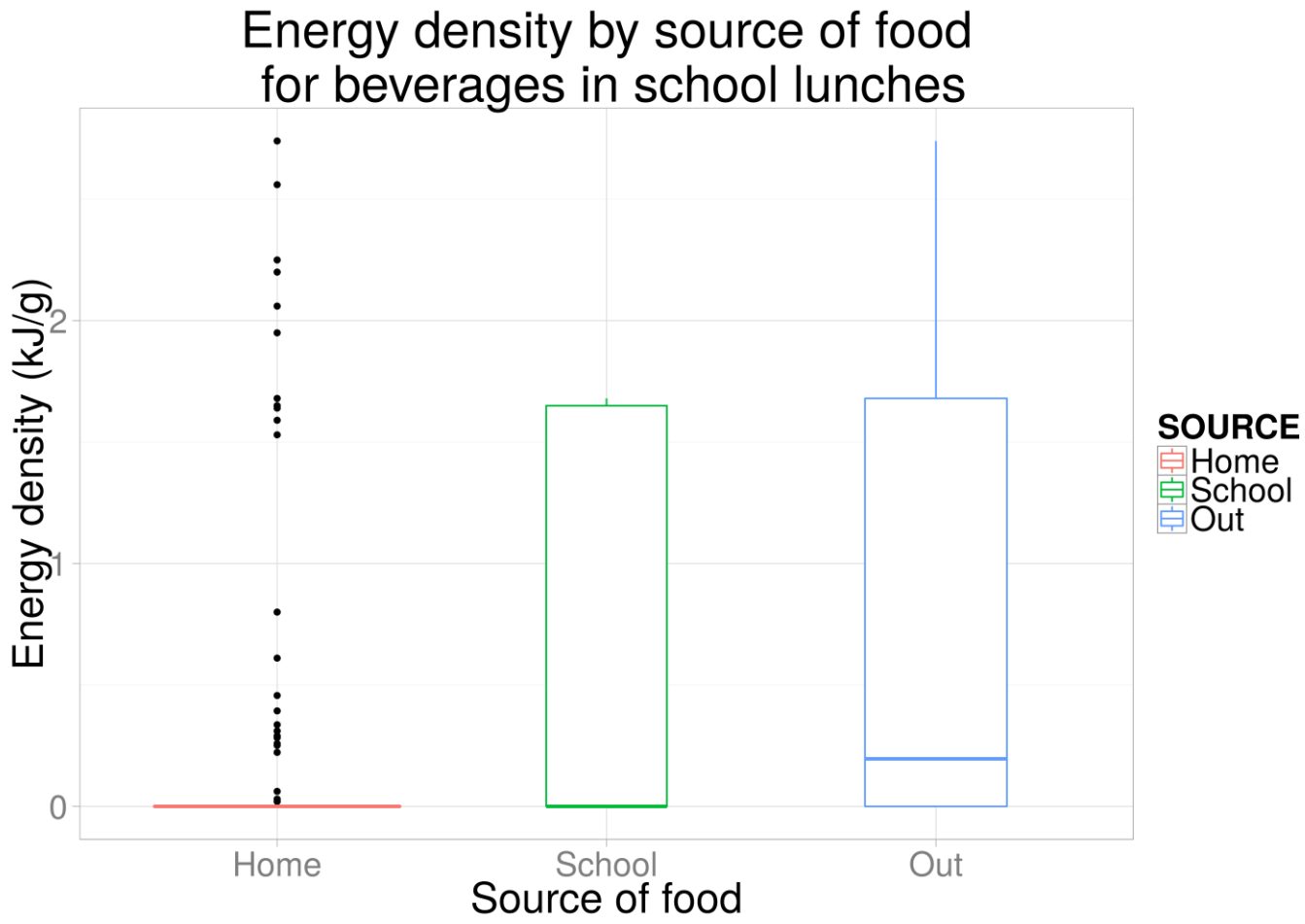

Figure 8.2 Box-and-whisker plots of energy density (kilojoules/gram) of beverages sourced from home, school and external food outlets on school days

Figure 8.2 Box-and-whisker plots of energy density (kilojoules/gram) of beverages sourced from home (beverages brought to school from home), school (beverages purchased or obtained in school and consumed at break or lunch time) and externally sourced lunches (beverages purchased in external food outlets i.e. shops, fast food and other restaurants, cafes and delis) on two school days among male and female 15-17 year olds in five post-primary schools. The width of each box is proportional to the number of observations (lunches from each source); the horizontal line within the box represents the median value; the bottom and top edge of the box represent the 25th and 75th centiles, respectively; the ends of the bottom and top whiskers represent the minimum and maximum values, respectively; and black bolded points are outliers. P value from ANCOVA: <0.0001. P values from Tukey's HSD post hoc analyses test show that energy density of beverages from both school (P<0.0001) and externally (P<0.0001) was significantly greater than that of beverages from home.

Table 8.5 shows the mean energy and nutrient values for each lunch source. The average school and externally sourced lunches were significantly higher in energy (school $p=0.02$ and external $p<0.001$), total fat ($p<0.001$ for both), and free sugars (school $p=0.01$ and external $p<0.001$) than home lunches. External lunches weighed significantly more than home lunches ($p<0.001$) and were also higher in carbohydrate ($p<0.001$), starches ($p<0.001$), total sugars ($p<0.001$) and saturated fat ($p=0.03$). School lunches were lower than home or external lunches in dietary fibre, and folate, and lower than home lunches in vitamin C ($p=0.01$).

In comparison with the average home lunch, school and external lunches had a higher density of total fat (school $p<0.001$, external $p=0.05$), free sugars ($p<0.001$ for both sources), and lower density of dietary fibre ($p<0.001$ for both sources), sodium ($p<0.001$ for both sources), iron ($p<0.01$ for both sources), folate ($p<0.001$ for both sources) and vitamin C (school $p=0.02$, not significant for external $p=0.06$). The average school lunch had a higher saturated fat density than home, which was not significantly different for external lunches (school $p=0.05$, external $p=0.93$) (Table 8.6).

Table 8.7 describes the food groups consumed by students from each source at lunch time. Students sourced more meat products, chips, and high-calorie beverages and less fruit, wholemeal breads, cheese, and red meat from school and external sources compared to home. Confectionery items as part of lunch were sourced equally from home, school and external food outlets, however the portions sizes were significantly higher in externally sourced lunches compared to school and home (mean external 58g versus home 36g 95% CI[11, 35] and school 42g, 95% CI[2, 32]). White bread and rolls were equally popular from all sources with a mean portion size from external sources significantly greater than home, but not school (external 85g versus home 70g, 95% CI [5, 23]). Portion sizes of meat products sourced from school and externally were significantly larger than home (external 106g versus home 67g, 95% CI [20, 57] and school 96g versus home 67g, 95% CI [8, 50]). A similar finding was observed for butter,

spreads and fats (external 20g versus home 13g, 95% CI [3.7, 8.8] and school 18g versus home 13g; 95% CI [1.6, 6.8]).

Table 8.5 Mean, standard deviation energy and nutrient intakes of lunches on school days by home, school and external lunch sources among 15-17 year old male and female students in five post-primary schools

	Food Source													
	Home n376		School n 155		Out n 124		UK Nutrient based standards[§]	Home-School-Out	School-Home		Out-Home		Out-School	
	Mean	SD	Mean	SD	Mean	SD		P*	P[†]	95% CI	P[†]	95% CI	P[†]	95% CI
Food weight g	224	159	244	194	327	235	-	<0.001	0.62	-27.4 - 63	<0.001	19.2 - 107	0.13	-9.6 - 100
Energy Kilojoule	1671	913	2047	1258	2624	1588	2700±135	<0.001	0.02	49 - 605	<0.001	343 - 883	0.11	-51 - 624
Protein g	16.8	12.0	18.7	15.6	20.6	15.9	≥13.3	0.470	0.64	-2.0 - 4.6	0.64	-2.0 - 4.4	1.00	-4.1 - 4.0
Total Fat g	16.6	13.3	23.5	16.7	30.1	21.9	≤25.1	<0.001	<0.001	1.8 - 9.6	<0.001	4.8 - 12.4	0.33	-1.9 - 7.6
Saturated fat g	6.2	6.6	8.1	7.3	10.3	8.4	≤7.9	0.011	0.30	-0.6 – 2.8	0.03	0.2 – 3.5	0.67	-1.3 – 2.9
Carbohydrate g	48.4	24.4	53.6	32.4	72.6	44.5	≥86.1	<0.001	0.18	-1.8-13	<0.001	9.7 - 24	0.01	2.1 - 21.0
Starch g	33.1	18.8	37.8	27.2	47.8	32.5	-	<0.001	0.16	-1.3 – 10.0	<0.001	4.2 – 16.0	0.19	-1.8 – 12.0
Total sugars g	15.0	15.0	15.4	18.1	23.1	27.2	-	0.001	0.85	-3.6 – 5.7	<0.001	1.8 – 10.8	0.07	-0.4 – 10.9
Free Sugars	7.4	12.1	12.6	18.2	19.3	27.5	≤18.9	<0.001	0.01	1.1 – 9.8	<0.001	5.3 – 13.7	0.16	-1.2 – 9.3
Dietary fibre g	3.8	2.5	2.8	1.9	3.8	2.6	≥5.2	<0.001	<0.001	-1.5 - -0.3	0.93	-0.7 – 0.5	0.02	0.1 – 1.5
Sodium mg	779.1	607.3	678.9	575.0	982.2	882.2	≤714	0.071	0.10	-299 – 20	0.96	-137 – 174	0.14	-36 - 352
Calcium mg	171.2	170.6	163.3	173.8	186.6	174.3	≥350	0.540	0.66	-58 – 27	0.72	-55 – 28	1.00	-50 - 54
Iron mg	1.8	1.1	1.6	1.1	2.1	1.9	≥5.2	0.110	0.19	-0.6 – 0.1	0.87	-0.2 – 0.4	0.16	-0.1 – 0.7
Vitamin A ug	116.3	269.9	106.2	143.9	109.4	143.8	≥245	0.750	0.78	-74 – 41	0.91	-66 – 46	0.98	-64 – 76
Folate ug	34.4	24.4	22.9	18.8	34.5	31.6	≥70	<0.001	<0.001	-18.6 - -6.3	0.24	-10.1 – 1.8	0.02	0.9 – 15.8
Vitamin C mg	11.6	27.3	4.1	8.2	6.3	14.2	≥14.0	0.006	0.01	-12.6 - -1.4	0.30	-8.9 – 2.0	0.45	-3.3 – 10.4

SD, standard deviation

[§] UK Nutrient-based standards for co-educational school lunches (UK Department of Education, 2014)

* Analysis of covariance comparing mean intakes of energy, nutrients, and macronutrients expressed as a percentage of lunch energy, adjusted for sex, survey day and school

[†]Tukey's Honest Significant Differences (HSD) Test

Table 8.6 Mean and standard deviation of energy intakes and nutrient density (g, mg or ug per megajoule) of lunches on school days for home, school and external sources among 15-17 year old students in five post-primary schools

	Food Source												
	Home n376		School n 155		External n 124		Home-School-Out	School-Home†		External-Home†		External-School†	
	Mean	SD	Mean	SD	Mean	SD	P*	P†	95% CI	P†	95% CI	P†	95% CI
Energy MJ	1.7	0.9	2.0	1.3	2.6	1.6	<0.001	0.02	0.05 – 0.6	<0.001	0.3 – 0.9	0.11	-0.05 – 0.6
Protein (g/MJ)	10.1	13.2	9.2	12.4	7.8	10.0	<0.001	0.02	-2.7 - -0.2	<0.001	-3.4 - -1.0	0.44	-2.3 – 0.7
Total Fat (g/MJ)	9.9	14.6	11.5	13.3	11.5	13.8	<0.001	<0.001	0.7 – 2.8	0.05	0.0 – 2.0	0.31	-2.0 – 0.5
Saturated fat (g/MJ)	3.2	7.2	4.0	5.8	3.6	5.3	0.048	0.05	0.0 – 1.1	0.93	-0.5 – 0.6	0.22	-1.2 – 0.2
Carbohydrate (g/MJ)	28.9	26.8	26.2	25.8	27.7	28.0	0.014	0.02	-5.7 - -0.4	1.00	-2.5 – 2.5	0.07	-0.2 – 6.2
Starch (g/MJ)	19.8	20.6	18.5	21.6	18.2	20.5	0.014	0.02	-5.3 - -0.3	0.30	-3.9 – 0.9	0.59	-1.8 – 4.3
Total sugars (g/MJ)	9.0	16.4	7.5	21.6	8.8	20.5	0.580	0.98	-3.8 – 3.2	0.67	-2.2 – 4.6	0.68	-2.7 – 5.7
Free Sugars (g/MJ)	4.4	8.8	6.1	14.6	7.3	14.3	<0.001	<0.001	1.4 – 7.2	<0.001	2.3 – 7.9	0.87	-2.8 – 4.3
Dietary fibre (g/MJ)	2.3	2.7	1.4	1.5	1.4	1.6	<0.001	<0.01	-1.8 - -0.8	<0.01	-1.3 - -0.3	0.20	-0.2 – 1.1
Na (mg/MJ)	466.2	665.5	331.6	457.1	374.3	555.5	<0.001	<0.001	-207 - -66	<0.001	-201 - -64	0.99	-81 - 90
Ca (mg/MJ)	102.5	187.0	79.8	138.2	71.1	109.8	0.130	0.73	-24 – 46	0.32	-55 – 13	0.18	-32 - -75
Fe (mg/MJ)	1.2	0.8	0.9	0.8	1.2	1.1	<0.001	<0.001	-0.4 - -0.2	<0.001	-0.4 - -0.1	0.39	-0.1 – 0.2
Vitamin A (ug/MJ)	69.6	295.7	51.9	114.4	41.7	90.5	0.510	0.69	-86 – 41	0.66	-84 – 39	1.00	-77 - 77
Folate (ug/MJ)	20.6	26.8	11.2	14.9	13.1	19.9	<0.001	<0.001	-13.5 - -3.9	<0.001	-13.6 - -4.3	0.99	-6.1 – 5.5
Vitamin C (mg/MJ)	7.0	29.9	2.0	6.5	2.4	8.9	0.003	0.02	-15.0 - -1.1	0.06	-13.3 – 0.2	0.90	-6.9 – 10.0

SD, standard deviation

* Analysis of covariance comparing mean intakes of energy and nutrient density (g, mg or ug per MJ) adjusted for sex, survey day and school

† Tukey's Honest Significant Differences (HSD) Post-hoc test: multiple comparisons of means

Table 8.7 Mean weight of food groups contributing to lunch from home, school and external lunch sources among 15-17 year old students in five post-primary schools, with number and percentage of consumers for each food group shown.

	Source												
	Home n 376			School n 115			External n 124						
	Mean	SD	n (%) consumers	Mean	SD	n (%) consumers	Mean	SD	n (%) consumers	Home/School/External P*	School-Home P†	External-Home P†	External-School P†
Fruit & vegetables													
Fruit	125	58	96 (26)	0	0	0 (0)	160	0	1 (1)	NP	NP	NP	NP
Vegetables	47	50	68 (18)	40	37	10 (9)	34	30	25 (20)	0.450	0.88	0.43	0.94
Fruit juice	228	87	12 (3)	0	0	0 (0)	200	0	1 (1)	NP	NP	NP	NP
Cereal products													
White bread & rolls	70	28	196 (52)	76	24	61 (53)	85	25	64 (52)	<0.001	0.33	<0.001	0.14
Wholemeal bread & rolls	68	21	78 (21)	68	6	2 (2)	72	0	4 (3)	NP	NP	NP	NP
Rice & pasta	162	88	11 (3)	162	76	4 (3)	200	124	9 (7)	NP	NP	NP	NP
Dairy products													
Whole milk	143	211	6 (2)	0	0	0 (0)	303	224	3 (2)	NP	NP	NP	NP
Low-fat milk	79	83	7 (2)	33	4	2 (2)	0	0	0 (0)	NP	NP	NP	NP
Cheese	39	20	80 (21)	48	12	13 (11)	35	15	11 (9)	0.120	0.17	0.71	0.13
Yogurt	118	29	16 (4)	150	0	1 (1)	0	0	0 (0)	NP	NP	NP	NP
Meat, fish & eggs													
Poultry	63	24	43 (11)	76	26	23 (20)	82	33	9 (7)	0.043	0.13	0.10	0.79
Red meat	48	31	134 (36)	60	16	8 (7)	64	42	7 (6)	0.186	0.46	0.31	0.96
Red meat dishes	84	89	3 (1)	174	35	3 (3)	126	103	10 (8)	NP	NP	NP	NP
Meat products	67	31	36 (10)	96	39	33 (29)	106	41	54 (44)	<0.001	<0.001	<0.001	0.47
Fish	74	36	7 (2)	45	0	2 (2)	0	0	0 (0)	NP	NP	NP	NP
Eggs	82	67	7 (2)	0	0	0 (0)	60	0	1 (1)	NP	NP	NP	NP
Savoury dishes e.g. pizza													
Savouries	60	65	7 (2)	63	24	12 (10)	165	175	5 (4)	NP	NP	NP	NP
Potato & potato products													
Potatoes	0	0	0 (0)	0	0	0 (0)	142	80	4 (3)	NP	NP	NP	NP
Chips	160	33	4 (1)	147	54	12 (10)	201	98	18 (15)	0.064	0.93	0.44	0.06

Spreads, fats & oils												
Butter & spreads	13	6	184 (49)	18	7	35 (30)	20	6	35 (28)	<0.001	<0.001	<0.001	0.31
Confectionery & savoury snacks												
Confectionery	36	17	89 (24)	42	18	26 (23)	58	44	33 (27)	<0.001	0.53	<0.001	0.02
Desserts	75	37	4 (1)	200	0	1 (1)	0	0	0 (0)	NP	NP	NP	NP
Biscuits and cakes	40	19	57 (15)	66	43	4 (3)	33	7	3 (2)	0.046	0.05	0.84	0.10
Sugar & preserves	21	11	14 (4)	10	0	1 (1)	17	5	4 (3)	NP	NP	NP	NP
Savoury snacks	33	13	37 (10)	36	12	9 (8)	27	11	7 (5)	0.314	0.77	0.44	0.29
Beverages												
High-calorie beverages	296	179	30 (8)	365	136	22 (19)	367	117	30 (24)	0.099	0.19	0.13	1.00
Low-calorie beverages	241	60	9 (2)	223	35	3 (3)	383	24	4 (3)	NP	NP	NP	NP
Miscellaneous												
Soups	229	74	12 (3)	216	36	3 (3)	201	0	1 (1)	NP	NP	NP	NP
Sauces & condiments	18	18	66 (18)	22	9	47 (38)	33	31	46 (37)	0.006	0.64	<0.001	0.03

Lunch Sources:

Home: Mean and standard deviations (SD) of food groups brought to school from home

School: Mean and standard deviations of food groups purchased at school and consumed at lunch time

External: Mean and standard deviations of food groups purchased in shops, fast food and other restaurants, cafes and consumed at lunch time

** Analysis of covariance comparing mean food weight between sources adjusted for sex, survey and school.*

NP: Analysis not performed (when n consumers <5 in any group)

†Tukey's Honest Significant Differences (HSD) Post-hoc test: multiple comparisons of means

Contribution of school lunch to total energy and nutrient intakes

The mean daily intakes of energy over the four-day food diaries are presented in table 8.8 alongside the percentage contribution of school lunches from home, school and external sources. The most substantial differences observed between sources were for total fat, saturated fat, and free sugars. Sodium contribution from all sources was high, but particularly so for externally sourced lunches. Vitamin C contributions were low from all sources, but particularly from school and external lunches.

Table 8.8 Mean daily energy, nutrient, and dietary fibre intakes, and the percentage contributions of home, school and externally sourced lunches to these for 15-17 year old students in five post primary schools

	Total $n_{participants}$ *305*	*Home* $n_{lunches}$ *376*		*School* $n_{lunches}$ *155*		*External* $n_{lunches}$ *124*	
	Mean	*Mean*	*% contribution*	*Mean*	*% contribution*	*Mean*	*% contribution*
Energy Kilojoule	8501	1671	19.7	2047	24.1	2624	30.9
Energy Kcalories	2032	399	19.7	489	24.1	627	30.9
Protein g	77.0	16.8	21.8	18.7	24.3	20.6	26.8
Total Fat g	84.4	16.6	19.7	23.5	27.8	30.1	35.7
Saturated fat g	31.6	6.2	19.6	8.1	25.6	10.3	32.6
Carbohydrate g	257.0	48.4	18.8	53.6	20.9	72.6	23.2
Starch g	163.1	33.1	20.3	37.8	23.2	47.8	29.3
Total sugars g	96	15.0	15.6	15.4	16.0	23.1	24.1
Free Sugars	65.2	7.4	11.3	12.6	20.9	19.3	29.6
Dietary fibre g	16.6	3.8	22.9	2.8	16.9	3.8	22.9
Sodium mg	2827	779.1	27.6	678.9	24.0	982.2	34.7
Calcium mg	789	171.2	21.7	163.3	20.7	186.6	23.6
Iron mg	11.3	1.8	15.9	1.6	14.6	2.1	18.6
Vitamin A ug	662	116.3	17.6	106.2	16.0	109.4	16.5
Folate ug	216	34.4	15.9	22.9	10.6	34.5	16.0
Vitamin C mg	70.0	11.6	16.6	4.1	5.9	6.3	9.0

8.3 Interim Discussion

Overall nutrient intakes from 4-day food diaries were similar to what is known about Irish adolescents from the NTFS (O'Connor et al., 2013; Hayes et al., 2009; Bannon et al., 2009). Like the NTFS, the majority of participants did not consume adequate dietary fibre, and average daily free sugar consumption was higher than recommended. Inadequate micronutrient consumption patterns were broadly similar to the NTFS in that issues with iron intakes among the majority of girls were identified, as well as approximately one-third of participants consuming inadequate Vitamin A and calcium (Hayes et al., 2009). There were small exceptions including more boys in the current study consuming inadequate calcium (32% versus 23%) and Vitamin A (39% versus 25%) compared to boys in the NTFS; and the larger proportion of girls reporting inadequate folate (35% versus 29%) and Vitamin C (15% versus 7%) intakes compared to girls in the NTFS (Hayes et al., 2009). It is important to acknowledge that these observed differences may indicate some limitations within the current study – i.e. the poor response resulting in a small sample of boys, as well as the shorter duration of the food diary compared to the NTFS (4 versus 7 days). Food records shorter than 7 days can limit the interpretation and accuracy of habitual micronutrient intakes (Livingstone et al., 2004). Despite small observed differences, however, overall results would indicate that the 4-day diary provided an accurate picture of the nutrient consumption patterns of adolescents compared to a nationally representative sample.

In light of results from the 4-day diary, it was perhaps unsurprising that school lunches from all sources would contain inadequate dietary fibre and micronutrients including iron, folate, Vitamin C, and Vitamin A, and excessive sodium. Even though home lunches had the healthiest nutrition profile in terms of energy and macronutrients, there were still significant shortcomings in terms of the micronutrients adolescents require the most. This is an important contribution of the study, because it shows one discrete meal time, and the various food sources, that need to be targeted in order to increase micronutrient intakes among young people. This has been done with success for school lunches

in the UK (Adamson et al., 2013; Pearce et al., 2013; Stevens et al., 2013), but consideration is also needed for how policies and practices can influence the quality of lunches brought from home and other places.

Prynne et al. (2013) have previously compared the percentage contribution of packed lunches from home with school lunches on mean daily intakes for students in the UK. For the most part, their data show that school lunches contributed more to daily energy, macro- and micro-nutrient intakes than packed lunches from home. The pattern is similar here, with the exception of dietary fibre, folate and Vitamin C. This finding would be indicative of food group consumption data where little or no fruits and vegetables were sourced from school. It should be noted that Prynne et al. (2013) reported percentage contribution values that were considerably higher than the current study for both home and school sources (e.g. packed and school lunches contributed 27% and 29% of mean energy in Prynne et al., while they only contributed 19.7% and 24.1% here). The data collection tools and means of estimating portions sizes were the same, therefore other factors explain differences observed. There may be cultural differences in the contents of packed lunches from home between the two countries, particularly given the history of the school meal programme and sitting for a meal in UK schools. Another possible explanation is that mean daily intakes for the whole sample were used here compared to consumer only groups in Prynne et al. (2013). It was not possible to discretely group consumers (e.g. packed lunch consumers) in the current study as some participants were included in two or three lunch source categories.

In this chapter, while the majority of lunches consumed were packed lunches from home, students also commonly sourced lunches from school or local food outlets over two school days. School and externally sourced lunches, therefore, were relevant to the majority of students at least one day of the week. Given the focus of public health messages on reducing high energy, fat and free sugar foods (WHO, 2016; EU Action Plan on Childhood Obesity, 2014; DoHC, 2005); findings here raise concerns about the quality of non-home sourced foods on school days. The absence of more nutrient dense foods such as wholemeal breads and rolls,

red meat, fruit and vegetables from school and external lunch sources highlights inadequate healthy food exposure during the school day, and the nature of students' purchasing behaviours away from home. While the availability of less healthy options may be expected from local food outlets, the provision of these foods in the school environment is not considered acceptable (WHO, 2016).

It is interesting to compare the results of this study with school lunch research in the UK because their findings comparing school and home lunches are, for most nutrients, in contrast to comparisons here. In the first instance school lunches are more commonly consumed, and in some studies more common than packed lunches from home (Pearce et al., 2013; Stevens et al., 2013). Since the introduction of new School Food Standards from 2007 across the UK, school sourced lunches are healthier than packed lunches from home (Pearce et al., 2013; Stevens et al., 2013). Among 11-16 year old students school lunches had better macronutrient compositions, and were higher in dietary fibre and micronutrients including Vitamin C, folate, iron and zinc than packed lunches from home (Pearce et al., 2013; Stevens et al., 2013). Prynne et al. (2013) reported similar findings for the quality of school and home lunches, with the exception of higher saturated fat and sodium in school lunches. A similarity between this study and others is that school lunches were higher than home lunches in total energy, although the extent of the differences varied in UK studies cited. For the UK it may be expected that school lunches would be higher in energy because a school dinner that allows for 2700KJ (645 kilocalories) per serving is provided (UK Department of Education, 2014). The contrast for Ireland is that hot dinners are not typically provided at school and lunch foods were more snack and finger food based (e.g. filled sandwiches or rolls). Restrictions on the sale of foods outside of the school meal programme including confectionery, soft drinks and savoury snacks have also been introduced in UK schools, and the impact of this is that home lunches are now the major source of these foods (Adamson et al., 2013; Prynne et al., 2013). The energy contribution made by school lunch foods is now more nutrient dense as high fat, sugar and/or salt foods are limited. Although home was a source of confectionery and savoury snacks in the current study, the impact on mean free sugar and fat intakes was

lower, which was explained by higher free-sugar density associated with school and externally sourced lunches compared to home, lower numbers of high calories beverage consumers from home and smaller portion sizes of home sourced confectionery compared to school and external lunches. It has been suggested that when low-nutrient, energy dense foods are restricted at school, students will source them from other places, including home (Prynne et al., 2013; Gilmore et al., 2008). The relevance of food from home and to a lesser extent, the local environment, is evident in the current study. These sources dilute the potential impact of school food policies because restricting foods from home and local food outlets is challenging. Local food outlets are particularly relevant and potentially influential for older adolescents because they have greater freedom of movement during lunch time on school days than younger children (Gilmore et al., 2008).

Despite this, making the healthy choice the easy choice remains the responsibility of the school setting and the health promotion, education and behaviour change opportunities of healthy school food environments are well documented (WHO, 2016; Nelson and Breda, 2013; Adamson et al., 2013; Glanz et al., 2005; Wechsler et al., 2000). The implementation of school food policy is relevant even in the absence of a state school meal programme. Provincial school food and beverage policies in Canada, for example, have had an impact in terms of reducing the availability of sugar-sweetened beverages, French fries, and confectionery available within schools (Watts et al., 2014; Fung et al., 2013); and a 'Healthy School Canteen' initiative in Dutch schools has improved the food environments, healthy eating curriculum and school food policy in the majority of participating schools (Mensink et al., 2012).

For participants, food from the local environment was as influential as school setting food because students were accessing both sources equally. There is a growing body of evidence globally to show easy access to fast food in the retail environments close to schools (Callaghan et al., 2015; Virtanen et al., 2015; Héroux et al., 2012; Davis & Carpenter, 2009). Close proximity to school (within 1km) increases the likelihood of fast-food purchases (Templeton et al., 2005) and

can have a negative impact on overall diet quality in terms of low fruit and vegetable and high fat and sugar consumption (Smith et al., 2013). A Scottish survey has highlighted that supermarkets, sandwich shops, bakeries and newsagents, rather than fast food outlets, were the most popular sources of foods for secondary school students outside of school at lunch time (MacDiarmid et al. 2015). This may be very relevant to the Irish context in light of findings from students' photos of local food environments presented in Chapter 4 where the majority of destinations at lunch time were convenience shops. This would concur with recent research showing an average of 6.71 local shops within 1km of Irish post-primary schools (Callaghan et al., 2015). Students as consumers in these outlets is particularly important in light of the large portions, excessive energy, total and saturated fats, and free sugars associated with food purchased from them (current chapter), as well as deals on unhealthy foods that appeal to students' budgets and purchasing behaviours (Chapter 4). Findings contribute to the literature by placing a spotlight on convenience shops as sources of food that share characteristics with fast food outlets.

A number of limitations are acknowledged when interpreting findings in this study. The sample was relatively affluent and this may have influenced the content of packed lunches from home, as well as the financial means to purchase lunch in school or locally. Lack of information about non-responders is a source of bias and the over-representation of girls compared to boys may have influenced the results in terms of food sourcing and nutrient and food consumption. The proportion of under-reporters is consistent with other dietary surveys with adolescents (Walton et al., 2014; Brandini et al., 2003), and Brandini and colleagues (2003) have demonstrated longitudinally that accuracy of reported energy intake among girls, in particular, declines from childhood into adolescence. With high levels of under-reporting for the 4-day diary significant differences in energy and nutrient composition of school day lunches between under- and accurate-reporters would have been expected but were not found. This may indicate inaccuracies at other periods of the food diary, for example in the evenings or on weekend days when routine is less structured. Busy or irregular lifestyles can explain some of the intentional (e.g. altering eating habits)

and unintentional under-reporting (e.g. forgetting to record items) in food surveys (MacDiarmid and Blundell, 1998). The structure associated with meals on school days may have improved recording, and is a possible explanation for agreement between the energy and nutrient intakes of accurate- and under-reporters. This study was unable to determine how participant characteristics and school food practices influenced lunch sources and food choice. Although the aim of this chapter was to understand the nutritional quality associated with lunch sources, the inclusion of some participants in two or three lunch source categories should also be acknowledged when interpreting these results.

To my knowledge, this is the first study to investigate the sources and nutritional content of school lunches in secondary schools in Ireland. The study provides evidence for initiatives that support packed lunches from home and the need to consider policy and regulation for school food that can addresses all lunch sources. Education and awareness among schools, students, and parents about the benefits of home lunches and the potential for improvement may be relevant to a large proportion of Irish students. The literature demonstrates that the school food environment is a modifiable factor that can be addressed through state and local policies. The impact of foods from outlets close to schools on the nutritional content of students' lunches is under-researched in all jurisdictions and findings here provide evidence of a significant negative impact. Policies that minimize student exposure to unhealthy food environments should be considered for secondary schools in light of these results.

8.4 Signpost to Next Chapter

This concludes the findings chapters. A general discussion chapter follows, where results from findings chapters are interpreted together through discussion. Recommendations for future research, policy and practice will be included at the end of Chapter 9.

Chapter 9

9 General Discussion

9.1 Introduction

In this chapter, key results from findings chapters will be integrated together through discussion. As interim discussions have facilitated the examination of main findings for the various methods employed, the purpose of this chapter is to bring novel and unexpected findings to the fore through further discussion. An important aspect of this discussion, in the context of the mixed methods study design, is to explore agreement and discrepancies observed between findings from various methodological sources. The discussion has been constructed to reflect the original research question, aims and objectives and it is divided into five main sections: (1) Overweight and Obesity, (2) Food at School, (3) Physical activity at School, (4) Education versus Environment, (5) Participatory Research. Study limitations are then discussed, followed by recommendations for future research, practice and policy.

9.2 Overweight and Obesity

Compared to national prevalence rates of 5-8% (Keane et al., 2014; DCYA, 2012; Whelton et al. 2007) obesity prevalence in the study sample was low at 2.1% for girls and 0.8% for boys. The relatively affluent sample is one explanation for low levels of obesity observed. It is interesting to note that in their focus group discussions adolescents felt obesity was not a common issue among peers in their schools. A similar view was reported by teachers in one mixed gender school, but overweight and obesity was highlighted as an issue by principals and teachers in other schools. It is not certain, however, if students' assessment of the situation was accurate. The lack of information about the weight status of non-participants in the five schools where anthropometry was conducted makes it impossible to say with certainty whether overall obesity prevalence was indeed lower than expected. While waist circumference results indicated that male students had low obesity rates defined by central adiposity (3.3%), the high

proportion of girls (15.4%) with waist circumferences above the 98th percentile would indicate that central obesity was certainly an issue for girls. Gender differences in obesity prevalence observed for waist circumference are consistent with international reports in developed countries (Sweeting, 2008).

Students' association between obesity and depictions of morbid obesity shown in the media is an important finding from this study. It highlights that obesity can be viewed as a curiosity rather than something present and visible in our society, which is insightful in light of known inaccurate body weight perceptions previously reported among young people and their parents (Safefood, 2012; Layte & McCrory, 2011; Burke et al., 2010). The GUI study has shown in the 9 year old cohort that 54% of parents with overweight and 20% of parents with obese children thought that their child's weight was 'just about right' (Layte & McCrory, 2011). Only a minority of 13 year olds who were obese in the GUI study thought they were 'very overweight' (18%), while 58% believed they were a 'bit overweight' and 22% believed they were 'just the right size' (DCYA, 2012). Gender, socio-economic status, educational status, weight status and socio-cultural factors have all been found to influence individuals' perceptions of body weight (Burke et al., 2010). There is also a shared cultural shift, as the dramatic increase in overweight and obesity prevalence over the last three decades means that young people have grown up with a social norm of larger body sizes. In their findings from analysis of large US NHANES datasets over time, Burke et al. (2010) provide evidence that the thresholds at which young people self-perceive as overweight and obese have been raised. Education on personal body weight and health may be warranted, which would be supported by students' attitudes to having their weight, height and waist circumferences measured as reported in Chapter 7. With a sensitive approach that is professional, private and includes feedback, weight checks may be an important element of personal health education and help communities with more accurate assessments of body weight.

The issue underpinning this thesis was the roles schools play in the health and health behaviours of their students. The overweight and obesity prevalence

observed among students demonstrated that participating schools had very real responsibilities to their students. There were potential opportunities, therefore, in participating schools to positively influence students' health.

9.3 Food at School

Results from food diaries provided a quantitative picture of 305 students' eating behaviours on two school days. One of the important benefits of conducting food diary analysis was that, to my knowledge, no Irish study has previously reported the impact of the school environment on students' dietary behaviours and nutrient intakes. Results from the food diaries provided evidence that the majority of students were obtaining food at school or in the local environment at least one day of the week, and these sources were of poor nutritional quality compared to lunches from home. National surveys show that high intakes of free sugars from sugar-sweetened soft drinks and confectionery are associated with significantly lower intakes of high quality foods like vegetables, fruit, fruit juice, and milk (Joyce & Gibney, 2008). This was also reflected in lunches sourced from school and external food outlets. Key nutrients that adolescents struggle to consume in adequate quantities including calcium, iron (for girls), Vitamin A, folate (for girls) and dietary fibre (Hayes et al., 2009; Bannon et al., 2009) were also low in school and externally sourced lunches. There was a noticeable lack of healthy options such as wholegrain breads, unprocessed meats, fruit, vegetables and dairy products in students' photos and descriptions of food at school, as well in school lunches analysed from food diaries. These findings are in direct contrast to current public health calls to create school food environments that support healthy diets for young people (WHO, 2016; EU Action Plan on Childhood Obesity, 2014; DoHC, 2005). The situation is totally inadequate, particularly since evidence of school food reform that positively influences students' diets exists from the UK (Adamson et al., 2013) and other countries (Fung et al., 2013; Mensink et al., 2012). The qualitative data in this study provided a rich body of evidence showing individual, socio-cultural and environmental factors contributing to food choice at school. These findings are considered particularly important for the Irish post-primary school context which has yet to introduce food and nutrient standards for school food.

Rolls or wraps containing processed meat products that students photographed, such as the chicken fillet roll or breakfast rolls, have at least double the energy,

carbohydrate, fat and saturated fat of an unprocessed meat, home prepared sandwich. High energy, fat and salt savoury foods observed here are of concern in light of the association between regular consumption of processed meat products and increased disease risk, most notably cancer (Bouvard et al. 2016).These foods are also associated with more energy dense diets (O'Connnor et al., 2014), which place regular consumers at high risk of weight gain. Large portions of confectionery and high calorie beverages found in food diaries and in students' photos are strongly associated with weight gain among children (Malik et al., 2006). The sale of low-nutrient, energy dense foods of all types are known to negatively affect the consumption of fruits and vegetables at school (Briefel et al., 2009; Kubik et al., 2003). This behaviour arising from the unhealthy nature of school food environments was also evident in results of food diaries here. Halving intakes of confectionery, baked goods, high calories beverages and savoury snacks among young people has been proposed as the measure required to reduce the consumption of added sugar intakes to within recommended levels (Patterson et al., 2010). Reducing the sale of chips to less than once a week and removing sugar-sweetened beverages and low-nutrient, energy dense foods at school have been identified as three practices that can reduce students' energy intakes (Briefel et al., 2009). The evidence in this study would indicate that current priorities for school food including a healthy vending policy (Department of Health SAGO, 2014) and 'Better Choice' food guidelines (DES, 2015) have not considered issues 'on the ground'. Poor food and beverage choices are available in all food service facilities in schools such as shops and canteens and are not limited to vending machines. In addition, items that should be prioritised for policy, in response to existing evidence, including sugar-sweetened beverages and high fat processed meat products, are not specifically addressed.

Students' descriptions of unhealthy eating behaviour 'norms' associated with peers and situations outside of the home indicated socio-cultural factors influencing food choice. These foods and beverages were referred to as "bad", "junk", "fatty", "greasy", and "unhealthy". This identification with high fat, salt and sugar foods and beverages has previously been described by Share (2008) in a study with Irish adolescents. Factors such as taste, the availability of junk food,

alternative priorities in youth, and confusion about nutrition information have been described to explain their preferences by Share (2008) and others (Yoshida et al., 2011; Fitzgerald et al., 2010; Stevenson et al., 2007; Neumark-Sztainer et al., 1999). As discussed in Chapter 5, food marketing also plays a role in influencing normative perceptions about adolescent eating behaviours. Attitudes among participants that junk foods are "bad but good" suggest identification with typical marketing concepts aimed at young people, which include strong elements of fantasy and fun (Cairns et al., 2013).

It was clear, therefore, that adolescents engaged with social, marketing and physical spaces that were different to adults. At the same time, messages from adults indicated an expectation that young people should know how to make healthy decisions in the face of very unhealthy environments. Share (2008) suggests that adolescents respond to adult condemnation of their eating behaviours through "attitudes or acts of resistance". The peer norm factor is linked to this because adolescents resist *together*, which is consistent with adolescent development literature showing that peer acceptance and reward are more highly rated than unhealthy behaviours themselves (Sawyer et al., 2012). In this study there were accounts of past resistance and envisioned future resistance to healthier school food by students, which was voiced by all school stakeholders consulted. These experiences were complex because student resistance had led to a power shift in the direction of the food providers within the school, who operated businesses and could not afford to waste unsold, perishable foods. So while all stakeholders consulted acknowledged the importance of healthy food at school, making it available as the norm featured lower down the priority list than profits. Even though students acknowledged their resistance, the outcome generated cynicism among them, created discomfort among staff, and ultimately prevented healthier food environments. Profits, in combination with students rejection of healthier options and current embracement of junk food, appeared to define the characteristics of school food observed in the study. These factors also contributed to the difficulty students had in envisioning an alternative food space that their peers would accept.

Financial factors associated with school food are important, because schools and/or food operators are dependent on the revenue (Story et al., 2009). Lost revenue from unhealthy foods, in addition to obtaining enough funding to keep school meals low in saturated fat, sugar, and sodium, and high in wholegrains, fruits and vegetables have been reported as important financial considerations in the school setting (Council on School Health, 2015). In the US, for example, reduced revenue is often cited as a barrier to schools restricting unhealthy, competitive food offerings (Story et al., 2009), however a systematic review of the literature suggests that the majority of schools have been able to improve the nutritional value of competitive foods without changing overall revenue (Wharton, Long & Schwartz, 2008). Findings in this study and others (Callaghan et al., 2015; Kelly et al., 2010) show that routine sale of low-nutrient, energy dense snack foods and beverages is an issue in Irish schools. 'Treat days' such as chips on a Friday, or sausage rolls on a Thursday are a relatively novel finding from the current study. Although practices like bake sale fundraisers, and the use of unhealthy food rewards have been highlighted in the literature as inappropriate for the school setting (Fung et al., 2013; Kubik et al., 2005), designated weekly treat days for the purpose of profits has not been described. It is a further example of compromises made by schools with local food providers in order to maintain a food service to the student body.

Financial factors were also important to students and their budgets are interlinked with the limitations felt by school food providers. Through their photos students showed us that their lunch budgets ranged from €2 to €4, and within this they expect to purchase multiple items or a 'meal deal'. Schools are responding to this and replicating what's available locally. Given the larger negative effect size observed for externally sourced lunches on portion size, energy, fat and sugar, the standards set are not appropriate for the school setting. The evidence showing the feasibility of healthy food provision did not appear to be available to the schools in this study as there was no vision among stakeholders for how it could work successfully. Active dissemination of models that 'work' is one possible solution to the issues identified here. The provision of incentives to participation in healthier food environments may also be of benefit

given the involvement of independent food operators in Irish schools. These approaches would provide an appropriate and targeted response to the situation identified in schools in this study.

The school setting differed from local food environments in their responsibilities for child welfare. The 'loco parentis' role of the school was clearly stated by principals and teachers, and results from student focus groups demonstrated that they were very much in agreement. Students also felt strongly that food provided at school should reflect their health education. This was their experience of home and primary school, but not post-primary school. A healthy environment is one of four key areas for health promoting schools, which also includes curriculum and learning, policy and planning, and partnerships (HSE, 2011). No school in this study had been through the Health Promoting Schools programme offered by the HSE. Although over half of post-primary schools report a health promoting ethos, in a recent survey only 2% had achieved the health promoting schools award and a further 6% were in the process of obtaining it (Moynihan et al., 2016). Ireland, like other countries, is struggling to implement current public health recommendations for healthy eating environments in the school setting (Moynihan et al., 2016; Council on School Health, 2015; Simovska et al., 2012). This has been linked to the absence of national nutrition policies for schools (Council on School Health, 2015; Story et al., 2009). The creation of such policies has been given increased attention alongside obesity prevention strategies (WHO, 2016). Outside of curriculum and learning, all areas of school health promotion were problematic for schools in the current study. There was little evidence of policy and planning, healthy environments, or school community partnerships. One school (School D) did have a healthy eating policy, but students felt it had limited impact and again, food provision was influenced by the school food operator and a weekly treat day was in operation. This finding is consistent with a larger Irish study showing that healthy eating policies may not be exerting significant influence on the health profile of foods sold at school (Callaghan et al., 2015). While other schools in the current study had banned individual items such as crisps or carbonated

beverages, there was no evidence of strategic commitment to eliminating junk food and promoting healthier options.

Evidence from the US and UK show how school food policies have tackled low-nutrient, energy dense 'competitive foods' that compete with healthier options on the school meal programme (Council on School Health, 2015; Adamson et al., 2013). Although Ireland has no school meal programme, these existing examples are important because they clearly define for schools the types of snacks and beverages that are appropriate and the types that are not (UK Department of Education, 2014). This provides schools and food operators with very clear instructions and leaves no ambiguity to be decided at local levels. If principals are struggling to negotiate school food with private food operators, this approach may provide the support required for Irish post-primary schools. The format of the UK food standards are a good example because they are user friendly, easy to read and have an accessible online format (www.schoolfoodplan.com).

Another step towards addressing food in Irish schools would be to introduce standards beyond snacks and beverages, and implement policy for school meals. This poses a greater challenge because catering infrastructures are not currently part of designs for Irish post-primary schools (DES, 2008). The model in some schools in this study, where food operators were investing in infrastructures in exchange for catering contracts, highlights how schools are adapting in response to demands for food at school. Previous research shows that most Irish post-primary schools do provide some level of lunch service (Callaghan et al., 2015; Shanley, 2015). The types of food provision and students' choices as a result of it, however, are unacceptable, and regulation that can influence schools to conform to healthy standards for school children is required.

Post-primary schools in the Netherlands and Canada share similarities with Ireland in that no state school meal programme exists. Mensink et al. (2012) describe a Healthy Schools Canteen programme introduced to Dutch schools with support from local health promotion officers to improve food policy, food

environment and the healthy eating curriculum, with the majority of participating schools demonstrating more positive practices for the three areas. This approach is not dissimilar to that offered by the Health Promoting Schools programme in Ireland; however a number of other health promotion topics are addressed by the current Irish programme including physical activity, mental health, bullying, and sustainable environments (HSE, 2013). Food, therefore, may not always be identified as the most important topic for action within a school. The Irish Heart Foundation have piloted and recommended the provision of a healthy school food catering award programme (Shanley, 2015). While voluntary catering programmes provide a source of information and support for schools to implement changes, there is also a strong case for the development of clearer school food standards at a macro level. The provinces of Nova Scotia and British Columbia in Canada have introduced school food policies, and recent evaluations show positive outcomes in terms of widespread provision of healthier beverages, improved food quality, and reductions in students' energy intakes (Watts et al., 2014; Fung et al., 2013). The policy for Nova Scotia addressed a wide range of food practices at school and included clear food and beverage standards for all items sold at school, the active promotion of healthy items, appropriate portion sizes, the provision of clean drinking water, participation in the province's school milk programme, affordable pricing, provision for vulnerable students, avoidance of unhealthy food fundraisers, and integration of school food practices with nutrition education (Fung et al., 2013). Results from the current study would indicate any food policy for Irish post-primary schools needs to address a broad range of factors with specific instructions. In Nova Scotia, for example, schools are not permitted to use deep-fat fryers to prepare food (Fung et al., 2013). Attention to particular details such as this would seem important in light of findings that fried products such as chicken goujons and chips were commonly offered in schools in the current study. Internationally, mandatory school food standards have demonstrated nutrition benefits in terms of increasing fruit, vegetables, dairy, and associated micronutrients and reducing energy intakes. The success of school food standards in terms of increasing the micronutrient (intakes of students) from countries including Canada, the US and the UK provide strong

evidence for their implementation. For both the US and the UK, school meals are now typically higher quality in terms of micronutrients and portions of fruits, vegetables and dairy than lunches from other sources, including home (i.e. 'competitive' foods sold outside state meals programme and home/other) (Council on School Health, 2015; Pearce et al., 2013; Stevens et al., 2013; Adamson et al., 2013).

There are also possibilities for more immediate action to improve school food in Ireland. While many schools in Ireland report that they discourage unhealthy foods, only a small minority are promoting healthy options (DES Lifeskills Survey, 2014). As the present study showed, school food is currently reinforcing normative perceptions students have about the kinds of food adolescents self-purchase. These food norms are also associated with taste, value for money, and convenience. Simply providing healthier options at school is not enough because in order for healthy food environments to 'work', students' views must be incorporated into changes. On the issue of taste, for example, Cohen et al. (2014) provided schools with a chef for 2 to 3 days a week over one school year to help local culinary staff create recipes that improved the palatability of healthy dishes using cost-effective foods already available to schools, incorporated wholegrains, healthier fats, and used less salt and sugar. This was a randomised control trial which found an increase in fruit and vegetable selection and consumption among students in schools that had an assigned chef compared to control schools (Cohen et al., 2014). The study also employed elements of 'food choice architecture' - the term used to describe how food choices are framed and the effect this has on decision making behaviours. Although they saw some short-term influence of product placement and promotion signage, the study did not find a long-term effect of this (Cohen et al., 2014).

Food choice architecture, however, is gaining momentum in the area of healthy food at school. Long used by food manufacturers and retailers, they are increasingly recognised as important behaviour change agents for healthy food choices. The UK government have set up a Behavioural Insights Team (or so-called 'nudge unit') with public health policy as one of its priorities (Quigley,

2013) and the Department of Agriculture in the US provide funding for behavioural economic studies for healthy eating in school canteens (Just & Wansick, 2009; Just et al., 2008). Just recently, in a circular to post-primary schools, the Irish Department of Education and Skills (DES, circular September 2015), alluded to the importance of promoting healthy options and discouraging less healthy options in the following pieces of advice: (1) "Explanation of 'Better Choice' products should be clearly displayed where these products are being sold" and (2) "'Better Choice' products should be placed in prime slots and at eye level to prompt their choice over less healthy offerings." In addition they advised schools to display the calorie content of vending machine items so students can make informed choices and avoid promoting food brands or products (DES, 2015).

Ensaff and colleagues (2015) designed an intervention to improve the sales of plant-based foods in UK secondary schools including a vegetarian hot dish, sandwiches containing salads, whole fruit and fruit salad. These options were made more prominent, had promotion posters and stickers such as "GOOD for YOU", and prefilled, disposable pots were used to improve convenience for students. Sales of promoted foods increased during the intervention, when students were 2.5 times more likely than pre-intervention periods to choose plant-based food items. The intervention components were interesting in light of views of students in the current study about healthy options being less visible, poorly marketed and unattractive compared to unhealthy foods, and student preferences for purchasing convenient options. This work is relatively novel in the UK and follows success in US school-based studies with nudge strategies (Hanks et al., 2012; Just et al., 2008). Recent work described above by Cohen et al., (2014) suggests some limitations in influencing student behaviour in the long-term. It also highlights how the theoretical definition of food choice architecture or nudge strategies may be inappropriate for the school setting because it does not forbid or remove any food item.

'Nudge' strategies are those that move consumers towards the desired product through product placement, accessibility, convenience and labelling. Thaler and

Sunstein (2008, pp.6) define a nudge as *"any aspect of the choice architecture that alters behaviour in a predictable way without forbidding any options or significantly changing their economic incentives."* By definition, nudge strategies allow for the sale of both healthy and unhealthy foods. The idea is to conserve choice but move consumers towards the healthy options while leaving the unhealthy at a disadvantage in the market place (Just & Wansick, 2009). It has been argued, however, that as a public health education space, there is no room for unhealthy foods at school (Shanley, 2015; UK School Food Plan). Their availability contradicts common healthy eating messages and formal education. Lytle et al. (2004) described some major challenges to a multi-component nutrition intervention in US schools, one of which was that education efforts were hampered by 'competitive foods' in the school environment. Cohen et al. (2014) placed non-sugar sweetened milk prominently in front of flavoured milks in the food service area but did not observe an increase in student selection of ordinary milk compared to controls. The views of many students and staff in the current study would agree with the stance that schools should not sell any unhealthy foods. At the same time, schools' dilemma of failed healthy food initiatives needs to be addressed. Principals wish to keep school canteens open in the face of small student budgets and competition from local shops. Their dilemma is: if all food at school was healthy, how would business (and hence the service to the school) be maintained? Nudge interventions should be easy and fairly cost-neutral, such as putting attractive fruit at eye level (Thaler & Sunstein, 2008). Interventions described indicate that while they have their limitations, 'nudge' strategies should at least be part of an immediate approach to promote under-performers such as fruit, vegetables, wholegrains, salads, unprocessed meats and dairy. Clear policy, as well as practical implementation guidelines that expand on recent advice from the DES (September 2015) may help more schools implement such strategies.

The social value of eating

The findings in this study also highlight some fundamental issues with the value placed on eating at school that requires a new approach at national and local levels. Photos and interviews demonstrated that food choice, food preparation,

sitting to eat a meal, eating from plates or with cutlery, and obtaining healthy drinks during the school day were not highly valued. It is regrettable that lunch time was viewed by some principals and teachers as an *"uncivilised experience".* The highly congested dining or common areas student portrayed at break times and the types of foods consumed by students contributed to this view. The factors principals considered in deciding how to provide school food – *"…a cheap way of getting a certain amount of calories into kids that will keep them going…."* – also demonstrates the low value that is placed on food and eating at school. It is something to be endured rather than enjoyed. Yet, discussion among students revealed that eating with peers is a new stage of their independence and a time they value and enjoy. This concurs with the literature that extra-familial socialising, including eating together, is an important stage of development for adolescents (Lachat et al., 2012; Fitzgerald et al., 2010; Steinberg & Morris, 2001). The social context of eating and meeting at lunch time was discussed by students only and not acknowledged by principals and teachers. Taking time to sit and eat was not a feature of school dining spaces. Photos from students were more likely to portray queues, crowded spaces and convenient hand-held food items. There was no evidence, with the exception of one school with storage and microwave oven facilities, that students had autonomy and independence beyond their packed lunch from home. This is particularly marked given that students were in the senior cycle of post-primary school and very close to 'adulthood'. The institutional nature of schools was evident, whereby students are not encouraged or empowered to take responsibility for eating healthily.

There is little available literature on storage, preparation and cooking facilities for students within the school setting. This may be explained by a lack of such facilities in general, but also less research and policy activity available for packed lunches from home compared to school food. Additional infrastructures that support lunches from home may be particularly relevant in the Irish context given that home was the most common lunch source in the current study. This would be in contrast to the UK, for example, where a greater number of students avail of the school meal programme compared to packed lunches from home (Pearce et al., 2013; Stevens et al., 2013). The fridge, microwave, kettle and oven

facilities available to students in School D were located in the home economics room, and this is an example of schools maximising the use of resources they already have. Home lunches had the healthiest nutrition profile, and schools could support this positive finding further by (1) providing optional storage facilities including fridges, (2) offering heating facilities such as microwaves and ovens, and (3) offering facilities to make hot drinks as an alternative to sugar-sweetened beverages. The places for students to access free water, while present in most schools, were not in the dining areas as recommended (DES, 2008); and in some cases, such as in bathrooms or changing rooms, were clearly inappropriately situated. Hygienic and easily accessible water filters, taps or fountains should be a minimum feature to promote healthy drinks in the school setting (Fung et al., 2013; Patel et al., 2012).

External Food Environments

This discussion has so far focused solely on the internal food environment of schools. The external environments were important as students photographed and wrote about these spaces and the types of foods and marketing that influenced them. In addition food diary analysis showed that the number of lunches sourced externally over two days was similar to the number sourced within schools. Students' photos and accounts of food destinations showed three factors influencing their access to external school food environments at lunch time. The first was an open/closed lunch-time campus policy; the second was the distance of school from local food outlet(s) and the third was the duration of lunch break. Only one school (urban girls-only, School B) had a closed campus policy for all students, therefore sourcing external food was not relevant. Data on the proportion of Irish post-primary schools with closed campus policies could not be found for comparison purposes; however the current study indicates that open campuses, at least for senior students, was the norm. A US study found that students attending school with an open campus policy were more likely to source lunches from fast food restaurants and convenience shops than students from closed campus schools (Neumark-Sztainer et al., 2005). A closed campus, however, is not an ideal one for mid- to older-adolescents, or indeed schools, for a number of reasons. While all principals expressed a

preference for keeping students in school at lunch time, many principals and teachers felt that the capacity of the school to provide supervision and food were limited and the age and independence of senior students makes it more difficult to impose restrictions. Again, the historic lack of school meals in Ireland explains the poor capacity to cater for the student body at lunch time.

Findings here concur with other research showing that distances above 1km are usually too far for most students to walk to at lunch time (Gilmore et al., 2010; Briefel et al., 2009; Neumark-Sztainer et al., 2005). The exception to this here was where students had a longer lunch break. In Ireland, post-primary schools have an average of 6.71 shops and 4.03 fast food restaurants within 1km (Callaghan et al., 2015). At the outset of this study, the impact of these food sources on the quality of Irish students' diets had not been published in the peer reviewed literature. Both the qualitative and quantitative findings in the current study show that students *are* regular consumers at local food establishments, who cater to their budget through meal deals and special offers. For principals external food environments represented a barrier to healthy school food policies because of the inability to monitor foods brought from them, and this is particularly relevant for adolescents who have more freedom than children. Results from the current study add to the literature because it shows that students used convenience shops more than fast food outlets. A Scottish survey has highlighted that supermarkets, sandwich shops, bakeries and newsagents, rather than fast food outlets, were the most popular source of foods for secondary school students outside of school at lunch time (Macdiarmid et al., 2015). Results here show that these types of outlets in Ireland are providing fast food quality meals – i.e. high in energy, fat, saturated fat, salt, sugar and low in fibre. They represent, therefore, a particularly negative everyday food environment for young people. The issue of lunch-time campus movement for post-primary school students deserves more attention in light of these findings. The enforcement of closed campus policies, however, would require more long-term planning and resource allocation in order to increase capacity and/or reorient current school environments.

Summary: School Food Environments

The quantitative findings in this thesis (Browne et al., 2016), in parallel with student and staff accounts of school food environments, provide an in-depth picture of a small sample of Irish schools. The depth of knowledge highlights important organisational factors that are unique to the Irish setting. A disconnect exists between education and food at school which is obvious at local institutional and public policy levels. The impact of this is that schools are contributing to the normative perceptions young people have about unhealthy eating. This is in direct contrast to the ethos that school food should positively influence the health and well-being of young people (Nelson & Breda, 2013; Glanz et al., 2005).

The literature shows opportunities for schools to implement healthy food promotion immediately. What is clear from the current study and others is that schools have recently set up or are thinking about setting up larger lunch provision infrastructures at school (Shanley 2015; DES Lifeskills Survey, 2014). This would suggest a unique timing opportunity in terms of positively influencing the standard of food available. A practical piece of advice that Ireland can take from international school food research is that state nutrition policies can be successful, as long as they provide clear standards for all foods (lunch, snacks and beverages) provided or sold at school (Adamson et al., 2013; Fung et al., 2013; Briefel et al., 2009; Story et al., 2009). The Department of Education and Skills have not traditionally been involved in school food provision in Ireland; therefore the development and implementation of policies will require more long-term planning. Experiences from the US and the UK also indicate that schools need extra funding, resources, support and clear guidance for the successful implementation and maintenance of school food standards (Council on School Health, 2015; www.schoolfoodplan.com). Moore et al. (2010) have highlighted the importance of physical, temporal and social factors associated with the food environments of primary schools. Findings here would concur that numerous factors affects students' eating experience at post-primary school level. In combination with healthier food availability, young people need spaces where they can access food quickly and still have time to eat *and* be social

with peers. Controlling food from local outlets is a bigger challenge, however national and local policies should consider solutions that would reduce student exposure to these spaces at lunch time.

9.4 Physical Activity at School

In this study 44.8% of boys and 55.4% of girls reported low physical activity levels and only a minority reported high levels of physical activity. These findings are consistent with national and international evidence showing high levels of inactivity during adolescence, and only a minority of adolescents meeting the recommended 60 minutes of daily MVPA (Belton et al., 2016; Currie et al., 2012; Woods et al., 2010). The negative impact of low physical activity levels on cardio-respiratory fitness (Martinez-Gomez et al., 2011) was evident in the study whereby 53% of girls performed poorly in the 6-minute run indicating low fitness levels for their age. (As previously discussed in Chapter 7 cardio-respiratory fitness (VO_2max) could not be calculated from the 6-minute run for boys but regression analysis showed a strong positive relationship between reported PALs and the 6-minute run for both genders, therefore a proportion of boys with low fitness levels that reflected low PALs would be expected).

Since students spend at least one third of their waking hours in the school setting, the education sector plays a central role in supporting students obtain their required daily physical activity. Qualitative data provided evidence that schools were not responding to students' physical activity needs. The findings contributing to this view will be discussed.

The value of physical activity at school

There were environmental, social and cultural issues in the way school presented physical activity to their students. Findings from the visual content analysis of students' photos in Chapter 4 provided the reader with a view of the physical spaces in participating schools. Two aspects of these spaces reflected a poor image of physical activity within the school grounds, including (1) the lack of visible facilities for individual and small group sports or activities and (2) the poor condition of facilities in some schools. These issues impose known and unknown limitations on students. The known limitation is that students interested in alternatives to team based sports were not catered for in the physical environment. The unknown limitations are how the poor condition and

lack of facilities affect the whole student body in terms of attitudes and intentions about being active at school. In a focus group study poor quality of facilities in community neighbourhoods is one reported barrier to physical activity participation among adolescents from low socio-economic areas (Humbert et al. 2006). While alternative spaces for post-primary school environments have been highlighted and recommended in the literature (Dyment et al., 2009; Gorman et al., 2007; Haug et al., 2010), change or even upgrading of the usual school facilities was not apparent in schools here. The social and fun aspects of being active with peers are vitally important for adolescents, and the evidence would suggest that spaces where young people can be active and social with peers are achievable, even by reorienting existing school structures and spaces (Gorman et al., 2007). Spaces for activity that met the design standards for schools were apparent from students' photos; however the spaces were not meeting the needs of students.

PE teachers highlighted an issue with the value placed on the formal PE curriculum and extra-curricular sports at school. These factors may be considered elements of the social and cultural support for physical activity within the school. Single class periods pose a major barrier to student engagement with PE, because the time allocated for any meaningful participation is too short. Teachers identified the negative impact this reality is having on students' attitudes, and it also limits the time they have to positively influence students. The particular challenge they face is keeping non-sporty students interested as they move from the junior to the senior cycle of school. Students did not identify short times in PE as a barrier at school, and this is most likely explained by the fact that the study was done with transition year students, who were the only year group in their school offered 120 minutes or greater of PE per week. Teachers, therefore, were describing the situation ahead of students in their next academic year. Kirby et al. (2012) reported that time allocated to PE to be the strongest school-level factor influencing girls physical activity levels in an exploratory study in HBSC schools in Scotland. Like SPHE, PE is at risk of low status because it is not an examination subject and teachers within this study reported that this places limits on the subject and students' perception of its

status. A review by Trudeau and Shepherd (2005) shows that students' positive attitudes to PE diminishes from early to mid-adolescence, which also coincides with schools' withdrawal of time and priority to the subject.

The other issue with student engagement in PE was the link between participation, extra-curricular sports and perceived skill. Teachers had no problems engaging sporty students, *"the cream of the crop"*, who were also involved in extra-curricular sports. It appeared that the school environment and culture geared towards facilitating these students, and there were real concerns among teachers for the activity levels of non-sporty students. The acknowledgement of skill by teachers also reflects what students discussed in their focus groups – where skill, and school and peer recognition of that skill is a motivator to be active. These social supports to be active are important to young people (Tannehill et al., 2014; Smith & Parr, 2007), however, at school level, these supports are directed towards students who already feel skilled and confident about participating in front of peers. If the aim of PE and extra-curricular sports is to develop in students positive attitudes to PE that will last for life (Trudeau & Shepherd, 2005), then social supports at school need to be shifted in the direction of the majority of students with low physical activity levels. The poor social supports to be active were particularly relevant for girls in this study which is discussed in more detail later. The current study was unable to measure the associations between time allocated to PE and students' physical activity and fitness levels. Based on views of teachers and female students, time, variety and support for non-sporty students appear to be three areas that require immediate attention. This finding would be expected in light of existing literature on the topic.

The poor value placed on physical activity at school discussed here highlights how the majority of students are offered limited physical activity opportunities at school. A further example of this was the small representation of students' bicycles compared to the larger representation of staff transport, i.e. car parking. This is important because in a review of the evidence Lubans et al. (2011) have shown that active transport to school is consistently associated with lean body

composition and cardio-respiratory fitness. Creative means of encouraging active transport in primary school children such as the walking school bus has shown positive benefits in terms of increases in young people walking and cycling to school (An Taisce, 2015). Post-primary schools also have a responsibility to assist students in taking the most active transportation options to school (Harrington et al., 2014; Nelson et al., 2008). The literature would suggest that cultures and built environment infrastructures are facilitators of cycling to school (Ostergaard et al., 2012; Van Dyck et al., 2010). This culture was evident in one single sex boy's school only where students' photos and surveys indicated that over 50% of students cycled. This was a novelty in light of national figures showing only 9.4% of boys cycling to school (Nelson et al., 2008). Not only does cycling contribute to students' daily physical activity levels (Carver et al., 2011), it also confers more cardio-respiratory fitness benefits than walking (Larouche et al., 2014). The impact of the cycling culture from School A on students' fitness was not clear because a validation was not completed for boys in the study. Comparing schools with different cycling cultures in Ireland would be an interesting investigation for future research. Given the high incidence of poor fitness levels among girls, measures to improve cycling cultures in post-primary schools are one possible solution to achieving recommended daily activity levels and improving fitness.

Gender Bias

There was an obvious gender bias in students' experiences, and staff accounts, of physical activity life at school. The differences were evident in the use of physical spaces, access to spaces and facilities, attitudes about PE, school culture and social supports to be active. The issue of access to and restrictions imposed on school facilities was an important finding of this study because it showed a gender bias, and also the subtle ways in which schools support unstructured physical activity for adolescents. Boys, for example, were represented being casually active outside with school equipment such as footballs and basketballs. Girls were not represented in the same way, and in addition, showed and explained their restricted access to facilities. Supervision and insurance issues explained restricted access to fitness suites; however, this did not explain why

girls were restricted from other facilities. Lynch and Lodge (2002) have previously described the very clear gender differences around sporting identities and cultures in Irish post-primary schools.

The observed gender divide in access is particularly relevant in light of evidence that student and community access to sports facilities outside of PE can positively influence cardiovascular fitness (Rashad Kelly et al., 2010). There are likely to be a variety of reasons to explain less visible physical activity culture within girls schools. The dominance of team sports within the school environment is one contributing factor. Focus group findings showed this was relevant for PE, and it was also evident in the dominance of team based sports facilities on school grounds. Previous Irish research found that less 'sporty' students discuss activities like cycling, swimming, pitch and putt, canoeing and rock climbing (Tannehill et al., 2015). However there was little or no evidence of infrastructural supports for individual or small group activities that girls prefer (Trudeau and Shepherd, 2005).

In their focus groups 'sporty' students described a number of factors that motivated their commitment to physical activity. They included social support from peers, coaches and school, and feelings of enjoyment, fun, loyalty, and passion. PE teachers felt that students decide on their commitments to extracurricular sports by the end of the junior cycle, therefore a large window exists to expose students to a variety of activities in the first 3 years of post-primary school. Unfortunately students' opportunities to find something they connect with and enjoy are limited in the school environment. While some individual or small group extra-curricular sports were available, staff and principal accounts suggest they were typically accessed by very interested, skilled students. These activities, therefore, weren't visible to the wider student body. Focus group findings with students would indicate that the positive influence of peers in motivating them to be active is not limited to team sports. The sense of camaraderie felt by students, however, was very much limited to those involved in teams. While teams are a positive aspect of school life in many ways, a major drawback is that students not involved in team sports, particularly

girls, are denied a range of socio-environmental and socio-cultural supports to be active.

Staff and students in girls and mixed gender schools did not put forward a sporting identity as strongly as in boys' schools. Staff members from the boys were more knowledgeable about extra-curricular opportunities and sports competitions. Both the principal and teachers in School A (urban male), for example, were passionate about the many deliberate practices to open school sports up to a greater number of students. GAA community links in School C (rural male) appeared to strengthen the physical activity culture within the school because teams, which many students were members of, had access to extra coaching during the school day. Good community/school links have been identified as important facilitators of extending youth physical activity participation beyond school hours (Dobbins et al., 2013; Woods et al., 2010). These links were not evident in girls or mixed schools.

The gender divide is in line with Irish and international research on school physical activity cultures and physical activity in general (Sullivan & Nic Gabhainn, 2013; Woods et al., 2010; Barr-Anderson et al., 2008; Brooks & Magnusson, 2006; Trudeau & Shepherd, 2005; Lynch & Lodge, 2002). The importance of sport in male identities and how society facilitates the expression of that, often overshadowing girls' sports, may explain much of these ingrained practices at school level (Allender, Cowburn & Foster, 2006; Lynch & Lodge, 2002; Eccles & Harold, 1991). Lynch and Lodge (2002) describe important cultural differences present in girls, boys and mixed gender schools in Ireland, where sport is an important distinguishing feature. While single sex girls schools tend to value good behaviour, artistic and social accomplishments, as well as high academic achievement, the celebration of physical strength and sporting prowess is very overt in single sex boys schools. Their research in mixed gender schools revealed gender inequalities, highlighted by girls, about schools' treatment of girls and boys in sport and PE (Lynch & Lodge, 2002). There were numerous examples in the current study of practices that agree with Lynch and Lodge (2002), such as more socio-environmental supports and less restrictions

for boys to be active at school, pointed recognition of sporting achievements for boys, and inadequate opportunities for girls in PE.

In the wider community, there is some evidence of a societal change underway, with increased celebration and recognition of female teams and role models in sport. While male sports still dominate, calls by national bodies for greater recognition and celebration of female sports to encourage youth participation have been important (Federation of Irish Sport, 2012). A recent conference entitled 'Women and girls in sport in Ireland: Let's level the playing field' organised by a number of Irish Governmental Departments (Dublin, October 2015) is evidence of increased attention on this important topic. Despite this, changes to sporting and physical activity cultures were not evident in schools here. While there were accounts of PE teachers acknowledging students' needs and preferences for alternative activities, there was more evidence of organisational, academic and infrastructural factors placing limitations on what they could realistically achieve. Removing these barriers are important for the Irish post-primary school setting and interventions show that small, targeted changes can improve participation for girls and non-sporty individuals (Brooks & Magnusson, 2006; Rees et al., 2006; Trudeau & Shepherd, 2006).

Some facilitators of an active school ethos can be taken from the current study. Publicly recognising and rewarding sporting achievements as described in School A was important to students, but has been linked to sporting prowess and masculinity in the school setting (Lynch & Lodge, 2002). It's questionable, therefore, whether the practice would have the same effect in single sex girls and mixed gender schools. More time and opportunities to be active at lunch times and after school have previously been reported as important facilitators for young people (MacPhail et al., 2003), therefore a longer lunch break may be a practice applicable to all school types. This would also create a shift in the value schools place on physical activity during the school day. While teachers generally prefer a shorter lunch break so that school finishes earlier, the principal in School A continued to ensure their 60-minute break was protected in order to facilitate casual and structured activities. The community links

observed in School C, and the provision of timetable space in addition to PE to facilitate extra-curricular sports training were examples of practices that 'worked', and are supported by a wide body of literature (Dobbins et al., 2011). These types of practices are not without sacrifices for principals and staff. School based literature cites academic pressures as a major barrier to extra-curricular sports participation, which is particularly true for examination years (Woods et al., 2010). In addition to students missing classes as a result of extra training and sports competitions, teachers involved in training also miss classes, which can be a contentious issue between schools and parents as one principal outlined.

Findings here are supported by literature that PE participation is a particular challenge in girls and mixed gender schools (Barr-Anderson et al., 2008; Brooks & Magnusson, 2006; Trudeau & Shepherd, 2008). Brooks and Magnusson (2006) described an interesting intervention to improve chronic under-participation in PE in a mixed gender school in the UK. The PE department shifted their value and priorities from sporting excellence and achievement to student participation with very positive outcomes. The intervention ideas came from students and included dance classes, gym and trampoline for girls, a re-design of the PE uniform and changes to physical environments including changing rooms, equipment and sports hall. Choice, empowerment and being listened to were important facilitators in increasing student engagement with PE (Brooks & Magnusson, 2006). This is an interesting approach in view of methods and findings in the current study – firstly students took an active role in the intervention, and secondly, it addressed skill versus participation in school based sports.

Research focusing specifically on improving girls' physical activity participation highlights the need to address attitudes and motivations to be active in order to address behaviours. Neumark-Sztainer et al. (2010) describe a US school-based group-randomised controlled design study, 'New Moves', aimed at taking focus off weight-loss. Addressing the relationship between physical activity and weight is considered important in light of findings from Chapter 5 where girls,

but not boys, focused on exercise as a means to balance out excessive food consumption. In the 'New Moves' study, physical activity education, as well as motivational and behaviour change techniques were used to promote activity, healthy eating and positive weight control behaviours. The programme changed attitudes, whereby intervention girls showed significant improvements in body satisfaction, perceived athletic competence and self-worth compared to control girls. Behaviours also changed with intervention girls significantly more likely than control girls to set more physical activity goals, display self-efficacy in overcoming barriers to being active and decrease time spent in sedentary activities (Neumark-Sztainer et al., 2010).

In this study, students' accounts of PE and activities in transition year were of more time and exposure to new activities. To know the impact of this on students' physical activity and fitness levels would be interesting, but would require an alternative study design to the one taken here, such as longitudinal research from junior to transition year classes. Nonetheless, in allocating extensive PE timetable space, schools see the potential for transition year to foster improved physical activity behaviours among students. The timing coincides with an age when teachers notice students making a decision about being interested in sport or not. The expectation that participation in PE and physical activity in general will reduce in the following school year is regrettable. A more positive outcome would be to support and maintain any increased interest in physical activity at senior level. It is widely accepted that regular physical activity during the school day improves academic performance (DES, September 2015; Van Dussen et al., 2011; Chomitz et al., 2009; Trudeau & Shephard, 2008), which should be viewed as a facilitator of adequate PE among students facing examinations. A recent circular from the DES (September 2015) to schools revealed a number of areas schools are advised to address in order to improve physical activity participation at school, including becoming involved in the Active School Flag initiative, drawing up an Active School Plan, a Green-School Travel Plan and engaging student councils in more physical activity opportunities for the student body. However, no advice or information with regard to increasing PE time allocation was given, despite the acknowledgement

that most schools struggle to meet 120 minutes per week for students outside of the transition year programme (DES, 2015; DES, 2014; DoHC, 2008).

Summary Physical Activity

The findings here would agree with research for Ireland showing good opportunities for extra-curricular sports in Irish post-primary schools (Woods et al., 2010). Sport can play a large role in a positive school identity for students and staff. However, the physical and social support provided for team based sports means that female and non-sporty students will struggle with participation in the school setting. Based on the findings in this thesis, there appears to be a significant image issue with how physical activity is presented and therefore valued in post-primary schools. Indoor and outdoor physical spaces were poor in all schools and the environments did not reflect the most important stakeholders at school: adolescent students who like to spend time together and have fun. The image issues, however, were most apparent in girls and mixed gender schools where social and environmental supports were inadequately catered for. Results from this study and others would suggest that schools are not in a position to respond to inadequate PE and physical activity opportunities unless a number of facilitating factors are present – interested teachers and principals, adequate teachers and facilities (i.e. additional resources), more youth-friendly physical environments on school grounds, participatory approaches, and timetable space. At present there seems to be no commitment nationally to make additional resources available to schools for the provision of minimum weekly PE time of 120 minutes. Schools are being tasked with addressing their physical activity situation 'in-house' (DES, 2015). As with many nationally mandated initiatives in schools, the success of implementation depends on resources and support in combination with positive support from local principals and staff.

9.5 Education versus Environment

The divergent views of school staff and students on the role of the school in improving eating and physical activity behaviours were briefly introduced in the interim discussion in Chapter 6. Students were clear that they had sufficient knowledge about the impact of behaviours on short and long-term health. They were aware of their poor food and physical activity choices, which was difficult for adults to accept. Modifying the school environment so that it became part of education was the primary solution for students. While poor food and physical activity environments were acknowledged by staff, it was the provision of more education that surfaced as their primary solution. A quote from one principal illustrated the disconnect between environment and education for staff; she stated she was *"....running an educational establishment...."* where the food environment was important in theory but not currently integrated with formal education. Another principal cited insurance as a barrier to students' access to fitness equipment. Students' solutions were more closely aligned to the ethos of health promoting schools whereby environments and student participation were essential elements of their healthy school experience.

It is unsurprising that principals and teachers identified education as their preferred avenue for intervention in the school setting. Principals are tasked with organising the formal and extra-curricular educational activities at school, while teachers have to teach students subjects for academic exams so that they can progress successfully through the education system. There is little space on the Irish school timetable for integration of the physical and social environments with classroom activities. Teachers' views were most likely guided by their professional identity and role within the school – as educators and instructors. This would be consistent with Jourdan et al. (2016 and 2010) that teachers reference the health curriculum, rather than schools' ethos with regard to health promotion. Among Australian teachers, St. Leger (1998) reported that curriculum significantly dominated responses to the question posed to teachers: 'What does the term health promoting school mean to you?' While other factors, such as the physical environment have been pushed up the agenda in recent

years, most Irish schools are not yet taking a whole school approach to health promotion (Moynihan et al., 2016). School is still a setting controlled by adults where young people feel they have little input or means to effect change (Horgan et al., 2015; de Róiste et al., 2012). Changing the traditional teaching system to one in line with a Health Promoting Schools ethos (WHO, 1997) poses challenges and has met with resistance because teaching in post-primary schools is typically driven by achieving academic performance (Carlsson & Simovska, 2012; Nic Gabhainn et al., 2010; Lynch & Lodge, 2002). This leaves little room for more democratic style learning approaches for students. In this study, teachers and principals' vision for more education at school compounds this view.

Teachers and principals saw the proposed new junior cycle and transition year as times to introduce short courses on healthy eating, activity and health. The new junior cycle approach for post-primary schools in Ireland will feature short courses, continuous assessment and a focus on numeracy, literacy and key skills like "staying well" and "managing information and thinking" (DES, 2012, pp.10). 'Health Living' is one of six key areas for education, with plans for introduction in 2017 (DES, 2015). There are opportunities for schools to design their own short courses under each area, or use those developed by the National Council for Curriculum and Assessment (DES, 2012; www.juniorcycle.ie). It is envisioned that topics currently covered: Civic, Social and Personal Education (CSPE), Social, Personal and Health Education (SPHE) and PE will be afforded more timetable space through short courses. In theory, this would be welcome because SPHE and PE are two subjects that require students' active participation, without focus on academic outputs (Nic Gabhainn et al., 2010; Trudeau & Shepherd, 2008). It would be insufficient, however, to design the content of such courses from a traditional education standpoint. Socio-environmental factors do not form integral elements of health education at school. Solutions to important factors highlighted by students in their photo observations and focus groups like unhealthy food environments, peer norms, aggressive marketing, value-for-money, convenience, and taste would be useful in terms of encouraging critical thinking about underlying factors influencing health-related behaviours. Young people in this study demonstrated sophisticated thoughts about the complex

environments they navigate and education needs to respond to and challenge their capabilities. The divergent views of staff and students focuses our attention on poor progress being made at developing health promoting schools, which concurs with current research (Moynihan et al., 2016). Young people value health education they receive in SPHE (Nic Gabhainn et al., 2010) and PE (Tannehill et al., 2015; Smith & Parr, 2007) and home economics (Chapter 5), however their views are not being accounted for sufficiently. If education reform is coming then a recommendation from the current study would be to place a high value on the views of students so that they can make a genuine contribution to courses and shape them to meet their educational needs.

Gender differences in nutrition knowledge and eating behaviours

Teachers in boys schools were particularly emphatic that boys lacked nutrition knowledge, and therefore made unhealthy choices in school and local food environments. This point is explored further here because of three findings arising from students' data. The first is that boys were more likely to buy lunch in local convenience shops, and they consumed more energy and macronutrients than girls, which was mainly owing to larger portion sizes and the consumption of foods with a higher fat content. The consumption of larger portions of food and associated nutrients among boys was expected because their body weights and associated nutrition requirements were higher than girls', however the fat consumption was associated with different foods. It's interesting, therefore, that teachers specifically highlighted their concern about boys' high fat savoury food choices, suggesting that they misunderstood some aspects of healthy eating. Convenience shops close to home have been shown to be associated with less healthy dietary quality in 9 year old boys in the GUI study, but not girls (Keane et al., 2015). While there are obvious differences between the context and ages of boys in the current study, further research on the influence of local convenience shops in relation to boys' eating behaviours may be warranted.

The second finding is that five boys (5.4%) reported taking protein or creatine supplements in wider results from the 4-day food diary. This confirms that some boys are engaged in dietary modifications for muscle building, which was of

concern for teachers. The use of these products by adolescent boys is consistent with a study by Field et al. (2005) who reported use among 4.7% of 4327 American boys surveyed. More recent Australian research would indicate a higher proportion of boys using protein building products (24.8% of 1148 boys surveyed) (Yager & O'Dea, 2014). The lower findings in the current study may be the result of students omitting information or not taking supplements on the days of the research, small sample of boys, and cultural differences in usage. Sporting campaigns that discourage the use of supplements among teenage boys would certainly indicate their popularity in recent years (IRFU, 2013). The use of unregulated nutritional supplements for the purpose of muscle building is not recommended as it has been associated with increased health risks for users, particularly adolescents who are still growing (Li et al., 2015; IRFU, 2013). This topic was not explored in focus group discussions, therefore an assessment of participant knowledge about this area cannot be made. No published literature could be found on this topic for Ireland, and further research may be useful in terms of exploring the frequency and extent of usage, as well as adolescents' attitudes towards them.

The third finding that placed a question over the level of nutrition knowledge among boys is that girls highly valued nutrition information they learned in home economics class at Junior level, which is a subject boys did not take or did not have access to at school. The home economics curriculum for Junior Certificate is more expansive than healthy eating in SPHE and covers the role of diet in health, factors affecting eating habits, awareness of current dietary advice and issues, and digestion and absorption of food (DES, 2008). The vast majority of students who choose to study home economics at school are girls (O'Connor, 2007; Lodge & Lynch, 2004). In junior cycle SPHE (years 1 to 3), which all students are taught, the primary learning outcomes for healthy eating under the 'physical health' module are being able to recognise the elements of a balanced diet and its implications for general health, and differentiate between healthy and unhealthy eating patterns (DES, 2000). SPHE devotes 1 to 2 classes to education about diet in the junior cycle, while food and culinary skills comprise 40% of the home economics curriculum (DES, 2008; DES, 2000). Comparing the

two curricula, it seems likely that girls would have a deeper understanding of nutrition and cooking than boys. It was also true in this study that girls were exposed to more environmental messages at school about healthy eating through restrictions on confectionery, savoury snacks and high calorie beverages compared to boys schools.

Research from the HELENA study with adolescents in nine European countries found nutrition knowledge among adolescents to be as good as among adults. Boys, however, had slightly but significantly lower nutritional knowledge scores compared to girls (Sichert-Hellert et al., 2011). The impact of this potential difference on dietary behaviours is not clear, however some gender differences are reported in large dietary surveys. In Ireland, for example, adolescent girls eat fruit more often than boys (Callaghan & Nic Gabhainn, 2013). Neumark-Sztainer and colleagues (2005) found that boys bought more soft drinks than girls, but not fast or convenience foods in a large US study. Girls tend to have a greater interest in food selection than boys that can be attributed to body image and social norms (Neumark-Sztainer et al., 2012; O'Connell & Martin, 2012). Results from the National Teen Food Survey (NTFS, 2006) showed that the percentage contribution of meat and meat products to daily energy intake for 15-17 year old males is considerably higher than for females of the same age (20.2% versus 13.6%). No differences, however, were observed for confectionery, desserts and savoury snacks. In the current study there is insufficient evidence to state whether boys had less nutrition knowledge than girls. A lack of general knowledge was not evident in focus group discussions with boys, who demonstrated their ability to differentiate between healthy and unhealthy foods. The primary purpose of the focus groups, however, was not to uncover gender differences in nutrition knowledge, therefore the required detail to identify subtle differences may not have been fully explored by peer researchers. While messages about the impact of lunches purchased externally should be targeted at both genders, boys schools may require particular attention in terms of broadening their nutrition and cooking skills, and addressing sports nutrition knowledge. Future research should explore potential knowledge deficits by gender in the context of problematic dietary behaviours observed in this study.

Summary: Education versus Environment

There is overwhelming evidence from qualitative accounts generated by students that school environments require 'health proofing' in order to support students to make healthier food and physical activity choices. Compared to education, environmental solutions did not appear viable for teachers and principals. Schools may benefit from information about the positive benefits specific practices, policies and infrastructures can have on the nutritional intake, physical activity levels and fitness levels of students. An example of potentially useful information, previously discussed, was how to improve food environments without affecting revenue. Another possibility of supporting schools is to help them formalise existing health promoting practices that staff and principals are engaged with in voluntary capacities. Research indicates that the health promoting schools programme is not reaching the majority of post-primary schools in Ireland (Moynihan et al., 2016). Schools may benefit, therefore, from direct policies and resources to implement healthy practices.

9.6 Participatory research

An important outcome of this study was that students were capable agents in researching about their lives and behaviours at school. The high level of interest in the role of peer researcher indicated that students were engaged with the methods and the topics of the project. There was no attrition among peer researchers, who all completed their tasks enthusiastically. They felt they had benefited from being involved, reporting new research, listening and social skills, and increased confidence. Many also said that by taking part, they gained a greater awareness and understanding of the issues that underpin unhealthy behaviours among adolescents. They also gained a better sense of health promotion elements within their school environs. These latter findings indicate that simple participation in exploration acted as a means of active learning. Greater awareness of social issues is a goal and proven outcome of collaborative approaches in health promotion (Duckett et al., 2010; Simovska, 2007). In addition the process was fun and enjoyable, which has previously been highlighted as an important aspect of participatory research with young people (Barron, 2011; O'Higgins et al., 2010).

Another benefit of adopting a collaborative model with students in the study was that young people genuinely contributed to data collection measures which resulted in the presentation of their views in this thesis. While the study was adult led, supportive collaboration is considered a valued approach in participatory methods with young people (Barron, 2011; Wong et al., 2010; Lerner et al., 2005). Wong et al. (2010) argue that in co-learning with youth, adults can serve as resources and collaborators, rather than experts. The co-learning process with adults can enhance empowerment and developmental benefits. In order to emphasise the important role participatory methods played in the study, three specific instances of how collaboration with students enhanced the process and outcomes will be highlighted.

The first was at the Youth Advisory Panel stage when a small group of students advised on the peer researcher methods including recruitment, and the structure

and use of language for information and consent forms, training workshops and data collection tools. Their advice on recruitment, to ensure the opportunity of peer researcher roles was open to all students was important and concurred with existing literature (Barron, 2011). There is a temptation in the school setting to recruit students, with the help of teachers, who frequently participate in school life and are considered 'good' students (Christensen & James, 2008). It can also be viewed as tokenism, which enjoys little credibility in youth participatory literature (Hart, 1992). An open call for volunteers was particularly appropriate here because the topic of food and activity applies to all. Murray (2006) used a friendship network recruitment process in peer led focus groups because specific youth groups in relation to crime were required for the research questions. According to the youth advisory panel, selective recruitment would have undermined the credibility of peer researchers, particularly focus group moderators. The risk was that students would not open up to peer researchers they did not trust or identify with. While the random selection of peer researchers from volunteers could not prevent the ultimate appointment of a 'good' student, the recruitment process proved popular among students in all schools. This may explain the large number of students who engaged with the study by expressing an interest in participating as peer researchers. There was no evidence that discussions were limited as a result of the peer moderator. The exception to this was limited discussion on body image; however this was common to all focus groups and appeared to be a topic that required specific or nuanced approaches to elicit discussion.

The second example of an important student contribution was at the pilot stage. Students participating in the peer-led photo pilot study believed photos taken in and around the school environment would not capture sufficient information about transport to school. They set about including a text-based report of the dominant modes of transport within their school and through discussion with the PhD researcher developed a sub-sample survey. This survey was included in the standard textual-tool that accompanied student photos for the final data collection phase in all six schools. A validated quantitative survey about transport could have been incorporated in the design of this study (e.g. Nelson et

al. 2008) and produced more 'robust' findings, however the student approach was preferable here. In identifying this gap the students who developed the survey demonstrated awareness about multi-levels of physical activity associated with school life, and allowing them to contribute to data collection like this conveyed that their knowledge was valued. The students learned how to develop a simple survey, and subsequent students who used it also had the experience of carrying out a survey with peers. The method – surveying students with one clear question by class group - is an example of a survey that 'works' in the school setting and could be used as a participatory approach to many research questions. While the findings highlighted show that school transport for the sample concurred with what is known for Ireland (Nelson et al., 2008), there were important local differences. These findings were integrated with findings from other participatory and qualitative methods in the study and contributed to a greater understanding of contextual differences at school level.

A third example of how peer researchers contributed uniquely to the study was when focus group moderators in School E decided to develop their own questions rather than opting for the standard questions supplied. This has been discussed in some detail in Chapter 5, Section 5.4. It is highlighted here to promote the agency of adolescents in fully participating in focus group research. While the finding is an example that concurs with collaborative participatory research theory and processes (Wong et al., 2010), descriptions of focus group moderation by adolescents is not widely available in the peer review literature. An exception is Murray's paper (2006) reflecting on peer led focus groups on the topic of resistance to criminal offences. She also provided training and conducted evaluations with peer moderators. They reported that prompt cards they were given for eliciting discussion with peers had been an essential tool to give structure to their sessions (Murray, 2006). Pre-defined topics and questions were important here too, particularly when the researcher, as an adult, introduces a study subject that wasn't chosen by young people themselves. While standard questions 'worked' in the current study, self-composed questions should also be considered where possible because it affords young

people the right to influence the study, take more ownership of their focus groups, introduce new topics, and use their own language.

The benefit of peer moderation that Murray (2006) also alludes to is the 'insider' role. The skills desirable for moderating focus groups, such as facilitation, listening, ability to probe and elicit discussion on meaning, developing group interaction and reflecting opinions, are well documented in qualitative literature (Creswell, 2007; Morgan, 1998; Kitzinger, 1995). When peers facilitate focus groups this classic skill set should feature lower in priority compared to community membership. Murray (2006) took a community focus group stance in her study with adolescents, where peer moderators invited their friends to participate in focus groups in their homes. This was considered appropriate for the topic being investigated because groups of friends had similar resister or desister characteristics. In light of two outcomes of the current study, focus groups organised by close peer networks is an approach that could be considered for diet and physical activity behaviours too. The first is that body image and weight reduction behaviours were not well explored in focus groups, and it's possible that these topics could be more easily discussed in close friendship groups. The other outcome related to sporting identity, and it would have been interesting to observe the attitudes and behaviours of close peer groups on this topic. A drawback to friendship groups is that the recruitment approach would have excluded the wider student body from volunteering for participation in the study.

Carlsson and Simovska (2012; Simovska and Carlsson, 2012) have demonstrated that the process of student involvement in identifying problems and planning change around school food helps to develop their confidence and sense of ability to envision change. The approach is a challenge to traditional formats of health education and indeed student involvement in school life. Teachers grapple with implementing the model because their expectations of education and change can be so different (Carlsson and Simovska, 2012). As previously mentioned, a current facilitator of a democratic learning style in Ireland is the Social, Personal and Health Education (SPHE) programme. SPHE has been a mandatory subject

in the junior cycle since 2003 and makes provision for a democratic approach to teaching and learning about social and health issues in line with key principles of Health Promoting Schools: democracy and the empowerment of students (Nic Gabhainn, O'Higgins & Barry, 2010; Kavanagh, 2012; DES, 2000; WHO, 1997). Physical health is one of 10 modules covered on the SPHE curriculum. There are no formal assessments, with students instead encouraged to discuss issues and reflect on their own attitudes and actions. SPHE aims to help students develop *"skills for self-fulfilment and living in communities and... a framework for responsible decision-making*" (www.sphe.ie). In order to support this alternative approach to teaching and learning, training is offered to all SPHE co-ordinators and teachers, there is a dedicated website (www.sphe.ie) providing a range of resources and a SPHE network with meetings and conferences to support teachers and co-ordinators. Some teachers in this study thought that the breadth of subjects included in the SPHE curriculum (relationships and sexuality, bullying prevention, mental and emotional health, physical health and personal safety) was a barrier to exploring healthy eating and physical activity behaviours in more depth with students. Share (2008) found similar issues with SPHE teachers, who reported problems with time allocated to the subject, as well as poor attitudes among staff and students. Nic Gabhainn and colleagues (2010) have found that staff attitudes to SPHE and uptake of training can impact the success of the SPHE programme within a school. Although valued by students, unfortunately SPHE can frequently fall down the list of priorities within schools as it is not an examination subject (Moynihan & Mannix-McNamara, 2012; Nic Gabhainn et al., 2010).

Despite the benefits of the health promoting schools approach (including whole school involvement, environmental changes, personal skill development, involvement of parents and the community, long-term implementation), most studies neglect whole school factors and narrowly focus on outcomes of classroom-based programmes (Stewart-Brown, 2006). More recent research would suggest that there is increased focus on participatory and whole school approaches to health promotion (Carlsson & Simovska, 2012; de Roiste et al., 2012; Griebler et al., 2012). The filtration of this down to school life was not

evident in schools in the current study. This is consistent with research showing that Irish post-primary school students are generally not consulted about or involved in decisions at school (Horgan et al., 2015; Share, 2008). More opportunities for active student involvement in food and physical activity choices at school, beyond the student council is an important step in reducing barriers to the sale of healthy food items and under-participation. Importantly in this study, students demonstrated their ability to view the issues from many angles and critically evaluate their own situation. This demonstrates their agency and the potential for alternative approaches to involving students in health promotion at school.

The alternative approach to teaching and learning in SPHE was also intended to encourage and facilitate student engagement with wider aspects of health promotion within their schools and foster a "supportive school environment" (DES, 2000). The time and resources for the realisation of this are still very limited (Horgan et al., 2015; Nic Gabhainn et al., 2010). When student participation is genuinely valued, however, it can have far-reaching effects for the whole school (Simovska and Carlsson, 2012; Griebler et al., 2012). In a US study, Hamdan and colleagues (2005) combined a peer-led approach with the promotion of healthier foods at school with interesting results. Both highly involved and less involved students reported increased awareness and trying of healthier options, with more significant positive outcomes among active participants. Research indicates that student representation on councils is not enough to effect meaningful change for the whole student body (Horgan et al., 2015; Griebler and Nowak, 2012). The student council did not feature as an influencing factor from any school stakeholders in the present study, which would suggest agreement with the literature.

Simovska and Carlsson (2012) described five European case studies where students successfully changed or enhanced food and physical activity practices at school. Examples of interventions were free fruit at breakfast, establishing a vegetable garden at school, removing a hot-dog-pass, changing the content of the vending machine, establishing a bicycle workshop at school, increasing the safety

of the traffic around the school and using the local swimming pool for PE classes. Interventions in each school were unique, demonstrating genuine student empowerment to effect change and no one, standard 'fix' for schools. This study is highlighted here because it is an example of the steps that can follow from students' research on their experiences of health education and environment at school. Although an intervention was not conducted in the current study, there was evidence of students' vision for change based on their research experience.

In both this study and others, the success of both formal and informal health promotion practices in schools are largely dependent on the capacity, motivation and interest of school principals and co-ordinating teachers (Nic Gabhainn et al., 2010; Woods et al., 2010). The peer-led approaches in the current project demonstrated that transition year students are well placed to become involved in health promoting activities at school. The transition year programme aims to promote students' social and personal development (Clerkin, 2012). It is a time when students have "space to learn, mature and develop in the absence of exam pressure", which should "prepare them for their role as autonomous, participative and responsible members of society" (Department of Education, 1993, pp.1-2). Involving students in many aspects of food life at school has been incorporated into healthy school food programmes in other countries such as Finland (Finnish National Board of Education, 2008) and the UK (www.schoolfoodplan.com). Findings from participatory elements of enquiry demonstrated the sophisticated understanding young people have of their food places and spaces, which should place them at the centre of consultation for any future scoping of school environments. Not only that, but students in this study highlighted the important influence of normative perceptions and beliefs about peer behaviours. This is another important reason why students need to be at the centre of issue identification in the school setting. They are not just formal education spaces - they are also spaces where young people learn in contexts outside of the classroom, socialise and interact with peers, and develop as people from early adolescence right up to early adulthood. There is a role for student involvement in health promotion at school beyond the usual student council role,

which has known limitations in terms of benefiting the wider student body (Griebler et al., 2012).

Summary: Student participation

In summary, the participatory methods undertaken in the study produced outcomes that concur with the whole-school approach to healthy eating and physical activity as recommended by Health Promoting Schools (WHO, 1997). Student engagement with the collaborative research methods in this project demonstrated that the transition year programme was an ideal stage in post-primary school to engage students in alternative education about health promotion practices and environments at school. These methods could potentially be developed into a transition year module and made available to schools through existing networks.

9.7 Study Limitations

This was a study with a convenience sample of post-primary schools and participants were not representative of all Irish post-primary schools or adolescents. The under-representation of lower socio-economic groups and boys were the key limitations of the final sample.

Recruitment and response rates

A weakness in the overall study was the poor response from students and staff in School F, which left students from lower socio-economic backgrounds unrepresented in the results. School F was the only DEIS school recruited and was located in a socially disadvantaged urban area. Staff struggled to keep students engaged with and attending school, which explains some of the recruitment issues. Staff members were not as willing as staff in other schools to commit time to the research. In Ireland, principals in DEIS schools report many issues including student non-attendance, poor social skills and behaviour that demand their time and make for a more challenging working environment than schools in more advantaged areas (Weir et al., 2014). Since overweight and obesity are known to be higher among lower socio-economic groups, it is particularly regrettable that more students in School F did not participate. The students who took part in qualitative methods were enthusiastic and some had encouraged their friends to take part, which resulted in 14 participants in total. A recommendation for future work in DEIS schools would be to spend longer building relationships with students before recruitment, set up a peer-led recruitment system, negotiate some school-related credits or rewards for participation and allow for a longer time-frame to collect data and provide feedback. Short, less formal one to one interviews with teachers could have been a means of capturing their views instead of focus groups.

Recruitment in other schools was enhanced by the support of the link teacher. Their influence cannot be underestimated, because if they were supportive of the project, they spent more time and energy encouraging students to participate. These reminders influenced students' response rates with the exception of one school. Recruitment and data collection at School E (mixed urban) was more

challenging to organise than others because there was such a large student body (209 transition year students). Conducting the anthropometry and fitness tests on separate days was unavoidable, which resulted in missing fitness data. Boys in School E were under-represented in all quantitative measures in the study and a number of teachers informed me that they had more difficulty engaging boys compared to girls in general school-life participation. More research personnel or the recruitment of a sub-group of students from larger schools would be solutions to the issues encountered.

Socio-Economic Status

Defining participants' socio-economic status by home address is acknowledged as a limitation because more specific, accurate and commonly used methods such as parental education or occupation were potentially available. However, as the focus of the study was the school setting, parents were not involved. With the available information, home address was used as the proxy measure. This is a less accurate measure of socio-economic status and places limits on its use in defining the sample and the analysis using SES in Chapter 7.

Transition Year Programme

The potential biases of the 'transition year student' are acknowledged as a limitation. Transition year is an optional non-academic year offered by over 80% of secondary schools in Ireland, with approximately 55% of Irish students enrolling in the programme (Clerkin, 2012). Almost all students in girl's only and mixed schools in this study participated in the programme, but the uptake was lower for boys' schools (figures not obtained during the study). Physical activity during transition year is different to other year groups because students are offered at least 120 minutes per week of PE, as well as new and interesting opportunities. Physical activity results, for boys in particular, may not be reflective of typical post-primary school students.

Food Diaries

A lack of interest or too much effort was a reason more boys opted out of or did not complete food diaries. Girls may be more interested in their food

consumption and hence, were more willing to give time to this element of the study. With the exception of School E, boys were more interested in giving time for fitness tests and anthropometry. Food diaries are known to impose a high burden on participants compared to other dietary assessments such as 24-hour recalls or food frequency questionnaires (Livingstone, Robson & Wallace, 2004). Using self-report food diaries in this study had the advantage of observing actual food consumed in the context of various food sources. Although it was beyond the budget of the current study, future research should consider digital means of food recording (e.g. mobile phone applications), which may reduce the burden on participants and be a more fun method for use with young people.

Anthropometry and non-participation questionnaire

This questionnaire was used to assess participants' experiences of having their weight, height and waist circumference measured and find out why non-participants opted out of the study. Because both participants and non-participants would be filling out the form, they were anonymous. The limitation this imposed was that experiences with anthropometry were not linked to measurement results. Using the same form for all students was chosen because it reduced class disruption, as requested by schools, when conducting the questionnaires. Ideally, the questionnaire would have been part of the fieldwork day. The findings were of value, however, because feedback from students provided insight and guidance for routine anthropometry measures in the school setting with adolescents.

Catering

Although peer researchers engaged with caterers during their observation days, the direct views of catering management and staff are not represented in the results. Given their role in school food, it would be important to capture their views in future research.

Parents and family

Students outlined the strong influence parents and family have on the development of eating and physical activity behaviours. This finding is

supported by a large body of literature. Parents were asked to indicate whether they would be willing to contribute their views about school food and physical activity through focus groups at the information and consent stage of the study. There was a poor response from parents in all schools (range of 0 to 3 parents) therefore this aspect of the study was not conducted. Alternative methods to parental consultation could have been employed such as one to one interviews by phone, or a survey or questionnaire to be delivered back to the researcher via students. Another possible approach, in line with participatory methods, would have been data collection by students with their parents in the home environment. This would have been a novel method that may have yielded some contribution from parents. More time for recruitment could also have been beneficial, however given the commitment to a significant number of methods conducted in schools, this was not possible. A lack of interest from parents in school food at post-primary level has been described as a barrier to the implementation of healthy eating policies (Gilmore et al., 2008). Incorporating the views of parents as stakeholders in school food, in particular, would be an important element of future research or interventions with schools. Parents are providing their children with packed lunches and/or money to buy food at school or in the local environment. Therefore, they need to be part of any strategies to improve food choices of students.

9.8 Conclusions

This research examined the food and physical activity environments and practices in a small number of Irish post-primary schools in order to understand their influence on the behaviours of students. The study brings some novel findings to school-based research in Ireland. The use of peer visual techniques and focus groups, as well as food diaries provided new perspectives on school food. The key findings were the convenient and 'fast' culture of school food, the mirroring of external food environments within school canteens, and poor access to facilities such as fresh water, adequate dining and food storage. Findings from food diaries provide measurable evidence of how unhealthy food environments negatively impact the nutritional quality of school day lunches consumed by adolescents.

In terms of planning change for school food the following findings are highlighted from this thesis. Students placed a high value on healthy and supportive environments as part of health education which contrasted with the traditional educational role of school as viewed by teachers and principals. Changing the status quo represents a challenge, however students' views provide evidence of support for healthier environments in line with the Health Promoting Schools ethos. The influence of independent school food operators is an important finding of this study, which represents a particular challenge that must be considered when addressing school food in Ireland.

The gender bias observed in physical activity at school has been described by others, however some new findings emerged from the current study. The photos were a new method in the area of physical activity research in Irish schools. The themes generated from students' photos were novel for the Irish setting because they illustrated issues with lack of infrastructures for non-team based sports and also highlighted gender differences in students' access to facilities at school. The dominance of team-based sporting facilities visible at school indicates that the way we plan and build our schools do not provide sufficient infrastructural support for physical activity for the majority of students. Gendered access to equipment and facilities that support physical activity outside of PE contributes

an additional piece of information to our understanding of physical activity cultures within our schools.

The positive experience students had with participatory methods in this study complements their views on holistic health education. It was through their experiences with peer research that students demonstrated their agency to become involved in problem identification at local levels, which is an important outcome of the study. Another key finding from consultations with students that contributes to the literature was their positive view of anthropometry screening by health professionals or researchers.

The findings presented in this thesis strengthen the evidence base from which to call for changes to how we provide food and physical activity at post-primary schools. The results are relevant for stakeholders at multi-levels: from local school and community levels to local authority and national governmental levels.

9.9 Recommendations

9.9.1 Short to medium term recommendations

- National school food and nutrient standards are required for Irish schools as a matter of urgency. There are a number of possible stages for the development and introduction of such policies:
    a. Food marketing influences adolescents. Healthy food needs to be appealing, tasty and interesting and fit with students' budgets. Immediate action could be taken in schools to improve the promotion and sale of healthy options through product framing and marketing strategies. National resources could be developed and circulated to schools.
    b. Information and evidence showing economic models of successful healthy food for schools could be developed for food providers in post-primary schools.
    c. Incentives and penalties that encourage private food operators to comply with healthier school food should be introduced.
    d. Food and nutrition standards for schools need to be clear and non-ambiguous – i.e. extend to all foods sold in school shops, canteens, tuck shops, and vending machines; refer to cooking methods e.g. no frying; refer to specific problem foods e.g. processed meat products, refined carbohydrates, sugar-sweetened beverages, confectionery; and address specific practices e.g. weekly canteen treat days.
    e. Students should be invited to participate in all stages of the development and roll out of any school food standards.
- The value of packed lunches from home should be highlighted by the Department of Education through schools and parents councils.
- A national campaign to raise awareness should target 'out' purchased lunches, in order to generate discussion about alternatives. The campaign should also include information on the key nutritional inadequacies of school lunches (iron, calcium, Vitamin A, folate, Vitamin C, dietary fibre) and promote components of a healthy lunch.

- Individual health promotion practices in schools should be supported and recognised through rewards, awards and incentives through existing programmes and subjects like Health Promoting Schools, PE, home economics and SPHE. Initiatives that 'work' could be shared on an education online forum.
- Formal nutrition education should go beyond traditional healthy eating and physical activity recommendations and target 'problem areas' identified in this study. One possibility is to invite Irish students to challenge unhealthy eating and inactivity norms associated with adolescence through participatory methods. Transition year was identified as a good time to do this as schools require greater resources and curriculum flexibility in order for students to participate in health promotion at school.
- A range of infrastructural, social, and cultural factors require attention in Irish schools in order to support non-sporty and female students.

9.9.2 Medium to long-term recommendations

- School food should enjoy more support from governmental departments. This has the potential to improve the value placed on eating in the school environment and positively impact the nutritional intake and well-being of students.
    a. The Department of Education has a responsibility to acknowledge current demands on Irish schools to provide food. One long-term requirement would be to address the design standards for Irish post-primary schools by incorporating adequate food and dining infrastructures.
    b. Infrastructures should enable students to have some control over the food they eat at school. This would include facilities for food storage, heating and making hot drinks, for example.
    c. Home economics is a subject that should be available to all students in all schools.
- Schools require greater resources and curriculum flexibility in order for students to participate in school food.
- Similarly school physical activity should enjoy more support from governmental departments. Physical activity requires a new image in the Irish post-primary school.
    a. There is a responsibility on the Department of Education to address the challenges schools face with implementing 120 minutes per week of PE, and find viable solutions.
    b. Design standards for Irish post-primary schools should cater for and support all students to be active at school – at individual, small group and team based levels.
    c. Physical activity and physical education needs to be envisioned as part of, rather than a barrier to, academic life with greater emphasis put on their value at senior levels of school and in girls schools. New activities students are exposed to in transition year could be supported right through the senior cycle of school.
- Environmental planning needs to consider the built environment close to schools. "Healthy zones" within a certain radius of schools (e.g. 2km) should

incorporate adequate active transport (e.g. bike lanes and footpaths) and policy about healthy food infrastructures.

9.9.3 Recommendations for future research

- Develop and evaluate a transition year module with guidelines on student-led health promotion research and action suitable for use at local school levels - e.g. issue asset identification (through peer-led focus groups or photos for example), alternative visions for school food and physical activity, taking action and maintaining change. Transition year modules are usually designed to be completed over one school term and weekly classes are allocated. Schools have access to and choose from various modules that are shared nationally through the transition year co-ordinator network. Through research, this approach could be piloted, evaluated, and if successful, offered to the network for schools to access.
- Conduct a study examining the feasibility of formalising existing, ad-hoc health promotion practices in post-primary schools so they could contribute to an 'interim' health promoting schools award, even if they schools had not yet fully worked through the health promoting schools process.
- Conduct a study examining knowledge deficiencies amongst adolescents in view of poor dietary behaviours and gender differences observed in the current study. This research should focus specifically on the nutritional quality of commonly purchased foods and beverages.
- This cross-sectional study was not designed or powered to quantitatively assess the full impact of school food and physical activity practices on students. Longitudinal studies with a greater number of schools, collecting similar measures to the current study, but perhaps quantifying school environment variables, would be useful in terms of determining the impact over time of school environments and practices, on students' overweight and obesity levels, fitness, dietary and physical activity behaviours.
- Additional research is required into the diet and physical activity behaviours of students from low socio-economic backgrounds at school.
- A peer-led focus group study on physical activity with participants split into sporty and non-sporty groups was recommended by peer researchers. Recruitment could be conducted using close peer networks.
- Body image in the school setting was not fully explored in the current study. Future research could explore how body image issues impact eating and

physical activity behaviours during the school day. Linked with this is the topic of mental health, and how it interacts with diet and physical activity behaviours.

- A study to validate the 6-minute run through laboratory measurement of VO_2max with adolescent boys of mixed fitness abilities.
- The inclusion of a feedback and referral support system for adolescents identified as overweight or obese in national anthropometric surveys. Participants could be consulted at various stages to obtain their experience of receiving feedback, finding support, and subsequent outcomes.
- An ecological study exploring the barriers and facilitators of cycling and active transport cultures in post-primary schools would be valuable for the Irish context.

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11 Appendices

A. Appendix A: Student information letter

Dear Student

Dublin City University (DCU) is carrying out a study with transition year (TY) students from certain schools in Dublin and Roscommon. Your school has agreed to take part.

We want to find out about the things that affect the choices of young people around food, exercise and lifestyle. In particular, we would like to hear what you think about making food, exercise and lifestyle decisions. By taking part, you will have the chance to be involved in conducting the research as well as contribute valuable information on an important issue.

The research is completely confidential and anonymous. No information that identifies any student will ever be shared or published.

There are lots of parts to the research study in your school. Below are some of the ways you can become involved. More information can be found on the letter to your parents/guardians.

Volunteer to be a peer researcher to either carry out a focus group (small group discussion) with another 8 TY students or do an observation of the school food and exercise facilities. You will be trained by Sarah Browne.
Volunteer to be part of a focus group to share your views in an informal discussion with a group of students

We would like all TYs to get involved in these parts:
Keep a food and activity diary for 4 days
Have your weight, height and waist circumference measured by a trained researcher in private and fill out a short maturity stage form in private
Take part in a short fitness test at school
Take part in a lifestyle survey later in the year

We would like all transition year students to think about getting involved in as many parts of the study as possible. Even if you agree to take part now, you are free to pull out at any time. Students who finish their parts of the study will be entered into a draw to win one of two tablet computers.

B. Appendix B: Parent information letter with consent & assent forms

10th December 2012

Dear Parent/ Guardian

The School of Nursing & Human Sciences at Dublin City University (DCU) is carrying out a study looking at the things that influence the knowledge, attitude and behaviours of teenagers about food, exercise and lifestyle. The School of Nursing and Human Sciences at DCU is funding the study. Your school has kindly agreed to get involved in this research. It will start in January 2013.

We are interested in hearing the opinions of young people aged 15-17 years of age. We would also like to hear views of families and teachers on teenagers' choices about food and exercise. We're hoping this will help us to understand relationships between food, exercise and health in young people.

This study is being carried out among transition year students in a number of schools in Dublin and Roscommon. By taking part, students, teachers and parents will have the opportunity to contribute valuable information about important issues that might help to improve health promotion strategies for young people.

There are 2 parts to the research study in your school. Most of the information will be gathered in the first part and this will help to design a survey for the second part.

All transition year students who agree to take part will complete the following:
Keep a food, drink and activity diary for 4 days
Have their weight, height and waist circumference measured in private by trained researchers.
Self-report their maturity or pubertal stage in a short questionnaire in private in order to correctly interpret body weight measurements and fitness levels
Undergo a short fitness test at school with trained researchers
Complete a lifestyle survey later in the year

We think that students can gather very valuable information by doing their own research. We will ask transition year students in each school to volunteer to be researchers
We will train 2 students to lead a focus group (a small group discussion with 8 TY students) and another 4 students to take notes about food and exercise facilities on the school grounds. All training and supervision will be carried out by myself, Sarah Browne – a PhD student at DCU.

We will also listen to the opinions of parents and teachers through focus groups with the researcher.

Please note that students who complete their part in the study will be entered into a draw to win one of two tablet computers.

I would be grateful for your son/daughter's assistance in this research. Any student who agrees to be involved can pull out at any time. If you have any questions please contact me [Sarah Browne, Tel: 017005018 or Email: sarah.browne26@mail.dcu.ie]

The research will be confidential. No identifying information about any participants will ever be shared or published. Audio recordings of the focus group discussions and any survey sheets will be destroyed as soon as the research is finished.
Ethical approval for the research has been granted by the Research Ethics Committee at DCU. We are committed to protecting young people involved in our research. Confidentiality cannot be promised with regard to information disclosed that indicates a students' safety or welfare is at risk from peers, teachers, family or other source.

If you have any questions or concerns about this study and wish to contact an independent person, please contact:
Fiona Brennan, Secretary, Dublin City University Research Ethics Committee, c/o Office of the Vice-President for Research, Dublin City University, Dublin 9. Tel 01-7008000

If you are willing to allow your son/ daughter to take part in this research or aspects of this research, please tick the appropriate boxes and sign the attached form and return it to the school.

Yours truly,

_____

Sarah Browne
PhD Research Postgraduate

C. Appendix C(a): Parent / Guardian consent

PARENT / GUARDIAN CONSENT FORM
This form is to be completed by parent/guardian to give consent for their son/daughter to take part in the research study with The School of Nursing & Human Sciences at DCU. Your son or daughter can take part in all, some or none of the research.
I give consent for my son/daughter to take part in the following areas of the research study (please tick where agreed)

- ☐ Attend training to be a peer researcher:
- ☐ To lead a focus group (small group discussion)
- ☐ Take notes about food and exercise facilities at school
- ☐ Take part in a focus group discussion led by 2 trained transition year students
- ☐ Keep a 4-day food, drink & activity diary to submit to the researcher
- ☐ Have weight, height and waist circumference measured in private
- ☐ Self-report their maturity/pubertal stage in a questionnaire in private
- ☐ Complete a short fitness test on school grounds with trained researchers
- ☐ Complete an anonymous lifestyle survey questionnaire
- ☐ Be entered into a draw to win one of two tablet computers

If you are interested in sharing your views on this topic as a parent/family please tick the following:

- ☐ I / we are willing to take part in the following areas of the research study:
- ☐ Take part in a focus group with other parents
- ☐ Take part in a family focus group

Name of school _____ Class _____

Name of daughter / son_____ Date of Birth _____

Name of parent(s)/guardian(s)_____

Home Address _____

Home contact number for parent(s)/guardian(s) _____

Mobile contact number for parent(s)/guardian(s) _____

Signed parent(s) / guardian(s) _____Date_____

Appendix C(b): Student Assent Form

TO BE COMPLETED BY THE STUDENT

Participant – please complete the following (Circle Yes or No for each question)

I have read the information letter (or had it read to me)	Yes	/	No
I understand the information provided	Yes	/	No
I have had an opportunity to ask questions and discuss this study	Yes	/	No
I have received satisfactory answers to all my questions	Yes	/	No

I agree to become involved as a participant of this study. I understand that I may withdraw from the research at any time. I agree to abide by the confidentiality arrangements for this research and to treat all participants with dignity and respect.

Name _____

Signed _____

Date_____

D. Appendix D: School Environment Observation tool – FOOD

SCHOOL ENVIRONMENT OBSERVATION TOOL
For use by groups of 2 trained researchers from Transition Year over 1 school day

The form is meant to be filled in at the time you are observing an activity – e.g. observing students at the shop at break time (Q 9) should be done at break time, the time it's happening. In some cases you can fill in certain questions in advance – for example what's on offer in the shop (Q7). Record each photo you take, as you take it, so the researcher knows what they are later on. There is a place to record them at the back of this form.

Remember that this is a view of the school from your perspective. If you notice something interesting that isn't asked on the form, take a note of it, and a photo if appropriate. It can be discussed with the researcher when you're finished.

Where do you see students eat and drink before or during school hours?

Meal	Time	Location (s)
Breakfast		
Snacks Morning break		
Lunch		
Snacks Afternoon		

Activity 1: Take pictures of the places students eat before school, at break / lunchtimes (no people in the photo)

Describe the different places where students eat their breakfast, breaks or lunch: What do you see? E.g. what's around the room, hall? Where do students sit?

_____
_____
_____
_____
_____
_____

Are there seats & tables in the areas where students eat?
Yes / No

Are the places where students eat comfortable? Yes / No
Why / Why not? (please give reasons for your answer)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Are the places where students eat clean? Yes / No
Please give reasons for your answer:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Is there a shop at 1st or small break time? Yes No

Describe the shop at break time. What do you see? E.g. Where is it? How is it laid out?

_____
_____
_____
_____

If Yes, what does it sell? (fill in box)

Item in Shop at break time (Food or Drink)	Price	Item in Shop at break time (Food or Drink)	Price

What are the top 3 selling items in the shop at break time?
(Talk to the shop manager or student in charge before or after break time.)

_____
_____
_____

Activity 2: Take pictures of the top selling items in the shop at breaktime

Activity 3: Take a picture of the front of the shop front just before break time, during break time and after break time (no student faces in the picture)

What do you see students buying most from the shop at 1st or small break time today? (your own observations when the shop is open)

_____
_____
_____

Is there a school canteen or shop at lunch time? Yes No

Describe the school canteen or shop at lunch time. What do you see? E.g. Where is it? How is it laid out?

_____
_____
_____
_____
_____
_____

What can you buy there?

Item in school canteen or shop at lunch time (Food or Drink)	Price
If it's the same as little break time tick here If there's extra food at lunchtime – write them in the space below	☐

What are the top 3 selling items in the canteen or shop at lunch time? (Ask the canteen manager or student in charge. Take pictures of the products)

_____
_____
_____

Activity 4: Take pictures of the top selling items from the canteen or shop at lunch time.

Activity 5: Take a picture of the front of the canteen front before lunch, during lunch and after lunch (without student faces)

What do you see students buying most from the shop/canteen at lunch time today? (your own observations when the shop is open for lunch)

_____
_____
_____

Are students allowed to leave the school premises at break or lunch times?

Yes No

If yes, what year groups are allowed to leave?

_____

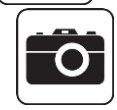
Where do most students go if they leave school at break or lunch times
How long does it take you to walk there? What route do you take?

Places off school ground that students go at lunchtime	Roughly, how long does it take to walk there? Describe the route you would take

What are the top three items students buy off the school grounds at lunch time? (ask students in your year and observe in locations at lunchtime. Take pictures if you can)

1_____
2_____
3_____

Activity 6: Take pictures of the front of the locations students go outside of school to purchase food (without students in photo)



Activity 7: Take pictures of popular food / drink items students buy when they leave the school grounds at lunchtime.

Are there vending machines in the school? Yes No

If yes, describe the vending machine(s). What do you see? E.g. Where are they?

_____
_____
_____
_____
_____
_____

If yes, where are they and what do they sell? (please fill out in box)

Location of Vending Machine	What's available?	Price of each item	Times allowed to use vending machine

Observe the vending machine during break or lunch times.
What do you see students buying most of today?
1_____
2_____
3_____

Are there any school rules about students using the vending machine?

Activity 8: Take photos of all vending machine(s) in the school (no students in photo)

Do you notice any food or drink brands, logos or colours around the school grounds or on school equipment Yes / No

Describe what you see. E.g. What kind of brands are displayed? And where?

_____
_____
_____
_____
_____
_____

Activity 9: Take photos of any food or drink brands, logos or colours you notice on the school grounds or on school equipment

Do any students bring their lunch from home to school?
☐ Nobody ☐ Not many ☐ Some ☐ Lots ☐ Everybody

What sort of things do you see students bring for lunch from home?

1_____
2_____
3_____

Are there any facilities for students to store or heat food?

Fridge Yes / No
Microwave Yes / No
Toaster Yes / No
Kettle Yes / No
Other Yes / No

_____
(please specify)

How many students are using these facilities (approximately)?

Time of day	How many students
Breaktime	
Lunchtime	

Any other times	

Activity 10: Take a photo of all student food preparation or heating facilities in school

Are there places for students to get free drinks (e.g. water)?

Yes / No

If yes, Where are they located?

_____
_____
_____
_____

Activity 11: Take photo (s) of all the places students can access free drinks at school

Activity 12: If possible, photocopy a map of the school layout and mark on it important places to do with food / drink. For example, where the water fountain is located or where the school shop / canteen is. (Ask in the office)

Extra Notes or Observations:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Questions for the student researchers:
These questions are for you to answer on your own, without consulting other students or teachers. 'Healthier' refers to anything to do with health, not just food or exercise.

Have you ever been asked about your opinion on making the school a healthier place to be? Yes No
If Yes, describe how you were asked and what your response was

_____
_____

Describe any ways that you know about where the school is trying to be a healthier place for students:

_____
_____

Describe any activities that the school principal and teachers discourage students from doing because it is not healthy:

_____
_____

Describe any ways in which students (from any years) are involved in making the school a healthier place:

_____
_____

Are you aware of a group (e.g. teachers, students, parents) that meet to discuss ways that the school could be healthier?
Yes No

If Yes, describe what you know about this:

_____
_____

Each time you take a photo, describe the photo you've just taken:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____

E. Appendix E: School Environment Observation tool – PHYSICAL ACTIVITY

SCHOOL ENVIRONMENT OBSERVATION TOOL

For use by trained researchers from Transition Year over 1 school day.

The form is meant to be filled in at the time you are observing an activity – e.g. observing students in school yard at break time (Q 7) should be done at break time while you're observing what's happening. In some cases you can fill in certain questions in advance – for example sports on offer at school (Q3). Record each photo you take, as you take it, so the researcher knows what they are later on. There is a place to record them at the back of this form.

Remember that this is a view of the school from your perspective. If you notice something interesting that isn't asked on the form, take a note of it, and a photo if appropriate. It can be discussed with the researcher when you're finished.

Sports Facilities
What sports facilities does your school have and who's using them?

Sports facility (e.g. gym, pitch, dance studio)	Location	Is it available for students to use during breaktime or lunchtime or outside school hours? Please tick each time facility is available for students to use	How many students are using the facilities at different times today? (not including PE class)
		☐before school ☐breaktimes ☐lunchtimes ☐After school ☐Other times _____ (please specify)	
		☐before school ☐breaktimes ☐lunchtimes ☐After school ☐Other times _____ (please specify)	

Activity 1: Take a photo of each school sports facility that you listed in the table (no students in photo)
Questions 2 & 3 – visit one class per year on the day of the observation. Explain that you are carrying out an observation of the school physical activity facilities and wish to ask them 2 questions.

How many classes a week does each year spend in PE? (ask students from each year to tell you how many PE classes they have each week and some of the common activities they do in those classes)

Year	PE classes per week	Activities in PE class (if known)
1st Year		
2nd Year		
3rd Year		
4th Year		
5th Year		
6th Year		

How do students travel to school? (count show of hands after asking the following question: What was the main form of transport you used to get to school this morning? Walk / Bike / Car / Bus / Other?)

Year	Walk	Bike	Car	Bus	Other
1st Year					
2nd Year					
3rd Year					
4th Year					
5th Year					
6th Year					

What school sports are available for students to take part in?
When do they take place? (please fill in table)

Sport	Training times & number of times a week	Location	Trainer	Number of students taking part (ask trainer or coach)

How long does your school take for break and lunch during the school day?

1st Break

10min
15min
20min
Other _____ (please specify)
Lunch

30min
35min
40min
Other _____ (please specify)

Do any students go out to the school yard during 1st break?
Yes No

Describe the areas where students go to outside during break times. What do you see? E.g. where are students standing, sitting, socialising?

_____
_____
_____
_____
_____
_____

Activity 2: Take a photo of the school yard (s)
(No student faces in photo)

Activity 3: Take a photo of the activities students do at break times
(Distant photo with no student faces)

If students go out to the school yard what activites do they take part in (please specify the activities)?

_____
_____
_____
_____

Do students go out to the school yard during lunch time?
Yes No

If students go out to the school yard at lunch what activities do they take part in (please specify activities that you see)?

_____
_____
_____
_____

Do students take any equipment out to the school yard at break periods (e.g footballs)?
Yes No

If Yes, please specify what equipment

_____
_____
_____

Do you notice any food or drink brands, logos or colours around the school grounds or on school equipment? (other than brands of food / drinks)
Yes / No

Describe what you see. E.g. What kind of brands are displayed? And where?

_____
_____
_____
_____
_____
_____

Activity 4: Take photos of any food or drink brands, logos or colours you notice on the school grounds or on school equipment. List the places of the photos you took.

Extra Notes or Observations:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Questions for the student researchers:
These questions are for you to answer on your own, without consulting other students or teachers.

Have you ever been asked about your opinion on making the school a healthier place to be? Yes No
If Yes, describe how you were asked and what your response was
_____
_____

Describe any ways that you know about where the school is trying to be a healthier place for students:
_____
_____

Describe any activities that the school principal and teachers discourage students from doing because it is not healthy:
_____
_____
Describe any ways in which students (from any years) are involved in making the school a healthier place:
_____
_____

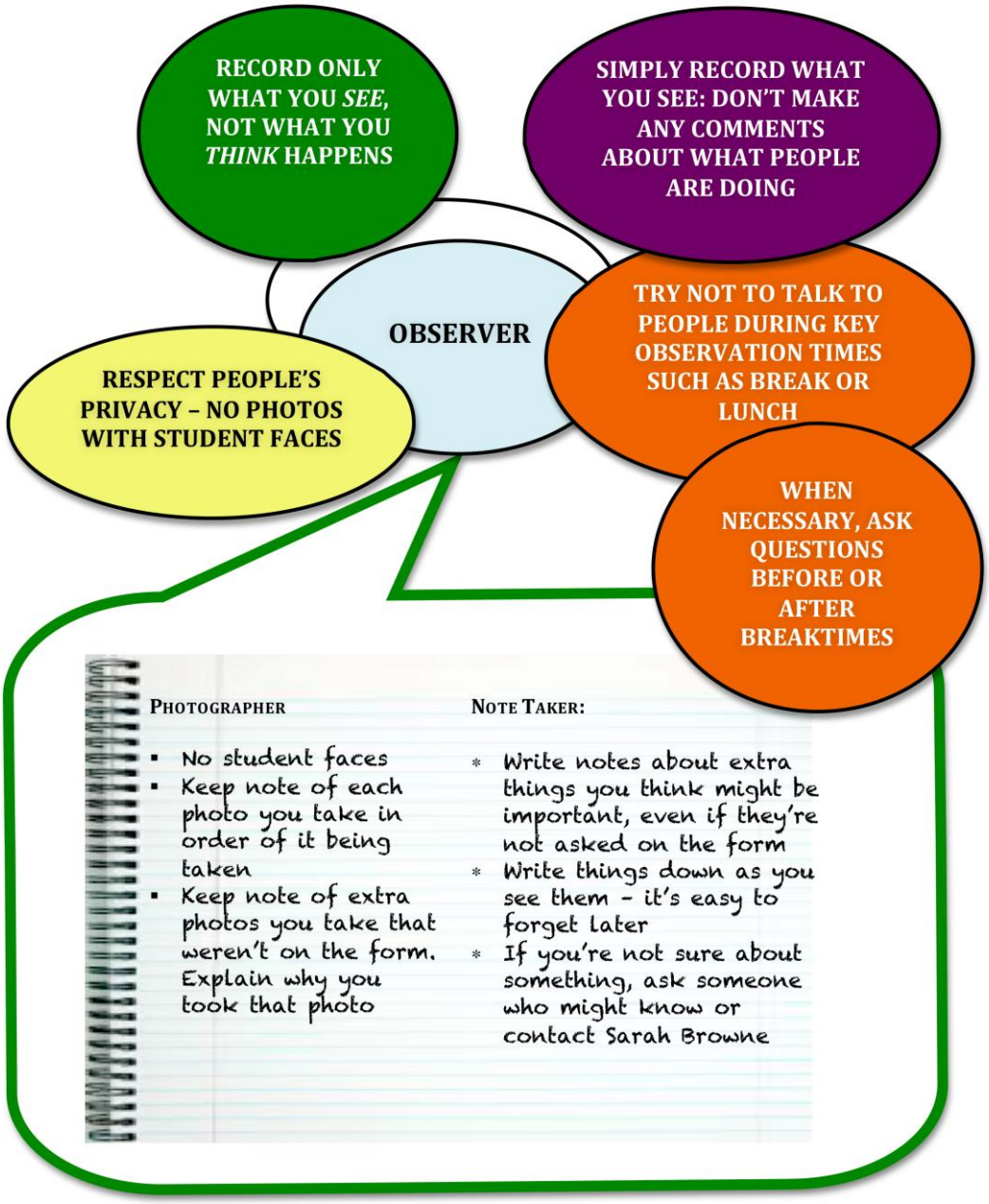
Are you aware of a group (e.g. teachers, students, parents) that meet to discuss ways that the school could be healthier?
Yes No

If Yes, describe what you know about this:
_____
_____

Describe each photo taken in the order that you take them:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____

F. APPENDIX F: Peer-led Observation training material



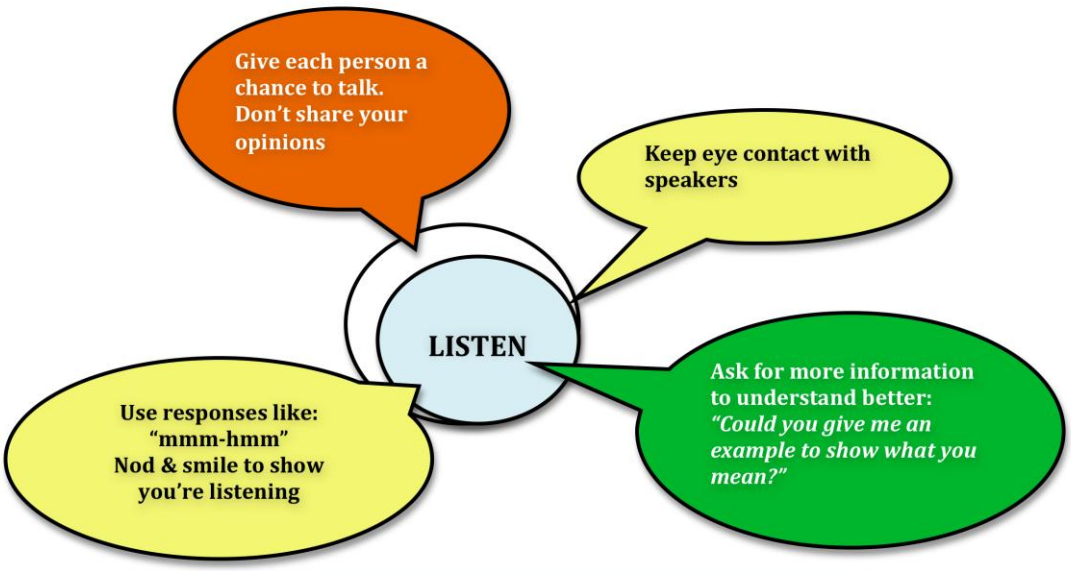
G. APPENDIX G: Focus group training protocol for peer researchers

Format of Training:

Participants come to training room

1. Everybody helps to set up room like a focus group – chairs in circle with small table or stool in centre for recorder
2. SB introduces the session:
    a. Turns on the recorder and explains why we record FG
    b. Thank you for coming today to be part of this FG. The purpose is to train you how to become focus group moderators. So for the next 2.5 hours you will learn information about how to run a focus group. Two people are needed for a focus group – 1 moderator and 1 assistant. I am training more people than we need today so that more people can gain this experience. We will decide together who will run the FG in your school together at the end of the session today. Please turn off your phones…….. Confidential
    c. Ask a question that everyone answer: just before we get started. please say their name and one thing they like about transition year so far (consciously left intros until 5-10 minutes into training to demonstrate method and relax participants)
3. Ask participants to ask their Qs about FG*
4. Composed some agreements together & put up on wall
    a. No judging people's opinion
    b. Everything you hear is confidential
    c. When someone's talking, don't butt in
    d. Let everyone have time to talk – don't have loads of people talking at the same time
    e. Turn off mobile phones
    f. Take it seriously
    g. Asked someone to read through agreements as would in the FG
5. Discussed setting up the room – meeting beforehand
6. Run through the training material
7. Take break
8. List all equipment needed to run the FG (work in pairs)
9. Asked participants to read through questions and mark any not sure about (didn't have any issues)
10. Reassured that they will do a great job and they are best to know what to say to people your own age.
11. Run the focus group – ask participants to ask alternate questions, got discussion going with the rest and I interrupted when there was examples of prompting that could be used or ways to enhance the discussion
12. Decided who would take roles

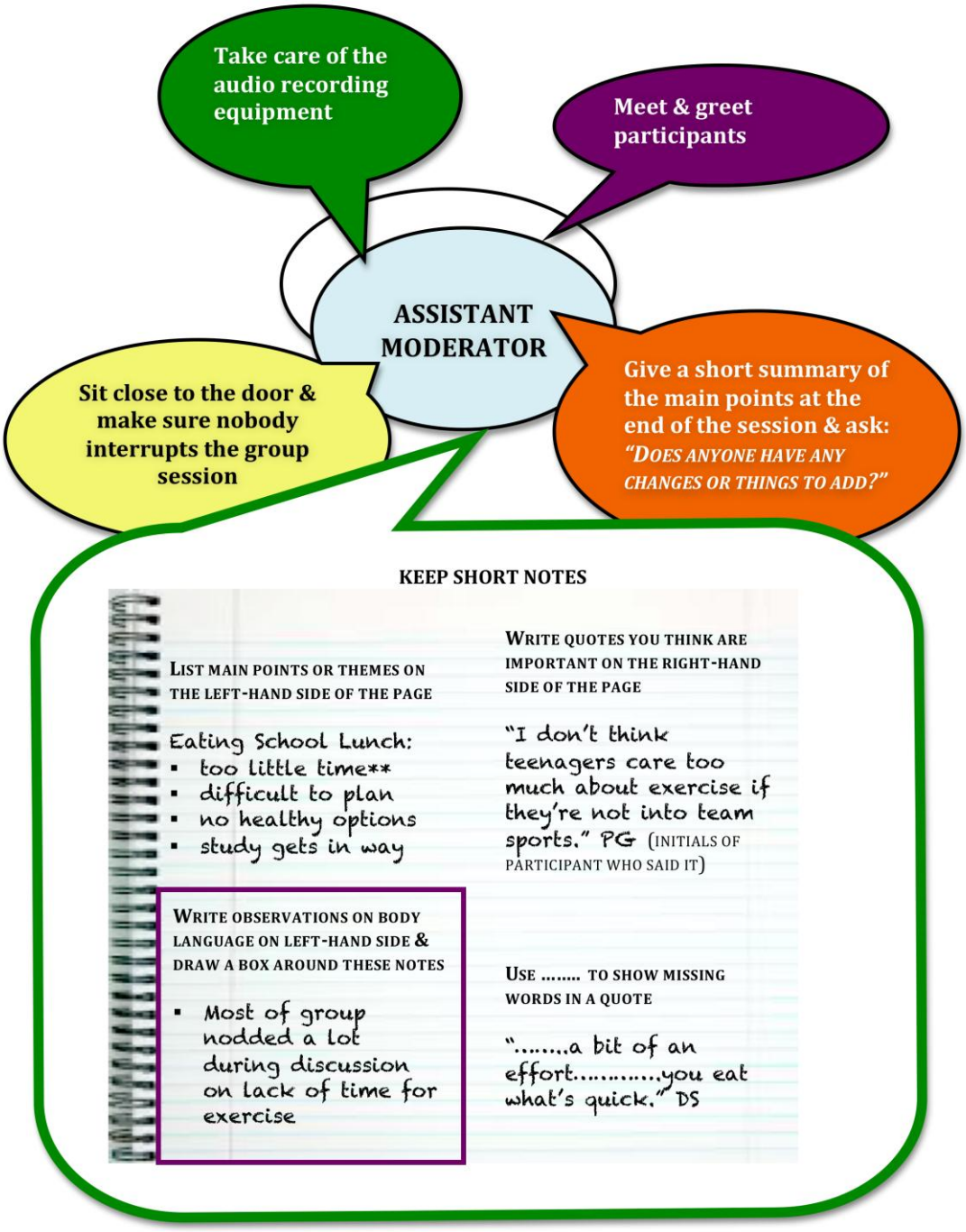
H. APPENDIX H: Focus group training material for students



A FOCUS GROUP IS ALL ABOUT DISCUSSION & INTERACTION BETWEEN GROUP MEMBERS. THESE TIPS CAN HELP THIS HAPPEN

- Ask questions that encourage people to talk about things rather than just saying 'yes' or 'no' – for example, "What do you think about…….?"
- Pause for 7 seconds after asking a question
- Be interested but don't show favourtism to any participant
- Ask for different opinions before moving on – "Does anyone see it differently?"
- Make eye contact with shy people to encourage them to talk
- Don't let one or two people do all the talking – try saying:
  - "I'd like to get someone else to answer this question too…." ***or***
  - "Sorry to interrupt, but I know other people would like to answer this too and I want to make sure we have enough time."
- Refer to the group agreements if you need to, for example:
  - "Please remember our agreements at the start and don't interrupt one another."

APPENDIX H: Focus group training material for students



I. APPENDIX I: Questions for student-led focus groups

1. What does health or being healthy mean to you?
2. What makes you feel healthy?
3. What do you think healthy eating means?
4. What sort of foods make up a healthy diet?
5. What makes it easy to eat healthy foods?
6. What are the hardest healthy foods to eat and why?
7. What would make it easier for teenagers to eat healthy foods?
8. How do you find out what you know about healthy foods?
9. What foods do you like the taste of and why?
10. What foods do you not like the taste of and why?
11. How do people our age make their own choices about what they eat?
12. When do you make your own choices about what you want to eat?
13. Are there differences in how teenagers eat at home, to school or other places?
    a. In what way?
14. If you're not at home, where else would you often eat?
15. Do you ever eat with your friends – where and when?
16. Do you ever skip meals?
    a. What would be the main meals you'd skip and why?
17. Do you think what you eat has changed over the last few years?
    a. If Yes: In what kind of ways?
    b. Why have you changed how you eat?
18. What do you think when you hear exercise or activity?
19. In what kinds of ways are people our age active?
20. How much activity or exercise do you think people our age should do?
    a. How do you know this information?
21. What makes it easy to be active?
22. What gets in the way of being active?
23. What would make it easier for people our age to be active or exercise?
24. Do you still take part in hobbies or activities you did in primary school?
    a. If yes: What makes you keep doing them?
    b. If No: Why do you not do them anymore? When did you stop doing them?

25. Where do you get information about food and fitness?

(or: If you were looking for information about food & exercise, where would you go?)

[brainstorm, where the assistant moderator writes the responses up on a flip chart / board]

    a. If you had to rank them in order of importance, what would be the most important source of information for teenagers……..and the next…….. and why?
26. Who would you trust the most to give you information about food and fitness?

One of the reasons the researchers are doing this study is because levels of overweight & obesity are increasing among young people – 25% of teenagers in Ireland are overweight or obese. What do you think about this?
Now we'll summarise some of the important points that were discussed
[assistant moderator will give brief summary of responses to main topics]
Do you have any changes to that or things to add?

Focus group questions developed by students at School E

a. Is what you eat important to you? Why or why not?
b. Are you conscious of what you eat?
c. What influences you to eat what you eat?
d. What kinds of foods do you eat at home, school or away from home?
e. What do you think of the food available in the school?
f. What do you think about price of food in school?
g. Do you bring a packed lunch & how do you choose?
h. What do prefer to do?
i. What do you usually drink during the day?
j. Would you ever eat with your friends outside of school, if so what and where?
k. Do you ever read food labels for info & if so what do you look for?
l. Do you think teenagers ever go on a diet?
m. Is exercise important to you?
n. Why keep fit?
o. In what ways are you active?
p. What influences you to be active ?
q. How do you feel about activities in school?
r. What would discourage you from taking part in exercise or sport activities?
s. Any activities you prefer doing to exercise?
t. What sports facilities are available in your area and what are they like?
u. When do you get more exercise – with team or friends?
v. Drinking water – is it important?
w. Does sleep affect the way you eat?
x. How do you feel about growing obesity rates among young people in Ireland
y. Does media play a role?
z. How could we change food in schoool?

J. APPENDIX J: Peer researcher evaluation questionnaire

Questions 1 & 2 for focus group peer researchers only
Do you think the small focus groups with students worked? Yes / No
Please give a reason for your answer

_____
_____
_____

Do you think the information coming from this discussion is true-to-life and gives a realistic picture of how teenagers really think and feel? Yes / No
Please give a reason for your answer:

_____
_____

How did you find the training to be a peer researcher?

_____
_____

How confident did you feel about putting what you learned into practice?

_____
_____

What have been the advantages for you being a peer researcher?

_____
_____

What have been the disadvantages for you being a peer researcher?

_____
_____

Do you think you missed any important information about teenagers attitudes and behaviours to diet, exercise and health?

_____
_____

If you were involved again what would you change?

_____
_____

Did you enjoy being a peer researcher? Yes / No
What did you enjoy about it?

_____
_____

What did you not enjoy about it?

_____
_____

K. APPENDIX K: Information & consent form for teachers

INFORMATION FOR TEACHER FOCUS GROUP

The teacher focus group is a group discussion led by researcher and DCU PhD research student, Sarah Browne. The following topics will be discussed within the group:
Food and exercise habits of students in the school environment
Knowledge, attitudes & behaviour towards food / diet and physical activity
Weight
Factors that influence the food choices of children and teenagers
For this research study we would like to know more about teachers views on food and exercise choices teenagers make.
The focus group will last approximately 40 minutes. The discussion will be recorded. Sarah Browne will listen to the audio recording and take down what has been said, typing it word for word into a written report. The audio recording will be deleted as soon as this has been done. No identifying information will be contained in the written summary of the discussion.

CONSENT FORM
TO BE COMPLETED BY PARTICIPATING TEACHERS

I have read the information letter (or had it read to me)	Yes	/	No
I understand the information provided	Yes	/	No
I have had an opportunity to ask questions	Yes	/	No
I have received satisfactory answers to all my questions	Yes	/	No
I am aware that the discussion will be audio taped	Yes	/	No

I agree to become involved as a participant of this focus group. I understand that I may stop the discussion at any time and/or withdraw from the study. I agree to abide by the confidentiality arrangements for this research.

Name _____

Signed _____
Date_____

L. APPENDIX L: Teacher focus group question guide

Teacher Focus Group questions

1. What knowledge do you think teenagers have about food and exercise with regard to their health?
2. Where do you think they get their information?
3. Do you think teenagers are interested in food and fitness?
4. For what reasons?
5. What motivates them to be interested in healthy eating or to be active/play sports?
6. In your opinion, what would make them more interested in food and fitness?
7. Do students ever ask teachers for information about diet, exercise and health?
8. What sort of things do they ask?
9. Would you ever hear students talk about dieting/weight loss?
10. How would you describe students' eating habits while in school?
11. What do you think influences their decisions about food?
12. How would you describe students' involvement in physical activities while in school?
13. What do you think influences their decisions about exercise?
14. What do you think about their fitness levels?
15. In your opinion, what sort of things trigger young people to make changes to their diet and activity levels during the school years?
16. What makes you think that?
17. Taking up / giving up sports – what are the influences?
18. What type of nutrition / exercise policies do you have in the school? How are they implemented?
19. Do you think schools can influence eating and exercise habits of teenagers? How?
20. Let's summarise the key points [give brief summary of responses to main topics] Do have have any changes or additions?
21. The goal of the study is to find out about what influences young people to make choices about their diet and exercise. Would anyone like to say anymore about this or have any further advice us?

M. APPENDIX M: Information & consent form for principals

INFORMATION FOR INTERVIEWS WITH PRINCIPALS

The interview will be conducted by researcher and DCU PhD research student, Sarah Browne. The following topics will be discussed:
How decisions are made in school with regard to health education, food provision and physical activity
Food and exercise habits of students in the school environment
For this research study we would like to know more about how principals view the role of the school in terms of food and exercise policies and practices.
The interview will last approximately 30 minutes. The discussion will be recorded. Sarah Browne will listen to the audio recording and take down what has been said, typing it word for word into a written report. The audio recording will be deleted as soon as this has been done. No identifying information will be contained in the written summary of the discussion.

CONSENT FORM
TO BE COMPLETED BY PARTICIPATING PRINCIPALS

I have read the information letter (or had it read to me)	Yes	/	No
I understand the information provided	Yes	/	No
I have had an opportunity to ask questions		Yes	/ No
I have received satisfactory answers to all my questions	Yes	/	No
I am aware that the discussion will be audio taped		Yes	/ No

I agree to become involved as a participant of this study. I understand that I may stop the discussion at any time and/or withdraw from the study. I agree to abide by the confidentiality arrangements for this research.

Name _____

Signed _____
Date_____

N. APPENDIX N: Principal interview notes and question guide

1. Where does nutrition and physical activity fit into your list of priorities for the school?
2. How does the school make decisions on what food is provided on the school grounds?
3. Have parents any involvement or expressed any interest in this area?
4. What are the budgetary issues for a school when it comes to food, physical activity?
5. What are the main barriers to health promotion in this area for the school? What changes do you think schools could be effective with?

O. APPENDIX O: Code key for the visual content analysis framework for students' photographs

School A School B School C School D School E School F	SA DC CB RC MC TC
DEIS status	DEIS NONDEIS
Gender mix of school	Male only = M Female only = F Mixed gender = MX
Urban Setting	yes=Y no= N
Rural Setting	yes=Y no= N
School size	400-600 = 1 600-800 = 2 800-1000 = 3 1000-1200 = 4
Catering facilities within school 1	yes=Y no= N
Catering facilities within school 2	yes=Y no= N
Commercial company providing school food	yes=Y no= N
Breakfast	yes=Y no= N
Mid-morning break	yes=Y no= N
Lunch break	yes=Y no= N
Student led tuck shop	yes=Y no= N
Permitted to leave school at lunch time 1st year	yes=Y no= N
Permitted to leave school at lunch time JunC	yes=Y no= N
Permitted to leave school at lunch time SenC	yes=Y no= N
Data collected by	each student
Age of informant	
Gender of informant	Male = M Female = F
Month images recorded	October = Oct November = Nov December = Dec January = Jan February = Feb

Catering facilities within school 1 – oven, deep-fat fryer, hob
Catering facilities within school 2 – microwave, sandwich toaster, fridge

Spaces

Food service area	yes=Y no= N unapplicable = U/A
Junior/senior/mixed food service area	Mixed=MX Junior=JunC

	Senior=SenC
Indoor dining spaces	yes=Y no= N unapplicable = U/A
Junior/senior/mixed indoor dining space	Mixed=MX Junior=JunC Senior=SenC
Student food storage/heat facilities	yes=Y no= N unapplicable = U/A
Junior/senior/mixed student food storage/heating facilities	Mixed=MX Junior=JunC Senior=SenC unapplicable = U/A
Students in the space indoors	small numbers of students = SN large number of students = LN
Signage image	yes=Y no= N unapplicable = U/A
Outdoor dining space	yes=Y no= N
Junior/senior/mixed outdoor dining space	Mixed=MX Junior=JunC Senior=SenC
Students in the space outdoors	small numbers of students = SN large number of students = LN

Junior/senior/mixed dining spaces – separate areas for students to eat.
JunC=1st-3rd years, SenC=4th-6th years, MX=all year groups 1st-6th year

Beverages to purchase in School

Carbonated sugar-sweetened beverages	yes=Y no= N unapplicable = U/A
Carbonated diet beverages	yes=Y no= N unapplicable = U/A
Non-carbonated sugar-sweetened beverages	yes=Y no= N un applicable = U/A
Flavoured milk based drinks	yes=Y no= N un applicable = U/A
Water bottled	yes=Y no= N un applicable = U/A
Water fountain or tap inside SB	yes=Y no= N un applicable = U/A
Water fountain or tap outside SB	yes=Y no= N un applicable = U/A

Water fountain or tap inside SB – located within the school building
Water fountain or tap outside SB – located outside the school buildling, tap usually on school walls

Food to purchase at school

Rolls / wraps	yes=Y no= N un applicable = U/A
Hot meals	yes=Y no= N un applicable = U/A
Hot food other than hot meals	yes=Y no= N un applicable = U/A
Processed meats	yes=Y no= N un applicable = U/A
Soup	yes=Y no= N un applicable = U/A
Fruit	yes=Y no= N un applicable = U/A
Vegetable or salad	yes=Y no= N un applicable = U/A
Confectionery	yes=Y no= N un applicable = U/A
Biscuits & cakes	yes=Y no= N un applicable = U/A

Savoury snacks	yes=Y no= N un applicable = U/A

Food outlets students go in local environment

Small chain convenience shop	yes=Y no= N un applicable = U/A
Independent local convenience shop	yes=Y no= N un applicable = U/A
Fast food	yes=Y no= N un applicable = U/A

Beverages to purchase in local environment

Carbonated sugar-sweetened beverages	yes=Y no= N un applicable = U/A
Carbonated diet beverages	yes=Y no= N un applicable = U/A
Non-carbonated sugar-sweetened beverages	yes=Y no= N un applicable = U/A
Flavoured milk based drinks	yes=Y no= N un applicable = U/A
Water bottled	yes=Y no= N un applicable = U/A

Foods to purchase in local environment

Rolls / wraps	yes=Y no= N un applicable = U/A
Hot meals	yes=Y no= N un applicable = U/A
Hot food other than hot meals	yes=Y no= N un applicable = U/A
Processed meats	yes=Y no= N un applicable = U/A
Soup	yes=Y no= N un applicable = U/A
Fruit	yes=Y no= N un applicable = U/A
Vegetable or salad	yes=Y no= N un applicable = U/A
Confectionery	yes=Y no= N un applicable = U/A
Biscuits & cakes	yes=Y no= N un applicable = U/A
Savoury snacks	yes=Y no= N un applicable = U/A

Savoury foods –
Rolls / wraps = all bread products filled or unfilled: bread, rolls, wraps, paninis, bagels etc.
Hot meal = food served on a plate including protein, carbohydrate and eaten with cutlery
Hot food other than hot meals = hot food other than 'hot meal' – e.g. sausage roll, hot chicken roll,
Confectionery – sweets, chocolate, cereal bars
Biscuits & cakes - biscuits, cakes, pastries, muffins
Savoury snacks – crisps, nuts, tortilla chips, popcorn
Chain convenience shops = spar, centra, etc.
Fast food = eat-in or take-away outlets for pizza, chips, chinese
Foods to purchase in local environment – establishments with 0.5km range of school
Un applicable = U/A

P. APPENDIX P: Student Evaluation of anthropometry and non-participation

Questionnaire for students at the end of study period
This section is only for students who took part in the study.
Please tick any aspects of the study you did not complete.
Give your reason(s) for not completing certain things.

☐ Did not complete food diary
Reason:_____
☐ Did not complete weight, height, waist circumference
Reason:_____
☐ Did not complete self-report maturity questionnaire
Reason:_____

☐ Did not complete fitness test
Reason:_____
If you took part, what was your experience of having your weight, height and waist circumference measured? (Please comment on your answer)

☐Positive ☐Negative ☐Neither

Comment:

_____
_____
_____
_____

This section is only for students who did not take part in the study.
Please give your reason(s) for not taking part in the study.

☐ Did not take part in any aspect of the study
Reason(s): _____
_____

Q. APPENDIX Q: VO2 max validation study results

This validation study was carried out by Dr. Davide Susta, School of Health and Human Performance, DCU and PE teacher and Cardiff University Masters student Eve McCartney. With their permission, results are presented here to provide a background to 6-minute run results from Chapter 7.

Background

VO2 max is a measure of the highest volume of oxygen the body can take in and use in 1 minute at maximum physical exertion. It is expressed as millilitres O2/minute/kilogram body weight. VO2 max is a gold standard test of an individuals cardio-respiratory fitness level and is an accurate predictor of physical performance. Regular aerobic training increases VO2 max through increased cardiac output and stroke volume, increased haemoglobin, increased glycogen stores and reduced adipose tissue. Women will have lower VO2 max than men, which is due to smaller body sizes. Age also affects VO2 max with decreasing values as age increases.

The 6-minute run is a convenient fitness test for the post-primary school environment. Equipment requirements are limited to sufficient space, lap markers and a timer. A 6-minute run (or walk) allows for a more sustained speed compared to other tests (e.g. intermittent or shuttle tests). To our knowledge it has not been validated as a measure of cardio-respiratory fitness in European adolescents.

The aim of the current study is to investigate if the reduced cooper test (distance travelled in a six-minute run) is a valid predictor of cardio-respiratory fitness in 15-17 year old adolescents.

Methods

A sample of 105 male and 196 female adolescents took part in a 6-minute run fitness test in their school gyms. A sub-sample of participants were invited to attend the School of Health and Human Performance at Dublin City University to take part in individual VO2 max tests. Participants were randomly chosen from the highest ten, middle ten and lowest ten performers from the 6-minute run scores. All girls who were invited participated in the validation study (n=10). Response from boys resulted in an under-representation of low performers compared to medium to high performers. The VO2 max tests were carried out by trained researchers in a human performance laboratory setting. Body weight and height were measured just prior to the VO2 max testing. Each participant wore a device to block the nose and a mouth piece to collect oxygen and carbon dioxide from the breath. Heart rate was monitored by a chest strap. They ran on a treadmill, and were instructed to gradually increase speed until they reached self-reported maximum physical exertion.

Results

Ten female and eleven male adolescents took part in the VO2 max testing. The average VO2 peak value for male and female participants were significantly different, therefore results are interpreted by gender separately. The average VO2 peak and associated values are presented in table P.1. The mean VO2 max for boys was above average (80th-90th percentile for age), while the mean VO2

max result for girls corresponded with the 50th-60th percentile for age (American Medical Association, 2006).

Table P.1 Mean predicted VO2 peak, heart rate and CO2:O2 values for female and male participants

	Mean VO2 peak ml/kg/min (SD)	Heart rate	CO2:O2 ratio
Female n = 10	38.4a (5.5)	187.0	1.2
Male n=11	56.5b (6.7)	189.1	1.1

a and b are significantly different ($p<0.0001$)

VO2 peak results were correlated with distance travelled (metres) from the 6-minute run scores using a Pearson correlation test. The resulting correlation coefficients were r=0.729 in females (95% CI 0.1833 to 0.9312 and p=0.0168) and r=0.731 males (95% CI 0.2332 to 0.9252 and p = 0.0106).

Conclusion

A 6-minute run test can predict oxygen consumption at 73% accuracy in medium to high performance 15-17 year old males and low, medium and high performance 15-17 year old females. Male participants represented average and above average performers, therefore mean predicted VO2max result for boys was higher than expected. This validation study should be repeated with boys of mixed fitness abilities.

The 6-minute running test has potential for a fitness test that can easily be applied in the school setting to estimate cardio-respiratory fitness. Participants keep sustained speeds for the duration of the test, which provides physiologically meaningful results in terms of maximum aerobic capacity. We recommend it as an appropriate alternative to more intense speed fitness tests for the general adolescent population.

Regression equations

Predicting VO2 max

where y=mlO2/kg/min & x=metres travelled in 6 minute run

Female: $y = 0.0182x + 19.994$

Male: $y = 0.021x + 28.508$

American Medical Association (2006) Cardiorespiratory Fitness Levels among US youth 12 to 19 year sof age: Findings from the 1999-2002 National Health and Nutrition Examination Survey. Arch Pediatr Adolesc Med. 160(10):1005-101

R. Appendix R(a): Self-report maturity questionnaire for girls

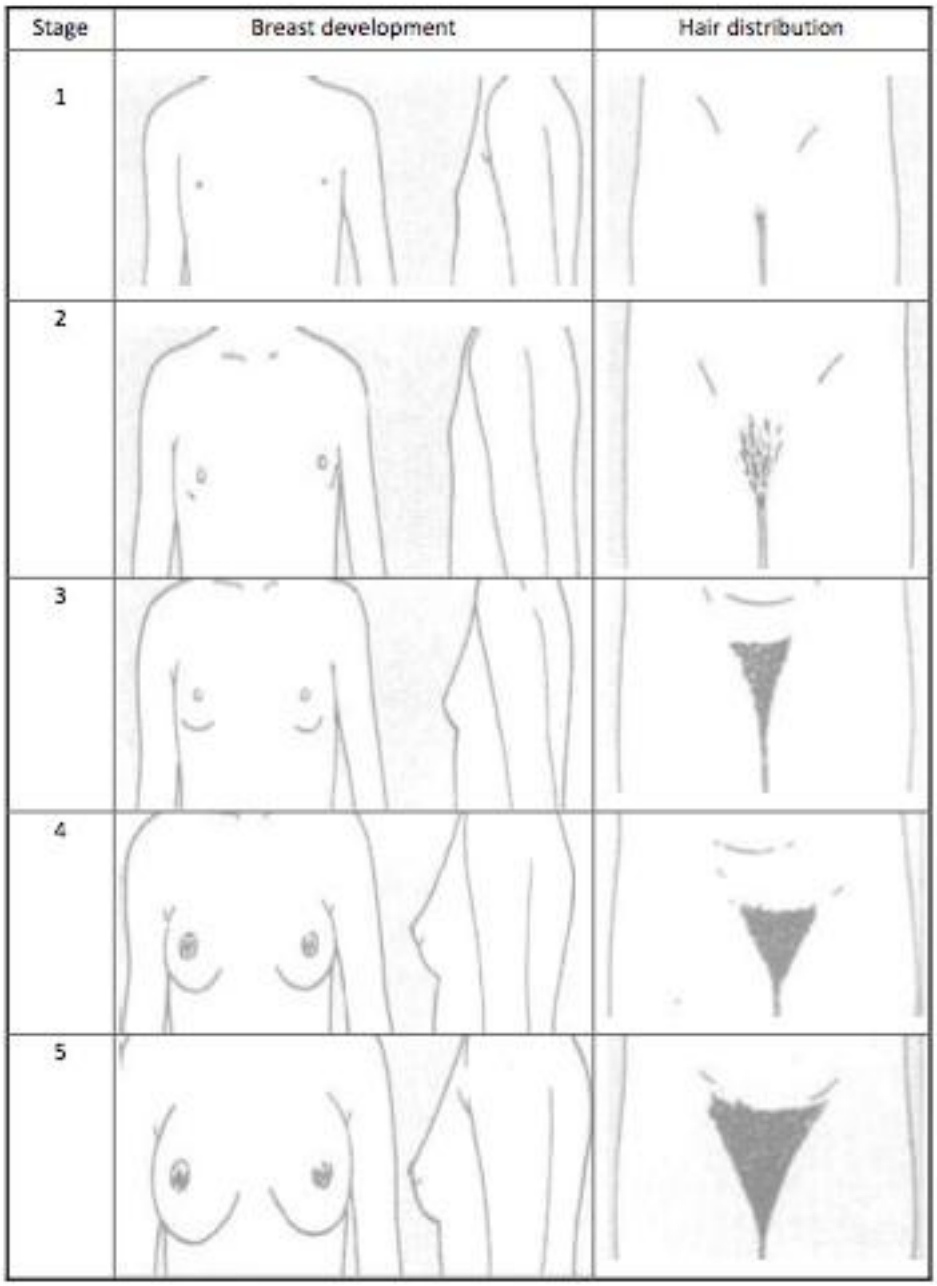
Take the picture cards out of the envelope and line them up.

Look at the pictures of the upper body and check the number of the picture that most closely resembles you.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Look at the pictures of the lower body and check the number of the picture that most closely resembles you.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____



Appendix R(b): Self-report maturity questionnaire for boys

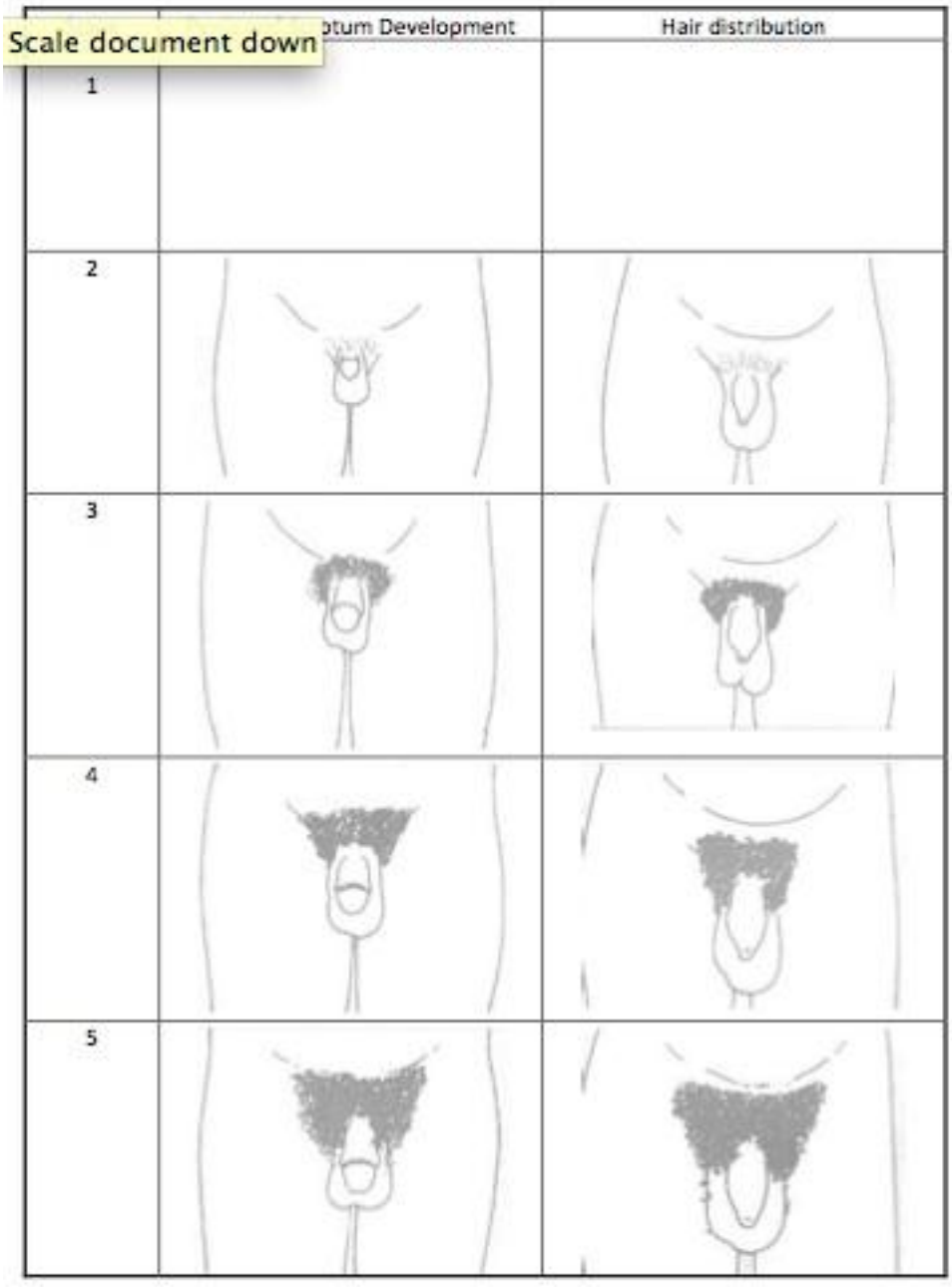
Take the picture cards out of the envelope and line them up.

Look at the pictures of the lower body and check the number of the picture that most closely resembles you.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

Look at the pictures of the lower body hair distribution and check the number of the picture that most closely resembles you.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____



S. APPENDIX S: Food and activity diary training and collection procedures

- Food Diary Training – Researcher with class (up to 20 students)
- Explain food diary and commitment involved
- Fill out page 1 (personal details, name, DOB, address, student assent signature) & remove from diary – researcher keeps
- Students checks ID code on every page of the diary
- Ask students to write out their own 24-hr recall.
- Read through the food diary instructions. Point out guide to quantify portions on page 9
- Discuss options for quantifying portions:
- small bowls, cups, spoons etc – Household measures
- Manufacturer info – e.g. ½ packet sweets – give total from packet, 1 bar and identify, brand
- Small, medium, large – e.g. potato, apple, roll, slice bread
- Take picture if not sure & show it to Sarah later – e.g. dinner, portion chips, take-away roll or sandwich
- Type – e.g. brown bread & brand, white wrap & size
- Students transcribe 24-hr recall into the 'practice' page on the food diary. Sarah checks in with each student during exercise to make sure they feel confident with filling in.
- Explain how to record physical activity
- Practice one physical activity day on the practice sheet

Food Diary Collection Protocol:

- Meet students in groups of eight at the end of the 4-day food diary (1-2 days after complete)
- Each student takes a copy of the photographic food atlas and further quantifies their portions using this guide. They write photograph codes beside portion sizes on their diaries
- Check each diary, asking questions about missing or inconsistent entries. Take brief notes on the diary accuracy, sign and take the diary from student.

T. APPENDIX T: Food Group Descriptions

Food Group	**Description**
Breakfast cereals refined	All ready-to-eat low-fibre, medium to high sugar (e.g. Cornflakes)
Breakfast cereals wholegrain	All ready-to-eat high fibre, low to medium sugar (e.g. bran flakes) and prepared (e.g. porridge) breakfast cereals
Biscuits & cakes	Biscuits, savoury and sweet and cakes, buns and pastries
Butter & spreads	Butter and fat spreads, including low fat spreads
Cheese	All cheeses
Chips	Chips and processed potato products (e.g. potato wedges)
Confectionery	All confectionery, including sweets and chocolate
Desserts	All desserts, including ice-cream, puddings & chilled desserts and milk puddings
Eggs	All eggs and egg products
Fish	White, oily and shellfish
Fruit	Whole fruit, tinned fruit,
Fruit juice	100% fruit juice, fresh or from concentrate
High-calorie beverages	Includes carbonated beverages, squashes and cordials
Low-calorie beverages	Includes diet carbonated beverages, tea, coffee
Low-fat milk	Low-fat milk
Meat products	Includes burgers, sausages, meat pies and other processed meats (e.g. breaded chicken)
Potatoes	All potatoes, not including processed potato products
Poultry dishes	All poultry dishes
Poultry	All fresh, unprocessed poultry
Red meat	All fresh red meat, including beef, pork and lamb
Red meat dishes	All red meat dishes
Rice & pasta	Rice and pasta, flour, grain and starches
Sauces & condiments	All sauces, including table sauces, cooking sauces, salad dressings
Savouries	Includes pizza, quiche and mixed pasta dishes
Savoury snacks	Includes potato-, corn-, starch-based snacks and nuts
Soups	All soups, ready-to-eat and dehydrated
Sugar & preserves	Includes granulated sugar, honey and preserves
Vegetables inc. Pulses	All vegetables, including fresh and processed
White bread & rolls	All white bread, wraps, paninis and rolls
Wholemeal bread & rolls	All wholemeal bread and rolls

U. Appendix U: Food & Activity Diary Template

Appendix U **Food & Activity Diary Template**

ID Number:

4 DAY FOOD, DRINK & ACTIVITY DIARY

If you have any questions about this diary please call
Sarah Browne on: 0879439446 or email: sarah.browne26@mail.dcu.ie

In this study we are exploring what teenagers eat and drink. We would really appreciate if you would keep a record in this diary of everything you eat and drink for 4 days; 2 days will be school days and 2 will be at the weekend.

ID Number:

First we have a few questions. Please tick in the box or write in the spaces where you are asked to describe something. You may need to ask someone else at home for information about bread/fats/milk.

1. How many days a week do you **usually** eat breakfast

Rarely or never	☐
1 – 2	☐
3 – 4	☐
5 or more	☐

2. On schooldays during lunch break do you **generally**; *(tick the one you do most often)*

eat the lunch served in the school canteen	☐
eat a packed lunch brought from home	☐
buy something from a school vending machine	☐
go out of school to buy something	☐

Other, please describe……

3. **For your main meal in the evening can you tell us (using the table below) how many times during the week you usually**

   a) eat out in a restaurant or café. This includes fast food restaurants such as McDonalds, KFC etc

   b) eat a meal at home where the **main item** was picked up or ordered from a take-away

   c) eat a meal at home where the **main item** was bought ready made from a shop and only needs to be reheated. E.g. a ready meal like ready-made lasagne or curry and rice.

   d) eat a meal at home where the **main item** was prepared from ingredients; this would include heating up different parts of a meal and combining them. E.g. pasta and sauce or baked potato and beans

	a) restaurant or cafe	b) take-away	c) main item a ready meal	d) main item prepared from ingredients
Rarely or never				
1-2 times per month				
1 – 2 times per week				
3 – 4 times per week				
5 or more times per week				

ID Number:

4. If you are thirsty between meals what do you **usually** drink?

Sweetened drinks (coke, pepsi, sprite, fanta, Capri sun, squash)	
Sugar free or diet drinks (diet coke, sprite zero, sugar free squash)	
Milk or milky drinks (milk shake, hot chocolate)	
Water (tap, bottled, still or sparkling)	
Unsweetened (pure) fruit juice	
Hot drinks (tea, coffee, etc.)	
Smoothie (e.g. Zest smoothies, shop bought or homemade)	

Other, please describe……

5. What type of milk/milk substitute do you **usually** have either as a drink or on cereal?
(tick the one you have most often)

Do not drink/use milk	
Whole	
Low-fat	
Skimmed	
Supermilk	

Other, please describe. *(Eg. sweetened soya milk, skimmed goats milk)*…….

6. What type of bread do you **usually** eat?

(tick the one you have most often)

Do not eat bread ☐
White Sliced ☐
Brown or Granary ☐
Soda bread ☐
Wholegrain ☐
Rolls ☐
Pitta bread ☐
Wraps ☐
Ciabatta

Other, please describe. (*Eg. rye, half&half, gluten free)*……

7. What type of butter or fat spread do you **usually** use?……

(Describe the type you use most often, name the brand and whether it is low fat or not. Eg. Dairy Gold Original, Flora light)

8. What type of water do you **usually** drink at home?

(tick the one you have most often)

Tap ☐
Tap, filtered ☐
Bottled ☐

.

If Bottled, please name the brand……

ID Number:

9. Is there fruit **usually** available at home?

YES	
NO	

10. How many pieces of fruit would you eat in a typical day?

(please tick the number of pieces of fruit)

0	
1	
2	
3	
4	
5+	

11. Does anyone at home **usually** ask what you have eaten at any time during the day? Give details:

……

12. Do you sometimes get up in the night to get something to eat or drink?

YES	
NO	

If **YES**, how often does this happen?

Rarely or never	
1 –2 times per week	
3 –4 times per week	
5 or more times per week	

Other, please describe……

If YES, describe what you usually eat or drink……

13. Are there any foods that you often or always avoid eating?

Meat	☐
Fish	☐
Dairy products (cheese, yogurt, milk)	☐
Foods made with wheat	☐
Nuts	☐

Other, please describe……

14. If you have ticked any of these boxes can you tell us **why** you don't eat that food?

……

……

15. Do you take any vitamin and/or mineral supplements?

YES	☐
NO	☐

If **YES**, give details of the supplement and how often you take it. *(If possible enclose a label)*……

……

16. Would you like to add any more comments about what you eat or drink?

……

……

How to fill in your diary

It is very important that you do not change what you normally eat or drink just because you are keeping a diary. Try to write down what you are eating or drinking as soon as you can and not leave it until the end of the day. You could also keep a note in your phone and write it into your diary later if you forget to carry it with you.

Whenever you have something to eat or drink write down;

When:

Each day is divided into time slots from first thing in the morning until late at night until the following morning. Find the right time slot and in the next column record the exact time when you eat or drink something.

Where: This could be

- Home
  - Bedroom
  - At table
  - Watching television
- Away
  - Street
  - Car/Bus
  - Café/ Restaurant (specify Mac Donalds, Pizza Hut etc.)
- School
  - School canteen
  - Corridor
  - Classroom
  - School yard

With Whom: This could be

- Alone
- With family
- With friends

What:

Describe your food and drink giving as much detail as you can. **Include any extras like sugar and milk in your tea or cereal, butter or other spreads on your bread and sauces such as ketchup and mayonnaise. Do not forget to include drinking water.**

If you know it include: cooking method (eg. roast, baked, boiled, fried)

brand name (eg. Kelloggs, Chef, Galtee)

Where obtained from: This is where you got the food from and could be

- Home (food and drink, usually bought by an adult, brought into the house and stored there until eaten)
- Shop (food and drink bought by you to eat/drink outside the home)
- School canteen
- School vending machine
- Restaurant/cafe (describe what type)
- Street vendor (eg kebab stall, ice cream van)
- Cinema kiosk/vending machine

Portion size: If you know the amount from the packet, write it down – e.g. 500ml lucozade or 1 packet Tayto crisps or 1 Goodfellas pizza or 1 carton Yoplait yogurt. For other foods write S (small), M (medium) or L (large) or specify glass, cup, mug, bowl, scoops, number (biscuits, crackers), slice (cake, pizza), big spoon or teaspoon.

These examples will help you to estimate your portion sizes:

FOOD	PORTION	FOOD	PORTION
Boiled potato, Baked potato with skin, Roast potato	small, medium, large	**Meat – e.g. steak, roast, chops**	small, medium, large
Mashed potato	scoops	**Fish – breaded / battered / natural**	small, medium, large
Chips – fried / oven / chipper	small, medium, large	**Chicken breast or leg – breadcrumbs or not**	number – e.g. 1 chicken breast
Potato wedges – fried / oven	small, medium, large	**Chicken curry**	small, medium, large
Waffles, Hash browns	number – e.g. 1, 2…….	**Lasagne**	small, medium, large
Potato cake	small, medium, large	**Stir-fry – list what's in it**	small, medium, large
Boiled or fried rice	cups cooked	**Vegetables or Coleslaw**	big spoons
Boiled pasta	cups, cooked	**Soup**	bowl - small, medium, large
Noodles - type	small, medium, large	**Stuffing**	big spoons
Bread	type & number slices	**Cheese – block** **Cheese - grated**	slices big spoons
Roll	small, medium, large	**Mayo, ketchup, salad cream, jam, nutella**	teaspoons
Pizza	slices – small, medium, large	**Cereal**	bowl - small, medium, large

If you're not sure about the portion size, take a picture if you can with your phone and show to the researcher.

On the first page of the diary we have filled in a whole day to show you what to do.

Day **EXAMPLE**	**Day** Thursday	**Date** March 31st	**ID No.** 1234

Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
6am	7.30	Kitchen, home	Alone	Orange juice Tea with milk and sugar Cornflakes, with milk and sugar Toast, with butter and jam	L mug 2 1 slice	home
to						
9am	8.30	Street	With friends	Mars Bar	1	shop
9am	11	School playground	With friends	Coke Crisps (Tayto)	can packet	vending machine
to						
12 noon	12	School corridor	Alone	Water	½ of large bottle	water cooler
12 noon	12.45	School canteen	With friends	Ham and cheese sandwich Crisps (tayto) Apple Ribena Kitkat	2 slices packet 1 carton 1	home
to						
2pm	1.50	School corridor	Alone	Water	beaker	water cooler

Day Example		**Day** Thursday		**Date** March 31st	**ID No.** 1234	
Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
2pm to 5pm	3.45 4.30	Bus Home, watching television	Alone With family	Fruit gums Tea (as above) Biscuits (jaffa cakes)	packet mug 3	shop home
5pm to 8pm	6.30	Home, at table	With family	Pork sausages Baked beans Mashed potato Broccoli Strawberry yoghourt (muller) Water	3 large L 2 scoops S Carton Glass	home
8pm to 10pm	8 9.30	Watching television Kitchen	Alone Alone	Orange Cream crackers (Jacobs) Cornflakes with milk and sugar	1 4 L	home
10pm to 6am	10.30	Bedroom	Alone	Hot chocolate	mug	home

Practice	Day	Date	ID No.

Time slot	When	Where	With Whom	What	Portion size	Where obtained from
6am to 9am						
9am to 12 noon						
12 noon to 2pm						

Practice		Day		Date	ID No.	
Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
2pm to 5pm						
5pm to 8pm						
8pm to 10pm						
10pm to 6am						

Day 1	Day	Date	ID No.

Time slot	When	Where	With Whom	What	Portion size	Where obtained from
6am to 9am						
9am to 12 noon						
12 noon to 2pm						

Day 1		Day		Date	ID No.	
Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
2pm to 5pm						
5pm to 8pm						
8pm to 10pm						
10pm to 6am						

Day 2	Day	Date	ID No.

Time slot	When	Where	With Whom	What	Portion size	Where obtained from
6am to 9am						
9am to 12 noon						
12 noon to 2pm						

Day 2		Day		Date	ID No.	
Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
2pm to 5pm						
5pm to 8pm						
8pm to 10pm						
10pm to 6am						

Day 3	Day	Date	ID No.

Time slot	When	Where	With Whom	What	Portion size	Where obtained from
6am to 9am						
9am to 12 noon						
12 noon to 2pm						

Day 3		Day		Date	ID No.	
Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
2pm to 5pm						
5pm to 8pm						
8pm to 10pm						
10pm to 6am						

Day 4	Day	Date	ID No.

Time slot	When	Where	With Whom	What	Portion size	Where obtained from
6am to 9am						
9am to 12 noon						
12 noon to 2pm						

Day 4		Day		Date	ID No.	
Time slot	**When**	**Where**	**With Whom**	**What**	**Portion size**	**Where obtained from**
2pm to 5pm						
5pm to 8pm						
8pm to 10pm						
10pm to 6am						

When you have completed your diary, think back and consider whether these 4 days were typical or was there something unusual such as a party, visitors, or perhaps you were not feeling well.

Was there anything unusual about these 4 days? YES ☐

NO ☐

If YES, please can you tell us what was different from usual.....

.....

.....

.....

The following questions are OPTIONAL AND CONFIDENTIAL.

We wish to know how alcohol affects the calorie intake of teenagers. Information you give will be used to calculate calories from alcohol only. We'd like to remind you that no identifiable information about you will ever be shared.

17. In a typical month how many days would you drink alcohol? (Tick the box that applies to you)

I never drink alcohol	☐
1 – 2 days	☐
3 - 4 days	☐
5 - 6 days	☐
7 – 8 days	☐
More than 8 days	☐

18. When you drink alcohol, how many drinks would you typically have? (One drink = 1 glass/bottle beer, ½ pint or can beer, 1 glass/long-neck bottle cider, ½ can/pint cider, 1 bottle alcopop, 1 small glass wine (6 glasses in one 750ml bottle), 1 pub measure of spirit – 35ml)

I never drink alcohol	_____	Wine	_____
Beer	_____	Spirits on their own	_____
Cider	_____	Spirits with sugar-free or diet mixers	_____
Alcopops	_____	Spirits with regular mixers	_____

19. On the days that you kept the food diary, please fill in any alcohol you consumed.

Day					ID No.
Date	**Time**	**Where**	**With Whom**	**What**	**Amount**
1					
2					
3					
4					

4-Day Activity Diary

Please record the activity you do on the days that you keep the food diary – 2 weekdays and 2 weekend days.

Day: __Practice_____

Date: ___01/09/12___

ID No.: ___1234_____

The 24-hour day has been broken down to 15 minute slots below and you are asked to complete each of these slots.

What you need to do: Record the day and date in the box at the top of the page
As you go through the day record the time and types of activities per hour and in 15 minute slots
Find the code of the activity you did with a number from 1-9 (see Activity Codes) and fill in each 15-minute slot with that number

	Midnight-1am				1 – 2 am				2 – 3 am				3 – 4 am			
Activity Code																
	4 – 5 am				5 – 6 am				6 – 7 am				7 – 8 am			
Activity Code																
	8 – 9 am				9 – 10 am				10 – 11 am				11 – midday			
Activity Code																
	Midday – 1pm				1 – 2 pm				2 – 3 pm				3 – 4 pm			
Activity Code																
	4 – 5 pm				5 – 6 pm				6 – 7 pm				7 – 8 pm			
Activity Code																
	8 – 9 pm				9 – 10 pm				10 – 11 pm				11 - Midnight			
Activity Code																

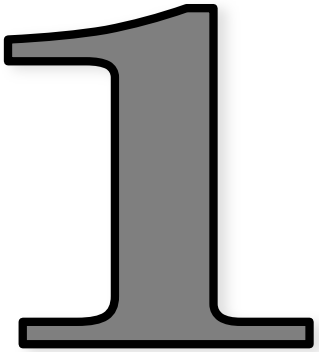
Activity Codes:

1. Sleeping
2. In the car / bus / train
3. Sitting (eating or reading / writing)
4. Watching TV / DVDs or on laptop, computer, playstation etc
5. Playing musical instrument (Piano, guitar etc.)
6. Washing / Dressing / Walking / Drama
7. Being active outside / running / cycling / at the beach
8. Organised sport/activity: basketball, football, camogie, hurling, soccer, hockey, swimming, dancing etc
9. Miscellaneous – doesn't fit into any of the above categories (please make not of the activity on this page)

If you filled in 9 for any time, write the time & activity here:

_____

_____



Day: _____

Date: _____

ID No.: _____

	Midnight-1am	1 – 2 am	2 – 3 am	3 – 4 am	4 – 5 am	5 – 6 am	6 – 7 am	7 – 8 am
Activity Code								
	8 – 9 am	9 – 10 am	10 – 11 am	11 – midday	Midday – 1pm	1 – 2 pm	2 – 3 pm	3 – 4 pm
Activity Code								
	4 – 5 pm	5 – 6 pm	6 – 7 pm	7 – 8 pm	8 – 9 pm	9 – 10 pm	10 – 11 pm	11 - Midnight
Activity Code								

Activity Codes:

1. Sleeping
2. In the car / bus / train
3. Sitting (eating or reading / writing)
4. Watching TV / DVDs or on laptop, computer, playstation etc
5. Playing musical instrument (Piano, guitar etc.)
6. Washing / Dressing / Walking / Drama
7. Being active outside / running / cycling / at the beach
8. Organised sport/activity: basketball, football, camogie, hurling, soccer, hockey, swimming, dancing etc
9. Miscellaneous – doesn't fit into any of the above categories (please make not of the activity on this page)

If you filled in 9 for any time, write the time & activity here:

_____

_____

2

Day: _____

Date: _____

ID No.: _____

	Midnight-1am				1 – 2 am				2 – 3 am				3 – 4 am				4 – 5 am				5 – 6 am				6 – 7 am				7 – 8 am			
Activity Code																																
	8 – 9 am				9 – 10 am				10 – 11 am				11 – midday				Midday – 1pm				1 – 2 pm				2 – 3 pm				3 – 4 pm			
Activity Code																																
	4 – 5 pm				5 – 6 pm				6 – 7 pm				7 – 8 pm				8 – 9 pm				9 – 10 pm				10 – 11 pm				11 - Midnight			
Activity Code																																

Activity Codes:

1. Sleeping
2. In the car / bus / train
3. Sitting (eating or reading / writing)
4. Watching TV / DVDs or on laptop, computer, playstation etc
5. Playing musical instrument (Piano, guitar etc.)
6. Washing / Dressing / Walking / Drama
7. Being active outside / running / cycling / at the beach
8. Organised sport/activity: basketball, football, camogie, hurling, soccer, hockey, swimming, dancing etc
9. Miscellaneous – doesn't fit into any of the above categories (please make not of the activity on this page)

If you filled in <u>9</u> for any time, write the time & activity here:

_____

_____

3

Day: _____

Date: _____

ID No.: _____

	Midnight-1am	1 – 2 am	2 – 3 am	3 – 4 am	4 – 5 am	5 – 6 am	6 – 7 am	7 – 8 am
Activity Code								
	8 – 9 am	9 – 10 am	10 – 11 am	11 – midday	Midday – 1pm	1 – 2 pm	2 – 3 pm	3 – 4 pm
Activity Code								
	4 – 5 pm	5 – 6 pm	6 – 7 pm	7 – 8 pm	8 – 9 pm	9 – 10 pm	10 – 11 pm	11 - Midnight
Activity Code								

Activity Codes:

1. Sleeping
2. In the car / bus / train
3. Sitting (eating or reading / writing)
4. Watching TV / DVDs or on laptop, computer, playstation etc
5. Playing musical instrument (Piano, guitar etc.)
6. Washing / Dressing / Walking / Drama
7. Being active outside / running / cycling / at the beach
8. Organised sport/activity: basketball, football, camogie, hurling, soccer, hockey, swimming, dancing etc
9. Miscellaneous – doesn't fit into any of the above categories (please make not of the activity on this page)

If you filled in <u>9</u> for any time, write the time & activity here:

_____

_____

4

Day: _____

Date: _____

ID No.: _____

	Midnight-1am		1 – 2 am		2 – 3 am		3 – 4 am		4 – 5 am		5 – 6 am		6 – 7 am		7 – 8 am	
Activity Code																
	8 – 9 am		9 – 10 am		10 – 11 am		11 – midday		Midday – 1pm		1 – 2 pm		2 – 3 pm		3 – 4 pm	
Activity Code																
	4 – 5 pm		5 – 6 pm		6 – 7 pm		7 – 8 pm		8 – 9 pm		9 – 10 pm		10 – 11 pm		11 - Midnight	
Activity Code																

Activity Codes:

1. Sleeping
2. In the car / bus / train
3. Sitting (eating or reading / writing)
4. Watching TV / DVDs or on laptop, computer, playstation etc
5. Playing musical instrument (Piano, guitar etc.)
6. Washing / Dressing / Walking / Drama
7. Being active outside / running / cycling / at the beach
8. Organised sport/activity: basketball, football, camogie, hurling, soccer, hockey, swimming, dancing etc
9. Miscellaneous – doesn't fit into any of the above categories (please make not of the activity on this page)

If you filled in 9 for any time, write the time & activity here:

_____

_____

The food diary was adapted with permission from ROOTS Adolescent Food Diary, Medical Research Council, Human Nutrition Research, Cambridge, UK
The activity diary was adapted from the Eat Smart Study, developed by the Children's Nutrition Centre, University of Queensland, Australia