

# Hypertension prevalence, awareness, treatment and control in the over 50s in Ireland: evidence from The Irish Longitudinal Study on Ageing

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## ABSTRACT

**Background** To assess the prevalence, awareness, treatment and control of hypertension among adults in Ireland and to describe the determinants of awareness, treatment and control in order to inform public health policy.

**Methods** A cross-sectional study of a nationally representative sample of community living adults aged 50 years and older using data collected from 2009 to 2011 for the first wave of the Irish Longitudinal Study on Ageing (TILDA) ( $n = 5857$ ). Hypertension was defined as systolic blood pressure (BP)  $\geq 140$  mmHg or diastolic BP  $\geq 90$  mmHg and/or currently taking antihypertensive medications.

**Results** The prevalence of hypertension was 63.7% [95% confidence interval (CI) 62.3–65.1%]. Among those with hypertension, 54.5% (95% CI 52.6–56.2%) were aware of their hypertensive status and 58.9% (95% CI 57.1–60.4%) were on antihypertensive medication. Among those on treatment, 51.6% (95% CI 49.3–53.9%) had their BP controlled to below 140/90 mmHg. Respondents facing financial barriers to primary care and medication were less likely to be on antihypertensive treatment compared with those without financial barriers.

**Conclusions** A high prevalence of hypertension was identified in this cohort, with low levels of awareness, treatment and control. Population and primary care interventions are required to reduce prevalence and to improve awareness, detection and management of hypertension.

**Keywords** adult, aged, awareness, cross-sectional studies, epidemiology, hypertension, Ireland, prevalence

## Introduction

Cardiovascular diseases (CVDs) account for one-third of mortality globally<sup>1</sup> and an almost identical proportion of deaths in Ireland.<sup>2</sup> Despite a dramatic drop in mortality rates since 1998, CVD remains the leading cause of death in Ireland.<sup>3</sup> This decline in cardiovascular mortality is attributed to a combination of improved treatment uptake (40%) and an improvement in risk factors (48%).<sup>4</sup> Hypertension is a leading modifiable risk factor for CVD and estimated to be responsible for at least 45% of ischaemic heart disease mortality and 51% of total stroke mortality globally.<sup>5</sup>

The burden of hypertension is increasing worldwide.<sup>6</sup> It was estimated that there were 972 million adults worldwide with hypertension in 2000. In the context of an ageing

population, this is expected to increase by 60% to reach 1.5 billion by 2025.<sup>7</sup> Ireland is a relatively young country with 1.2 million (28%) of the population aged 50 years and older in 2011.<sup>8</sup> The number of people in this age group is expected to increase to between 2.1 and 2.4 million by 2046.<sup>9</sup> This absolute increase in the number of older adults in the population

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will place a considerable burden on health services to prevent, identify and manage hypertension in order to prevent the more costly management of the complications of hypertension.<sup>10,11</sup> Previous research on a subsample of adults aged 45 years and older taken from a nationally representative sample of adults aged 18 years and older found a hypertension prevalence of 60% in 2007.<sup>12</sup> Recent data on the prevalence, awareness, treatment and control of hypertension in the Irish population are lacking. The aim of this study is to provide an estimate of the prevalence of hypertension in older adults in Ireland and to describe the determinants of awareness, treatment and control of hypertension in order to inform public health policy.

## Methods

### Study setting and participants

This study is cross-sectional in design using data from the first wave of the Irish Longitudinal Study on Ageing (TILDA). TILDA is a population-based prospective cohort study, representative of the community living older population in Ireland. The sample was recruited based on a national directory of residential addresses using the RANSAM system.<sup>13</sup> Each member of the population in Ireland aged 50 years and older had an equal probability of being invited to participate. Ethical approval for the study was received from the Trinity College Research Ethics Committee and all participants provided written informed consent.

Data collection took place between October 2009 and July 2011. Participants completed a computer-assisted face-to-face interview in their home, a self-complete postal questionnaire and a centre or home-based health assessment.<sup>14</sup>

### Estimation of hypertension

Blood pressure (BP) was measured by a nurse according to a standard protocol at an ambient temperature of 20–25°C. After a period of rest, a digital automated oscillometric BP monitor (Omron M10-IT, Omron Inc., Kyoto, Japan) with an arm cuff (22–42 cm) was used to measure BP in one arm, at heart height, while the respondent was seated comfortably in an upright position. BP was recorded twice while seated with a timed interval of 1 min between readings. The mean systolic and diastolic readings were obtained from these two measurements.<sup>15</sup>

Current antihypertensive medication use was recorded during the home-based interview and classified according to the World Health Organization (WHO) Anatomical Therapeutic Chemical (ATC) classification system. Combination therapy included any combination of two or more antihypertensive medications.

Hypertension prevalence was defined as systolic BP (SBP)  $\geq 140$  mmHg or diastolic BP (DBP)  $\geq 90$  mmHg and/or currently taking antihypertensive medications. Respondents were asked if a doctor ever told them they had 'high blood pressure or hypertension', awareness of hypertension was defined as endorsement of this item. Control of BP was defined as SBP  $< 140$  mmHg and DBP  $< 90$  mmHg while on antihypertensive medication.

### Covariates

Demographic covariates included age, sex, highest educational attainment (primary, secondary and tertiary) and geographical location (Dublin city or county, another town/city or a rural area). Behavioural factors included current smoking status, problematic alcohol consumption, body mass index (BMI) and physical activity. Problematic alcohol consumption was assessed as a score of 2 or more on the CAGE (Cut, Annoyed, Guilty, Eye-opener) questionnaire.<sup>16</sup> Height and weight were measured by the study nurse. BMI (weight in kg/height in m<sup>2</sup>) was classified according to the World Health Organization (WHO) classification—underweight: BMI  $< 18.5$ , normal weight: BMI  $\geq 18.5$  and  $< 25$ , overweight: BMI  $\geq 25$  and  $< 30$ , obese: BMI  $\geq 30$ . Physical activity was self-assessed using the International Physical Activity Questionnaire (IPAQ) short form.<sup>17</sup> The IPAQ scoring protocol was used to categorize physical activity as low (light-intensity), moderate (moderate-intensity) or high (vigorous-intensity).<sup>18</sup>

Morbidity covariates which included the presence of diabetes and CVD (angina, myocardial infarction, coronary artery bypass surgery, angioplasty/stent insertion, stroke or transient ischaemic attack) were based on reporting ever having a doctor's diagnosis of these conditions or a self-report of having undergone a procedure. Access to primary healthcare was assessed using three mutually exclusive categories of medical insurance status. These include, those (i) with a means tested medical card which provides free access to general practitioner (GP) care and heavily subsidized prescribed medicines (ii) with private health insurance and (iii) without medical insurance.

### Statistical analysis

Descriptive statistics were used to calculate prevalence and awareness of hypertension. Crude prevalence was calculated with survey weights applied to the estimates to adjust for selection bias and additional weights to reduce non-response bias to the health assessment component of the survey. The population weights were calculated based on age, sex and educational attainment of the population in Ireland. Further detail on the weights applied is available elsewhere.<sup>19</sup>

Multivariable logistic regression was used to determine independent risk factors for awareness, treatment and control of hypertension. Purposeful selection of variables for inclusion in the regression models was based on independent variables which were significant on bi-variate analysis and/or deemed of importance in the literature. Adjusted odds ratios and 95% confidence intervals (CIs) are reported for the main effects models. Underweight participants were removed from the multivariable analysis due to small numbers. The goodness of fit of the models was assessed using the area under the receiver operating characteristic (ROC) curve. Statistical significance was set at  $P < 0.05$ . The statistical software Stata/MP 12.1 was used to conduct the analyses.

## Results

In total, 8175 respondents completed the home-based interview, representing a household response rate of 62%. Of these, 5895 (72.1%) completed a health assessment. This analysis is based on 5857 (99.3%) participants for whom BP data were available. Table 1 outlines the characteristics of the sample. Participants ranged in age from 50 to 98 years (mean age 63.1 SD 9.3); 51.7% were female.

The mean SBP was 136.6 (95% CI 136.0–137.2 mmHg) for those aged 50 years and older. This increased at each 5-year age group from 129.8 (95% CI 128.8–130.8 mmHg) in those aged 50–54 to 149.9 (95% CI 145.5–154.4 mmHg) in those aged 85+. The mean DBP was 82.5 (95% CI 82.1–82.8 mmHg) for those aged 50 years and older. DBP decreased overall from 83.5 (95% CI 82.9–84.2 mmHg) in the youngest age group to 80.1 (95% CI 77.9–82.4 mmHg) in the oldest group. The pattern of difference in the mean SBP and mean DBP by age and sex is demonstrated in Fig. 1.

Weighted prevalence of hypertension was 63.7% (95% CI 62.3–65.1%) in those aged 50 years and older (Table 2). This yields an estimated hypertension burden of 797 091 in the population aged 50 years and older in Ireland. Hypertension prevalence was higher in men than in women (68.7 versus 59.2%,  $P < 0.001$ ) and higher in the oldest age group compared with the youngest (86.6 versus 52.6%,  $P < 0.001$ ).

Of those classified as hypertensive, 54.5% said they had previously been diagnosed by a doctor as hypertensive and 58.9% were on antihypertensive treatment (Table 3). BP control (SBP  $< 140$  mmHg and DBP  $< 90$  mmHg) was achieved in just over half (51.6%) of those on antihypertensive treatment (Table 3).

Among those on antihypertensive medication, the most commonly used medications were angiotensin-converting enzyme inhibitors 36.8% (95% CI 34.5–39.1%),  $\beta$ -blockers 36.7% (95% CI 34.3–38.9%) and angiotensin receptor

**Table 1** Sample characteristics (TILDA wave 1  $\geq 50$  years,  $n = 5857$ )

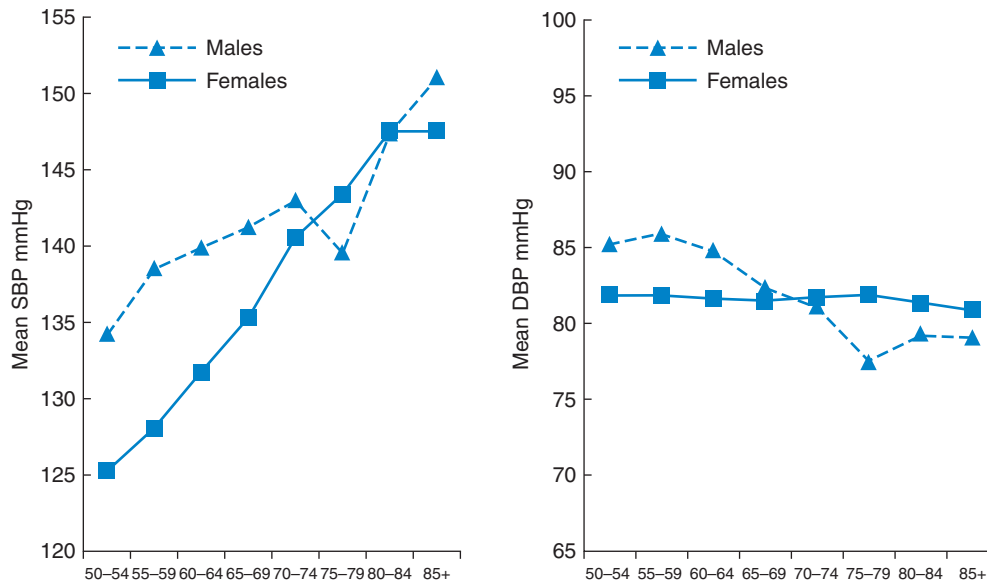
Characteristic	n	Weighted %	95% CI
Age			
50–64	3501	58.6	56.8–60.4
65–74	1556	23.3	21.9–24.5
75+	800	18.1	16.6–19.5
Sex			
Male	2688	48.3	47.2–49.4
Female	3169	51.7	50.5–52.7
Education			
Primary	1528	38.0	36.2–39.8
Secondary	2399	43.3	41.7–44.8
Tertiary	1928	18.7	17.5–19.8
Location			
Dublin City or County	1521	24.5	20.9–28.0
Another town/city	1609	27.3	24.0–30.6
Rural area	2722	48.1	44.3–51.9
Current smoker	933	17.1	15.9–18.3
Alcohol CAGE $\geq 2$	671	12.8	11.4–13.7
Body mass index			
Underweight	32	0.5	0.3–0.7
Normal	1302	21.2	20.0–22.3
Overweight	2509	42.8	41.4–44.1
Obese	1996	35.4	34.1–36.7
Physical activity			
Low	1752	31.8	30.2–33.4
Moderate	2040	34.0	32.5–35.6
High	2016	34.0	32.1–35.9
Diabetes	419	7.6	6.9–8.4
CVD history	643	12.1	11.0–13.1
Health insurance			
Medical card	2612	50.1	48.3–51.9
No insurance	594	10.6	9.5–11.6
Private health insurance	2648	39.2	37.4–41.0

TILDA, The Irish Longitudinal Study on Ageing.

blockers 30.5% (95% CI 28.2–32.7%) (Table 4). Just over half (52.5%) of those on treatment received combination therapy of two or more antihypertensive medications; this proportion was higher in the oldest age group compared with the youngest age group (62.0 versus 44.8%,  $P < 0.001$ ).

### Factors associated with awareness, treatment and control of hypertension

Controlling for other covariates in the model (Table 5), awareness of hypertension was higher at older ages [adjusted odds ratio (Adj OR) 1.01, 95% CI 1.00–1.02] and in women compared with men (Adj OR 1.63, 95% CI 1.39–1.90). Overweight (Adj OR 1.62, 95% CI 1.31–2.00), obesity (Adj



**Fig. 1** Distribution of weighted mean SBP and DBP in the adult population in Ireland aged 50 years and older by age group and sex (TILDA wave 1,  $n = 5857$ ).

**Table 2** Weighted hypertension prevalence and burden in the adult population in Ireland aged 50 years and older by age and sex (TILDA wave 1,  $n = 5857$ )

Age group	Female ( $n = 3169$ )			Male ( $n = 2688$ )			All ( $n = 5857$ )		
	%	95% CI	Population burden	%	95% CI	Population burden	%	95% CI	Population burden
50–64	45.7	43.3–48.1	167 658	59.5	56.8–62.1	217 997	52.6	50.7–54.4	385 655
65–74	66.9	63.4–70.4	99 393	81.2	78.3–84.1	115 546	73.9	71.6–76.2	214 939
≥75	88.0	84.4–91.5	115 257	85.3	81.4–89.2	81 238	86.8	84.3–89.4	196 496
Total	59.2	57.3–61.0	382 309	68.7	66.8–70.5	414 782	63.7	62.3–65.1	797 091

Hypertension: SBP  $\geq 140$  mmHg or DBP  $\geq 90$  mmHg and/or currently taking antihypertensive medications.

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OR 2.32, 95% CI 1.86–2.88) and co-morbidity with diabetes (Adj OR 1.88, 95% CI 1.44–2.45) or with CVD (Adj OR 1.47, 95% CI 1.18–1.83) were strong predictors of awareness of hypertension.

The adjusted odds of treatment for hypertension were also higher at older ages, in women, in those who were overweight or obese and in those with co-morbidity (Table 5). Those with high levels of self-reported physical activity were less likely to be on treatment compared with those that reported low levels of physical activity (Adj OR 0.68, 95% CI 0.55–0.83). Individuals with no medical insurance (Adj OR 0.69, 95% CI 0.51–0.93) or with private health insurance (Adj OR 0.82, 95% CI 0.67–0.99) were less likely to be on treatment compared with those with a medical card.

The adjusted odds of BP control in the treated group were lower for older adults (Adj OR 0.97, 95% CI 0.96–0.98) than for those at younger ages. Those living in towns/cities outside

Dublin (Adj OR 1.35, 95% CI 1.05–1.75) and in rural areas (Adj OR 1.45, 95% CI 1.14–1.83) were more likely to have their BP controlled than those living in the greater Dublin city or county area. A previous history of CVD was found to be a strong predictor of BP control (Adj OR 1.82, 95% CI 1.45–2.30).

## Discussion

### Main finding of this study

We found a high prevalence (63.7%) of hypertension among adults over 50 years in Ireland. Among those with hypertension, 54.5% were aware of their hypertensive status and 58.9% were on antihypertensive medication. Among those on treatment, 51.6% had their BP controlled to levels below 140/90 mmHg. Respondents facing financial barriers to

**Table 3** Weighted hypertension awareness and treatment in hypertensive adults in Ireland by age and sex and control in the treated by age and sex (TILDA wave 1, ≥50 years)

	Aware (n = 3579)		Treated (n = 3579)		Controlled BP in the treated (n = 2142)	
	%	95% CI	%	95% CI	%	95% CI
Sex						
Male	48.8	46.3–51.2	55.2	52.7–57.7	50.2	46.7–53.5
Female	59.6	57.2–62.1	62.2	59.8–64.6	52.9	49.6–56.3
Age						
50–64	50.3	47.8–52.7	49.1	46.6–51.5	54.9	51.5–58.4
65–74	57.5	54.4–60.6	66.7	63.7–69.6	49.1	45.4–52.7
≥75 years	64.0	60.1–67.9	80.1	76.9–83.3	44.2	39.5–48.9
Total	54.5	52.6–56.2	58.9	57.1–60.4	51.6	49.3–53.9

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primary care and medication were less likely to be on antihypertensive treatment compared with those without financial barriers.

**What is already known on this topic**

The highest reported hypertension prevalence for a nationally representative survey of adults aged 50 years and older is 78% in South Africa.<sup>20</sup> Previous research on a subsample (aged 45 years and older, n = 1207) of a nationally representative sample of adults aged 18 years and older in Ireland found a hypertension prevalence of 60%.<sup>12</sup> Our study conducted on a large older cohort is broadly consistent with the previous hypertension prevalence estimate for older adults in Ireland.

Awareness of hypertension is low (54.5%) compared with the level of awareness found in adults (35–84 years) in the USA (86%) and England (64%).<sup>21</sup> Older age and female sex were determinants of awareness in older adults in Ireland, raising concerns about the lack of awareness of this condition in younger adults and in men. The findings that obesity<sup>20</sup> and comorbidity<sup>22</sup> were determinants of awareness are consistent with previous research.<sup>20,22</sup> The lack of awareness raises questions about the ‘silent’ nature of hypertension and how a disease that progresses silently can be identified at an early stage if individuals do not come into contact with health services. There is no national programme for CVD risk assessment in Ireland similar to those in place in countries such as Belgium, Germany, Luxemburg and Switzerland.<sup>23</sup> The National Cardiovascular Health Policy 2010–2019<sup>24</sup> recommended evaluation of a structured programme for risk ascertainment and management in the primary care setting to

**Table 4** Antihypertensive medication utilization in adults aged 50 years and older in Ireland (TILDA wave 1, n = 2142)

	Anti-adrenergic agents		Diuretics		β-blockers		Calcium channel blockers		Angiotensin-converting enzyme (ACE) inhibitors		Angiotensin receptor blockers (ARBs)		Combination therapy	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Sex														
Male	4.6	3.3–5.9	19.1	16.4–21.7	38.9	35.7–42.0	26.1	23.3–28.9	41.8	38.7–44.9	27.5	24.5–30.5	51.5	48.0–54.9
Female	4.8	3.3–6.1	26.9	23.9–30.1	34.5	31.3–37.6	26.6	23.6–29.6	32.0	28.6–35.3	33.3	30.0–36.5	53.4	50.0–56.7
Age														
50–64	3.8	2.5–5.1	14.8	12.4–17.2	31.4	28.1–34.8	23.9	20.9–26.9	39.0	35.5–42.4	29.7	26.4–33.0	44.8	41.1–48.4
65–74	3.8	2.4–5.3	20.5	17.3–23.6	38.7	34.9–42.6	25.7	22.3–29.2	36.6	32.8–40.3	32.7	28.8–36.6	52.1	48.2–56.0
≥75 years	6.3	4.2–8.4	35.4	30.4–40.3	40.9	36.3–45.5	29.7	25.3–34.1	34.3	29.6–39.1	29.2	24.8–33.7	62.0	57.1–66.9
Total	4.7	3.8–5.6	23.1	21.0–25.2	36.7	34.3–38.9	26.3	24.3–28.3	36.8	34.5–39.1	30.5	28.2–32.7	52.5	50.0–54.9

TILDA, The Irish Longitudinal Study on Ageing.

**Table 5** Multivariable logistic regression models for Awareness, Treatment and Control of hypertension in adults aged 50 years and older in Ireland (TILDA wave 1)

	<i>Covariate</i>	<i>Awareness Adj OR (95% CI)</i>	<i>Treatment Adj OR (95% CI)</i>	<i>Control in the treated Adj OR (95% CI)</i>
Socio-demographic characteristics	Age	1.01 (1.00–1.02)**	1.04 (1.03–1.05)***	0.97 (0.96–0.98)***
	Female	1.63 (1.39–1.90)***	1.38 (1.17–1.63)***	1.18 (0.97–1.44)
	Education			
	Primary (ref)	1.0	1.0	1.0
	Secondary	0.82 (0.68–0.99)*	0.85 (0.69–1.05)	1.08 (0.86–1.36)
	Tertiary	1.03 (0.84–1.27)	0.96 (0.76–1.20)	1.19 (0.92–1.54)
	Location			
	Dublin City or County (Ref)	1.0	1.0	1.0
	Another town/city	0.91 (0.74–1.11)	1.23 (0.99–1.53)	1.35 (1.05–1.75)*
Rural area	0.92 (0.77–1.10)	1.18 (0.97–1.45)	1.45 (1.14–1.83)**	
Behavioural characteristics	BMI			
	Normal (ref)	1.0	1.0	1.0
	Overweight	1.62 (1.31–2.00)***	1.42 (1.13–1.78)**	0.98 (0.73–1.31)
	Obese	2.32 (1.86–2.88)***	2.02 (1.60–2.55)***	0.96 (0.71–1.28)
	Physical activity			
	Low physical activity (Ref)	1.0	1.0	1.0
	Moderate physical activity	0.93 (0.77–1.12)	0.81 (0.66–0.99)*	0.83 (0.66–1.04)
	High physical activity	0.78 (0.64–0.94)*	0.68 (0.55–0.83)***	0.92 (0.72–1.17)
Current smoker	0.81 (0.66–1.01)	0.79 (0.62–1.00)	1.30 (0.97–1.75)	
Alcohol CAGE $\geq 2$	1.20 (0.96–1.50)	0.90 (0.71–1.15)	1.04 (0.77–1.41)	
Comorbidity	Diabetes	1.88 (1.44–2.45)***	4.37 (3.04–6.26)***	0.95 (0.73–1.25)
	CVD history	1.47 (1.18–1.83)***	8.52 (5.94–12.22)***	1.82 (1.45–2.30)***
Health service access	Health insurance			
	Medical card (ref)	1.0	1.0	1.0
	No medical insurance	0.88 (0.66–1.17)	0.69 (0.51–0.93)**	0.83 (0.55–1.24)
Private health insurance	0.89 (0.74–1.07)	0.82 (0.67–0.99)*	0.90 (0.71–1.14)	
Combination therapy			1.07 (0.88–1.29)	
Number analysed		3116	3116	1868
Area under the ROC curve		0.63	0.74	0.60

\*\*\* $P < 0.001$ , \*\* $P < 0.01$ , \* $P < 0.05$ .

ROC, receiver operating characteristic; TILDA, The Irish Longitudinal Study on Ageing.

inform the development of a model for the delivery of care. The findings of this study highlight the urgency to implement that recommendation in relation to prevention, detection and management of hypertension.

Comorbidity was found to be a significant predictor of treatment in this cohort. This finding is consistent with previous research on quality of care and comorbidity<sup>25</sup> and is likely to reflect the higher level of contact between individuals with comorbidity and the health system. The Irish Heartwatch programme with a focus on secondary prevention of coronary heart disease<sup>26</sup> may have contributed to the higher odds of both treatment and control in those with a CVD history. In contrast, a diagnosis of diabetes was associated with treatment

but not control of hypertension. This appears to suggest less emphasis on achieving BP control in diabetics compared with those with a previous CVD history.

Individuals without medical insurance or with private insurance were less likely to be treated for their hypertension compared with those with medical cards who receive free GP consultations and heavily subsidized medications from the Irish Government. This is consistent with previous findings from Ireland and elsewhere that those with free healthcare are more likely to take cardiovascular medication<sup>27</sup> and that financial burdens deter patients from getting care for their hypertension.<sup>28</sup> In the USA, Hispanics are less likely to have access to health insurance<sup>29</sup> and historically have lower BP

control than non-Hispanics.<sup>30</sup> However, the antihypertensive and lipid-lowering treatment to prevent Heart Attack Trial demonstrated that Hispanic-whites had 20% higher odds of achieving BP control than non-Hispanic whites when provided with equal access to treatment at no cost in the clinical trial setting.<sup>31</sup> These results contrast with an examination of racial/ethnic disparities from 2003 to 2010 in the National Health and Nutrition Examination Survey (NHANES) which revealed that among those with hypertension, Mexican-Americans had the lowest levels of treatment and control compared with whites and blacks.<sup>32</sup> Health-care coverage in NHANES for those with uncontrolled hypertension was also lowest for Mexican-Americans (59.3%) compared with blacks (77.7%) and whites (89.4%). In Chile, a 1-year follow-up of the hypertensive population in a government-financed cardiovascular health programme revealed that 91.5% were on antihypertensive drug therapy and BP was controlled in 59.7% of patients, providing further evidence that removing financial barriers is an effective strategy for managing hypertension at the population level.<sup>33</sup> Our findings suggest that policy directed towards reducing the financial barrier to healthcare and medication will likely have a positive impact on the management of hypertension in Ireland.

Despite the availability of evidence-based clinical guidelines for the management of hypertension<sup>34</sup> and the acknowledgment that many hypertensive patients require multiple antihypertensive medications to control BP,<sup>35</sup> just over half of respondents in this study were treated with a combination of two or more antihypertensive medications. Non-adherence to medication regimes at an individual level or the absence of a structured programme of remuneration for control of BP at a population level may explain the low levels of treatment and control found in this study. Pay for performance remuneration for the management of chronic diseases, including hypertension is used in some countries, e.g. the Quality and Outcomes Framework in the UK.<sup>36</sup> Although no discernible effect of this system on hypertension-related clinical outcomes was identified in the UK, possibly due to performance targets being set too close to existing clinical practice,<sup>37</sup> it is reasonable to suggest that this is unlikely to be the case in Ireland where there is no routine clinical audit of hypertension management at a national level.

There is ongoing debate about how intensively hypertension should be treated in older adults, especially the oldest old and whether a target reduction in SBP (e.g. 10–20 mmHg)<sup>38</sup> or a target of <150/80 mmHg may be more beneficial<sup>39</sup> than the target level of SBP and DBP used in this study. While older adults were more likely to be on treatment for hypertension than younger adults, the finding that hypertension control is lower in the older age group suggests that

either control may be more difficult to achieve or that hypertension is not as aggressively treated in this age group. Better hypertension control in rural areas is an interesting finding which conflicts with consistent international evidence of poorer control in rural areas.<sup>40</sup> This finding may reflect health system differences, including the cost of primary care access in different areas in Ireland<sup>41</sup> and rural practices reporting fewer private patients;<sup>42</sup> this finding requires further investigation.

### What this study adds

This study provides the most comprehensive evidence on hypertension prevalence and burden in adults aged 50 years and older in Ireland. Monitoring the epidemiology of hypertension is a key component in addressing the burden of hypertension. The strengths of this study include the large nationally representative sample of community living adults, structured collection of data on a large number of covariates and the use of standardized protocols for measurements taken during the health assessment.

### Limitations of the study

Hypertension prevalence may be underestimated in our study as respondents are community living, thus excluding those in long-term residential care in whom hypertension is likely to be higher based on the age profile of residents.<sup>43</sup> Misclassification may have occurred in normotensive individuals whose BP tested high during the study, often termed ‘white coat hypertension’.<sup>44,45</sup> This effect would overestimate the true prevalence as white coat hypertension is estimated to occur in 15–30% of those with elevated office BP readings.<sup>46</sup> Equally, some participants with true hypertension may have been misclassified as normotensive, often termed ‘masked hypertension’.<sup>47</sup> Masked hypertension is estimated to occur in 8–23% of those with normal BP readings,<sup>48</sup> resulting in an underestimate of the prevalence of hypertension in this study. White coat hypertension and masked hypertension create difficulties in classifying hypertension based on single BP readings, as a result a minimum of two readings are required for epidemiological studies<sup>15</sup> and current clinical guidelines recommend ambulatory BP measurement to confirm a diagnosis of hypertension.<sup>34</sup>

### Conclusion

This study provides the most comprehensive estimate to date of hypertension prevalence, awareness, treatment and control in older adults in Ireland. The high prevalence of hypertension presents a major public health challenge which requires a multi-sectoral response aimed at achieving healthier lifestyles in the entire population, including weight management,

regular physical activity, restriction of salt and alcohol and smoking cessation. In addition to the population-wide focus, hypertension prevention in Ireland requires an ongoing commitment to early detection and evidence-based clinical management of those with a diagnosis of hypertension.

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