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Nursing-sensitive adverse events and missed nursing care in older hospitalised patients

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Declaration

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of PhD is entirely my own work, and that I have exercised reasonable care to ensure that the work is original and have conformed to the regulations on the use and declaration of Generative AI, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work. I hereby certify that no Generative Artificial Intelligence (Gen AI) tools have been used in the creation of the thesis.

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Abstract

Author

Anna Connolly

Thesis Title

Nursing-sensitive adverse events and missed nursing care in older hospitalised patients

Background

Nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium are predominantly but not exclusively affected by nursing care and are disproportionately experienced by older patients. They can result from missed nursing care, which is associated with nursing and resource shortages and increased care demands. Hospitals must consider and address the prevalence of missed care and nursing-sensitive adverse events to improve patient safety and healthcare quality.

Aims

The aim of this research was to understand and measure the rates of four specific nursing-sensitive adverse events and levels of missed nursing care in patients aged 65 and over in an acute hospital setting in Ireland.

Methods

A retrospective chart review of 1000 charts was used to conduct this quantitative study to determine adverse event rates and validate hospital administrative data. Using the chart data, logistic regression identified significant factors associated with the adverse events. The MISSCARE Surveys were used to gather nurses' and patients' perspectives of missed nursing care.

Results

There are various methodological approaches used to conduct chart reviews**.** An adverse event was identified in 231 admissions with 31.8% recorded within hospital administrative data. Speciality, age, number of diagnoses and procedures, ward moves, length of stay, sex, and admission place and times were significantly associated with adverse events. Mobilisation, oral care and communication were frequently missed. Significant reasons for missed care included inadequate staffing and urgent patient situations.

Conclusion

This study offers valuable insights for improving data accuracy and preventing adverse events and missed care. Strategies focused on vulnerable patients such as medical patients, older patients and those with longer lengths of stay and an increased number of procedures is required to reduce adverse events. This research demonstrates the need to prioritise nurse recruitment and retention strategies and highlights target areas for ensuring fundamental care delivery.

Chapter 1 : General Introduction

1.1 Introduction

"To be a nurse means to be many things at many times to many people" (Reising, 2019, p. 11).

Nurses play a vital role in the delivery of healthcare worldwide. It is difficult to describe the role of a nurse concisely due to the myriad of responsibilities and duties that nurses occupy. The promotion of health, prevention of illness and the care of the sick, disabled and dying are central to the role of a nurse (World Health Organization, 2024a). The provision of bedside care is a narrow definition of nursing as there are many other roles that nurses fulfil. In addition to their role in providing direct patient care, nurses focus on improving health by assuming educator, researcher and informatics specialist roles, among others (Reising, 2019). Daily, nurses are faced with conditions of uncertainty. Although their exposure to certain occupational hazards is considered to be within the nature of the job, there are additional physical, emotional and moral stresses that nurses are confronted with at work. Nurses are exposed to unique challenges where they are often faced with patients who are at the sickest and most vulnerable times of their lives (Ulrich, Rushton and Grady, 2020). It is in these times that nurses are expected to go beyond their clinical roles and fulfil additional caring roles by providing "a comforting hand, a compassionate touch, and a life-changing presence" (Love *et al.*, 2021, p. 87).

Evidently, nurses play an essential role in healthcare systems globally. Nevertheless, although nursing encompasses the largest occupational group in the health sector, making up 57% of all healthcare professionals, there is currently a global shortage of approximately 5.8 million nurses (World Health Organisation, 2025b). The shortage of nurses is particularly relevant in an Irish context with an increasing number of nurses considering emigration. Furthermore, Ireland relies heavily on international nurse recruitment, however with fluctuating nurse immigration rates and the increasing brain drain of those trained in Ireland, nurse retention and recruitment is of great concern (Humphries, Brugha and McGee, 2012; Hanlon and Humphries, 2024; Chima, Renjith and Humphries, 2026). Although there was a surge of non-EU migrant nurse inflow in 2022, following a period of continued decline from 2008-2015, EU migrant nurse inflow has substantially declined (Chima, Renjith and Humphries, 2026). These findings, coupled with the significant number of Irish-trained nurses emigrating in search of more favourable working conditions, demonstrate the urgent need to develop nurse workforce strategies focused on

training, recruiting and retaining domestic nurses, ethical international nurse recruitment and improving work environments and conditions. Nurses make a central contribution to patient safety (World Health Organization, 2020) however, a shortage of nurses poses a threat to patient safety given that inadequate staffing, amongst other variables, contributes to missed care or care that is left undone (Kalisch *et al.*, 2011).

A significant consequence of missed nursing care that has profound effects on patient safety is the occurrence of adverse events (Zhu *et al.*, 2019; Kalánková *et al.*, 2020). As the demand for nursing care exceeds the supply of care available, basic and fundamental nursing care may be missed due to the prioritisation of more urgent care. Older patients, aged 65 and older, are those who are most vulnerable to the effects of missed nursing care given their higher prevalence of co-morbidities and requirement of more complex nursing care (Merten *et al.*, 2013). The Failure to Maintain conceptual framework underpins the concept of missed nursing care as a contributing factor to the functional and cognitive decline in older patients. The four nursing-sensitive adverse events that are considered to be measurable indicators of this framework are pneumonia, delirium, urinary tract infections and pressure ulcers, again, all of which older patients are particularly vulnerable to in the event that fundamental and basic nursing care is missed (Bail and Grealish, 2016).

According to the Department of Health (2018), the monitoring of missed care and missed care events is essential in order to determine whether nurse staffing levels and skill mix in Ireland are sufficient enough to provide safe care and meet the needs of patients. Administrative healthcare data, such as the Hospital Inpatient Enquiry Data in Ireland have been recognised as a valuable source of information for measuring the relationship between nurse staffing and nursing-sensitive patient outcomes by the Department of Health (2018). If accurate, this data can be used to benchmark rates of patient safety incidents and make comparisons between hospitals and countries in order to highlight areas for improvement in relation to nurse staffing and resource allocation. The need for an effective performance improvement programme has been highlighted by the Irish Government. The Department of Health has recognised the importance of having accurate data in relation to the measurement and monitoring of nursing-sensitive adverse events in order to allocate necessary resources and define where changes in practice are required (Department of Health, 2018). In light of this, it was deemed appropriate

and important for this research to be conducted to further explore and gain a better understanding of nursing-sensitive adverse events and missed nursing care in an acute hospital setting in Ireland.

This study was conducted as part of a four-year project entitled COST2CARE which was funded by the Health Research Board (ILP-HSR-2022-009). As this research project is embedded within the wider COST2CARE project, the data collected as part of this wider project has also been used to inform the studies presented as part of this PhD thesis. Furthermore, the association between the research presented herein and the wider overall project has resulted in many output dissemination opportunities both nationally and internationally. In addition to the four publications presented within this PhD thesis, the outputs of this research have been presented at national and international conferences. A summary of the research outputs associated with this project are presented in Appendix A.

In order to set the research presented in this PhD thesis in the context of previously published literature within this field of research, this chapter will provide a brief overview and introduction of the overall research topic. This chapter will explore patient safety in the context of nursing care. Firstly, the concept of missed nursing care will be explored. The factors that influence missed nursing care and the consequences of care that is missed such as nursing-sensitive adverse events will be discussed. The vulnerability of older patients to nursing-sensitive adverse events will be outlined and a focus will be placed on the monitoring and measurement of such patient safety outcomes in administrative data. Furthermore, the challenges associated with using administrative healthcare data for research will be outlined and the need to validate such datasets will be highlighted. Various methods of validating rates of adverse events in administrative data will also be discussed, with a particular focus on the retrospective chart review and the methodological approaches used to conduct such chart reviews. Finally, this review will conclude with a brief discussion of the use of 'co-approaches', such as co-production, in healthcare settings to improve patient safety and healthcare quality.

1.2 Patient safety in the context of nursing care

Nurses play an integral role in the healthcare system. They are often referred to as the unsung heroes of health care given their critical role in organising and applying health actions both through the delivery of care at the frontline and at managerial levels to promote health, prevent

illness and provide care for ill, disabled and dying patients (World Health Organization, 2024a). Nurses make up the largest occupational group in the healthcare system by accounting for an estimated 57% of all health professionals (World Health Organisation, 2025b). However, an increased demand for care due to population growth has coincided with a decreased supply of nurses due to an ageing health care workforce and high rates of nurses leaving employment and has resulted in a global shortage of nurses (World Health Organization, 2020). A shortage of nurses is widely recognised as a factor that contributes to poor patient outcomes. Sufficient and safe nurse staffing levels are key to maintaining and improving patient safety (McHugh *et al.*, 2021; Department of Health, 2022). Patient safety is among the many health priorities to which nurses make a central contribution by providing direct care to patients, monitoring for and responding to clinical deterioration through communication and regular interaction with the patient themselves, their families and all members of the health care team such as physicians and pharmacists (Phillips, Peck Malliaris and Bakerjian, 2021).

1.3 Missed nursing care

Nurse shortages and staffing levels, in addition to other factors such as labour resources skills mix, the unavailability of material resources, care demand and communication issues, pose a threat to patient safety. These factors contribute to a concept known as missed nursing care when they interfere with the delivery of adequate fundamental nursing care (Chaboyer *et al.*, 2021). Missed nursing care, as conceptualised within the Missed Nursing Care Model, is a universal phenomenon that refers to the omission or delay of certain aspects of essential care on a regular basis (Kalisch, Landstrom and Hinshaw, 2009). These aspects of nursing care are often missed due to inadequate staffing, time constraints and the demand for care exceeding the supply of care which can be delivered due to increased patient acuity. The areas of missed care that are underpinned by this concept and often left undone are ambulation, turning, feedings, patient education, discharge planning, the provision of emotional support, hygiene care, documentation of intake and outputs and patient monitoring (Kalisch, 2006). In addition to the threat posed to patient safety, the consequences of missed nursing care also have a profound impact on nurses, patients and organizations (Janatolmakan and Khatony, 2022).

1.4 Factors that influence missed nursing care

Missed nursing care has been shown to be influenced by and associated with staff levels, skill mix, the availability of material resources, patient acuity and teamwork and communication (Chaboyer *et al.*, 2021). Implicit rationing of nursing care, defined by Schubert *et al.* (2008) as the withholding or inability to complete necessary nursing care due to inadequate time and staffing resources, is also associated and closely aligned with missed nursing care. Lower staffing levels and rationed care have been shown to result in an increased number of care interventions missed and a higher number of adverse events experienced by patients. Lower nurse-patient ratios are associated with higher levels of rationed nursing care, with an increased level of nursing care withheld and failure to complete all nursing duties. Furthermore, nurses who reported higher levels of rationed nursing care were more frequently involved in patient adverse events (Zhu *et al.*, 2019).

According to the Missed Nursing Care Model (Kalisch, Landstrom and Hinshaw, 2009), the various attribute categories associated with missed nursing care, as reported by nurses, include antecedents that are external to nurses. These antecedents influence nurse decision-making processes in relation to the prioritisation of care interventions, elements of the nursing process such as assessment, diagnosis, planning, implementation of interventions and evaluation and nurse's internal processes such as team norms, decision making processes, internal values and beliefs and habits. The antecedents referred to in this model include the number of staff available to provide care, the material resources available and relationship and communication factors that influence ability of nurses to provide care to patients. This model suggests that the actions taken by nurses to fulfil their duty to promote health, prevent illness and provide care are caused by these antecedents, integrated in the nursing process and are influenced by nurses' internal processes.

Based on the results of the MISSCARE survey conducted by Kalisch *et al.* (2011), inadequate staffing, followed by lack of material resources and communication or teamwork issues, respectively, were identified as the most common reason for missed care. Similarly, a literature review conducted by Tamburello, Borneo and Holden (2023) reported a significant association between lower nurse staffing levels and worse patient outcomes. Furthermore, nurses are also more likely to report care left undone or missed care when working on shifts with low nurse

staffing levels (Griffiths *et al.*, 2018). In further support of the association between nurse staffing and patient outcomes, Dall'Ora et al. (2022) have demonstrated that higher nurse staffing contributes to better patient outcomes. In light of such findings, and in order to improve patient safety and healthcare quality, hospitals must give consideration to these reasons for missed care to reduce the prevalence of care being left undone (Kalisch *et al.*, 2011). Collecting data on nurses' perspectives on the reasons for missed nursing care is important and should be investigated in all care settings in order to provide nurses and nurse managers with information that can aid in managing the level of missed nursing care in their hospitals. This will in-turn help to reduce the prevalence of patient safety incidents and improve patient satisfaction and healthcare quality (Amrolahi-Mishavan *et al.*, 2022).

1.5 Consequences of missed nursing care

Missed nursing care is associated with nurse-related, patient-related and organisation-related consequences (Janatolmakan and Khatony, 2022). Moral distress and job dissatisfaction are nurse-related outcomes associated with missed nursing care. The inability to carry out nursing interventions or complete nursing duties in a timely manner can be distressing for many nurses as it goes against the principles of their profession and leaves them unable to fulfil their duties to their patients (Janatolmakan and Khatony, 2022). Similar to the moral distress experienced by nurses in relation to missed nursing care, care left undone has also been linked to emotional health outcomes such as psychological exhaustion or burnout (Stemmer *et al.*, 2022). As a result, decreased job satisfaction has commonly been associated with missed nursing care (Cho *et al.*, 2020; Smith, Rogowski and Lake, 2020; Ergezen and Kol, 2021; Stemmer *et al.*, 2022). Based on a review of quantitative studies, Papastavrou, Andreou and Efstathiou (2014) identified the rationing of nursing care as a predictor of job satisfaction for nurses with levels of job satisfaction decreasing as levels of missed nursing care increase. This situation has also been associated with nurses' intent to leave the nursing profession (Tschannen, Kalisch and Lee, 2010; Jones, Hamilton and Murry, 2015; Drennan, 2025). Given the current global shortage of nurses (World Health Organisation, 2025b), it is imperative that health workforce sustainability is prioritised and missed nursing care is addressed in order to attract and retain nursing staff and maintain and improve the quality of patient care (Tschannen, Kalisch and Lee, 2010; Papastavrou, Andreou and Efstathiou, 2014; Stemmer *et al.*, 2022).

In addition to having adverse consequences for nurses, missed nursing care is also associated with patient-related outcomes such as decreased quality of nursing care and patient dissatisfaction (Kalánková *et al.*, 2020; Janatolmakan and Khatony, 2022). According to Janatolmakan and Khatony (2022), the decreased quality of nursing care provided to patients resulted in compromised patient safety, prolonged length of stay in hospital and, in some cases, death. Additionally, patients who experienced a poorer quality of care due to rationed nursing care are undoubtedly more dissatisfied with their experience in hospital. Furthermore, another major patient-related consequence of missed nursing care is the occurrence of adverse events (Kalánková *et al.*, 2020; Chaboyer *et al.*, 2021; Willis and Brady, 2021). Medication errors, falls, nosocomial infections, pressure ulcers and critical incidents are some of the adverse events that have been shown to be associated with rationed and missed nursing care (Schubert *et al.*, 2008; Willis and Brady, 2021). A more extensive group of 14 adverse events, including pressure ulcers, urinary tract infections (UTIs) and hospital acquired pneumonia, have previously been identified by Needleman *et al.* (2002) as nursing-sensitive outcomes or nursing-sensitive adverse events. They are patient outcomes that are affected by the processes of nursing care but for which nursing is not solely responsible (National Quality Forum, 2004). Given that these outcomes are ultimately experienced by patients, consideration and inclusion of the patient perspective has been identified as an important factor in healthcare quality improvement research (Bagnasco *et al.*, 2020; Chiappinotto, Coppe and Palese, 2023).

Finally, missed nursing care also has organisation-related consequences. Absenteeism, staff turnover, decreased credibility and increased hospital costs are examples of such organisation-related consequences of missed nursing care (Janatolmakan and Khatony, 2022). Heavy workloads and the strain of excessive work can impact nurses' physical and mental health and lead to absenteeism (Ticharwa, Cope and Murray, 2019). In the context of the COVID-19 pandemic, staff shortages, which placed high pressure on nurses, contributed to the inability to provide adequate care to all patients and resulted in further nurse absenteeism (Janatolmakan and Khatony, 2022). Occupational stress has also been linked to high levels of nurse turnover (Chegini, Asghari Jafarabadi and Kakemam, 2019), a factor that contributes to increased cost, reduced productivity and reduced human capital (Janatolmakan and Khatony, 2022). The credibility of hospitals is compromised due to missed nursing care when patients are dissatisfied with the level of care they receive and therefore, reflect poorly on the experience of their

hospitalisation (Aiken *et al.*, 2021). Organisational outcomes such as increased length of stay and readmission to hospital have also been associated with missed nursing care (Chaboyer *et al.*, 2021). These outcomes contribute to increased hospital costs due to increased demand for labour resources, medication, facilities and equipment (Janatolmakan and Khatony, 2022).

Evidently, missed nursing care has profound consequences for patients, nurses and hospitals. These consequences highlight the need to reduce missed nursing care and improve healthcare quality. Each of these consequences are important factors that should be considered when developing improvement strategies, particularly in relation to staff recruitment and retention.

1.6 Vulnerability of older patients to the effects of missed nursing care

Adverse events are a consequence of missed nursing care to which older patients are particularly vulnerable. In-hospital adverse events occur significantly more often in older patients given that this age cohort of patients tend to have a higher prevalence of co-morbidities and emergency hospitalisations in comparison to younger patients (Merten *et al.*, 2013; Schattner, 2023). In addition to socioeconomic, race, ethnicity, cognitive, functional and organisational factors, an increased number of medical diagnoses and medications contribute to the complexity of the care that older patients require. In the event that the demand for nursing care exceeds the supply of care available, adequate care may not be delivered to patients with complex care needs. In such situations, rationing of basic but fundamental nursing can occur and result in the development of nursing-sensitive adverse events. This phenomenon is underpinned by the 'Failure to Maintain' conceptual framework that indicates the rationing of care by nurses (Bail and Grealish, 2016). Delirium, in addition to pressure ulcers, UTIs and hospital-acquired pneumonia as nursing-sensitive patient outcomes (Needleman *et al.*, 2002), are four key measurable indicators of the F2M conceptual framework. Missed nursing care or rationing of basic but fundamental nursing care gives rise to these four adverse events and contributes to functional and cognitive decline in older hospitalised patients (Bail and Grealish, 2016). As these adverse events are used as measures of the quality of healthcare, their accurate recording and monitoring is essential in order to establish baseline levels of patient safety from which improvement strategies can be developed (World Health Organization, 2021).

1.7 Measuring and monitoring rates of adverse events using administrative data

Administrative healthcare data are recognised as potentially valuable sources of information on patient safety and effective tools for the monitoring and measurement of patient safety incidents such as adverse events, however the accuracy of these data is central to their effectiveness (Raleigh *et al.*, 2008; Boulanger, MacLaurin and Quach, 2025). These datasets provide information on each encounter that a patient has with the healthcare system whether it be in relation to a consultation they had with a physician, a procedure they underwent, an admission to hospital or a diagnosis they received (Cadarette and Wong, 2015). The events of a patient's stay in hospital are documented in their medical chart and upon discharge, their physician completes a discharge summary which provides a brief synopsis of their stay in hospital. This information is transferred to the medical records or health information department in the hospital. Administrative healthcare data is then generated when clinical coders assign alphanumeric codes to the diagnoses, procedures, complications and hospital services used, as documented in the patient's chart (O'Malley *et al.*, 2005). The generation of these datasets provides a rich source of primary data relating to the specific events that take place during a patient's stay in hospital.

The potential of these datasets to be used to monitor and measure patient safety has been demonstrated by the use of administrative data-based adverse event detection tools in the United States and Australia. The Agency for Healthcare Research and Quality in the United States developed Patient Safety Indicators using administrative data to capture adverse events which pose a threat to patient safety and may be of a preventable nature (Tokareva and Romano, 2024). These measures indicate patient safety in acute hospital settings and demonstrate the potential utility of administrative data in the measurement of patient safety. Furthermore, the Classification of Hospital-acquired Diagnoses (CHADx), a tool developed to allow Australian hospitals to monitor hospital-acquired adverse events (Jackson *et al.*, 2009), also demonstrates the potential for administrative datasets to provide valuable information on patient safety within hospital settings.

Although informing research is often not the primary purpose of administrative healthcare data, these datasets are increasingly being used for research purposes given that they provide readily available results and contribute to strengths such as low study costs, large sample sizes and

increased generalisability (Welk and Kwong, 2017). In an Irish context, Hospital In-patient Enquiry Scheme (HIPE) is a health information system that gathers demographic, clinical and administrative data on discharges and deaths from acute hospitals in Ireland. The statistics generated by this system are commonly used to inform epidemiological, quality assurance and market research. The Department of Health and the Health Service Executive in Ireland also use HIPE data to inform their planning and provision and monitoring of healthcare services in acute hospital settings (Healthcare Pricing Office, 2020b).

Given their increased use in informing research and health policy, it is vital that administrative healthcare data are accurate and robust. As these datasets are used to inform decision making and health policy, monitor diseases, plan health services, improve population health and provide benchmarking rates, confidence in all aspects of their quality is essential. Therefore, as good-quality healthcare information is essential to the provision and improvement of safe and high-quality patient care, the accuracy, validity, reliability and completeness of these datasets must be ensured (Health Informational Quality Authority, 2024).

1.8 Challenges associated with using administrative data to inform research and health policy

In order to use administrative healthcare data to inform health research and policy, it is evident that such datasets must be reliable. Although administrative data can be rich sources of patient information, there are some challenges associated with them. The limitations of administrative healthcare data include the lack of data fields available to answer clinical research questions, incomplete data, missing and duplicate data on visits to hospital and variability of data capture systems (McGuckin *et al.*, 2022). Furthermore, limited and variable accuracy has been identified as a challenge associated with using administrative data for benchmarking and surveillance of adverse events (Van Mourik *et al.*, 2015). Although coding of procedures and primary diagnoses are generally reported to be accurate, the inaccurate coding of secondary diagnoses has been noted as a challenge associated with using administrative data to monitor rates of adverse events as these rates can often be underestimated due to incomplete coding (Raleigh *et al.*, 2008). The inaccuracy of administrative data for recording adverse events has also been documented by Kim *et al.* (2022). More specifically, Boulanger et al. (2025) have highlighted the potential inaccuracies of administrative data for recording hospital-acquired infection and have

demonstrated various challenges associated with their recording, such as physician documentation-related and coder-related barriers, motivational, technical, organizational and systemic barriers. These challenges further reiterate the need to validate such administrative datasets to ensure that they are accurate and robust and that they can be used to fulfil their potential in informing health research and policy.

1.9 Methods of validating rates of adverse events in administrative data

Calls for validation studies to explore the reliability of administrative data and verify the accuracy of these datasets for recording rates of adverse events have been made in response to findings relating to imprecise rates of adverse events (Raleigh *et al.*, 2008; Van Mourik *et al.*, 2015).

A commonly used method of validating administrative data is through retrospective chart review by manually comparing the coded data to the data recorded in a patient's healthcare record (Nissen et al., 2019). Patient charts have often been referred to as the 'gold standard' reference point in many validation studies (Tirschwell and Longstreth, 2002; Goto *et al.*, 2014; Maass *et al.*, 2015) and retrospective chart reviews have been identified as promising methods of identifying and assessing adverse events (Bachnick *et al.*, 2024). Therefore retrospective chart review has commonly been used to measure healthcare quality and inpatient care (Vassar and Holzmann, 2013). Although there are limitations, such as high costs and subjectivity, associated with retrospective chart review, this method of validating adverse events is more feasible than other methods such as observational studies. The retrospective chart review method utilises readily available data and is less time-consuming and complex in terms of confidentiality and bias than that of its counterpart methods such as observation of patient care and the use of error reporting systems (Thomas and Petersen, 2003).

1.10 Chart review methodological approaches

There are various methodological approaches that can be used to conduct reviews of patient charts. The Harvard Medical Practice Study (HMPS) was conducted by Brennan et al. (1991). This resulted in the development of a method for measuring incidence rates of adverse events through chart reviews and has since been used to conduct validation studies and verify rates of such patient safety incidents. This two-stage approach involves a nurse review of patient notes for triggers that suggest the occurrence of an adverse event, followed by a physician review of

triggered charts for the recording of any adverse events using set definitions. Another methodological approach to chart reviewing known as The Global Trigger Tool (GTT) was developed by the Institute for Healthcare Improvement in response to the demand for a less labour-intensive approach to reviewing patient charts for assessing patient safety and identifying adverse events. Stage one of the GTT process involves a screening phase for a more comprehensive list of triggers than the HMPS, however the duration of this stage is limited to 20 minutes. In the next stage, a physician reviews the specific trigger or potential incidence of an adverse event, rather than the entire chart, and uses broader definitions to identify the occurrence of an adverse event (Rafter *et al.*, 2015).

1.11 Co-production for improving patient safety and healthcare quality

Involvement of patients and healthcare workers has been increasingly recognized as an effective method of improving the quality of care in healthcare settings (Batalden *et al.*, 2016; Vennik *et al.*, 2016; Williams and Caley, 2020). Batalden *et al.* (2016) propose a conceptual model of healthcare service co-production that recognizes patients and healthcare professionals as participants within healthcare systems who have agency to influence and contribute to the further development of healthcare services. Their model demonstrates how the broader aim of good health for all can be achieved by coproduced healthcare services.

In terms of research, 'Co' approaches are promising methods for enabling knowledge mobilisation (Grindell *et al.*, 2022). Knowledge co-production allows academics and practitioners to combine their skills in the research process (McCabe *et al.*, 2021) and provides a framework that can help to bridge the gap between research and practice (Banks *et al.*, 2016). The goal of knowledge exchange in co-production is to encourage collaborative research and to promote the application of research to policy and practice. Working in partnership with and facilitating interactions between patients, healthcare professionals, organisations, researchers and policy makers helps to align all stakeholders agendas and increase the use of research findings (World Health Organization, 2004). Co-production should continue to be embraced given its potential to improve the quality of research and contribute to policy development and implementation which may result in the enhancement of healthcare services (Oliver, Kothari and Mays, 2019). Effective co-production processes between researchers and healthcare professionals have demonstrated promising results in improving the understanding of health

systems, enhancing research outputs and implementing interventions to improve healthcare team performance, patient safety and patient outcomes (Ward *et al.*, 2018; Martin *et al.*, 2022).

1.12 Thesis Aims and Objectives

This PhD research study is situated within a wider four-year research project titled 'COST2CARE', which is funded by the health Research Board (HRB) in Ireland. As this research study is encompassed within the COST2CARE project, the data collected for the wider project has also been used to inform this current study. The overall aim of the COST2CARE project is to demonstrate the potential for safer hospital care and reduced healthcare costs associated with older patients in acute hospitals in Ireland through routine measurement of missed nursing care, and sustainable and accurate reporting of nursing-sensitive adverse events using routinely collected hospital discharge data.

1.12.1 Aim of the PhD research

The overall aim of this PhD research was to understand and measure the rates of nursing-sensitive adverse events and levels of missed nursing care in patients aged 65 and over in an acute hospital setting in Ireland

1.12.2 Specific objectives of each publication

The specific objectives of the research are as follows:

1) To determine an appropriate method for validating rates of nursing-sensitive adverse events in administrative healthcare data by understanding the methodological approaches used to conduct chart review validation studies.
2) To conduct a chart review to determine the rates of nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium in older adults in an acute hospital setting in Ireland.
3) To validate the recorded rates of the four nursing-sensitive adverse events in Hospital In-patient Enquiry (HIPE) data by comparing the chart review data and HIPE data.
4) To identify the risk factors associated with the occurrence of the four specific nursing-sensitive adverse events.
5) To measure missed nursing care from both nurses' and patients' perspectives with a focus on identifying the most frequently missed care tasks and the contributing factors.

Publication 1 - A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data

This study sought to meet objective 1) by determining an appropriate method for conducting the chart review component of this study by presenting an overview of the methodological approaches and strategies used to validate rates of adverse events in administrative data through patient chart review. The research also sought to understand the extent to which administrative data can accurately record rates of adverse events by presenting an overview of the level of accuracy, as identified through patient chart review, of administrative data for recording rates of adverse events.

Publication 2 – Validating adverse events in administrative healthcare data in Ireland: a retrospective chart review study

This study sought to meet objective 2) by conducting a chart review of the medical records of patients aged 65 and over in an acute hospital setting in Ireland to identify the rates of the four key Failure to Maintain adverse events: pneumonia, UTI, pressure ulcers and delirium. This study also sought to meet objective 3) by exploring the potential for administrative data to provide accurate information on the rates of adverse events by determining how these nursing-sensitive adverse events, in patients aged 65 and over, are currently represented in routinely collected hospital discharge data in Ireland. The rates of these nursing-sensitive adverse events within the Hospital Inpatient Enquiry (HIPE) data were validated through comparison with the retrospective chart review data.

Publication 3 – Risk factors associated with hospital-acquired nursing-sensitive adverse events in older patients in an acute hospital setting in Ireland

This study sought to meet objective 4) by identifying the factors associated with the nursing-sensitive adverse events in patients aged 65 and over in an acute hospital setting in Ireland and determining the relationship between the presence of a nursing-sensitive adverse event, a patient's discharge situation and in-hospital mortality.

Publication 4 – Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework

This study sought to meet objective 5) by exploring and providing a description of both nurse-reported and patient-reported perceptions of the frequency of missed nursing care. This research also sought to meet this objective by estimating the factors that contribute to missed nursing care from the nurse perspective. Furthermore, a secondary objective of this study was to identify to what extent the *MISSCARE* measurement tools can represent the elements outlined within the Fundamentals of Care framework.

1.13 Thesis structure

The objectives of this research, which have been outlined in the previous section, have been addressed by the research presented in chapters 3-6. The studies presented in chapter 3, 4, 5 and 6 have been published. The structure of the remaining chapters in this thesis is presented below (Figure 1.1).

Chapter 2: The methodology used to conduct this research is outlined in chapter 2. The philosophical underpinnings of the research are presented in addition to an outline of the theoretical frameworks that were used to guide this research. Furthermore, this chapter provides an overview of the specific methods used to meet each of the objectives of this research and the procedures followed to carry out each of the study presented. Finally, an outline of the ethical considerations and processes involved in obtaining ethical approval for this research is also provided in the methodology chapter.

Chapter 3: The study presented in chapter 3 is a scoping review of the methodological approaches used to conduct chart review validation studies. The title of the study presented in this chapter is "A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data". This study was conducted to meet the first set of objectives of this research. This research contributed to the determination of the most appropriate approach to chart reviewing and was used to inform the study presented in chapter 4.

Chapter 4: The study presented in chapter four was conducted to meet the second and third sets of objectives of this research. The title of this study is "Validating adverse events in administrative healthcare data in Ireland: a retrospective chart review study". This study utilised a chart review methodology to identify the rates of pneumonia, urinary tract infections, pressure

ulcers and delirium in patients aged 65 years and over in an acute hospital setting and validated the rates of these events within the hospital administrative data. Additionally, the chart review data that was collected as part of this study was used to inform the research presented in chapter 5.

Chapter 5: The study presented in chapter 5 sought to meet the fourth set of objectives of this research. The title of this study is "Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review". The risk factors associated with the four studied nursing-sensitive adverse events were investigated in the study presented in this chapter.

Chapter 6: The work presented in chapter 6 was undertaken to meet the fifth and final set of objectives of this research. Given the association between the missed nursing care and nursing-sensitive adverse events, the research presented in this chapter measured missed nursing care from both nurses' and patients' perspectives and identified the types of care that are most frequently missed and the reasons why care interventions are often missed. The title of the study presented in this chapter is "Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework: A cross-sectional survey".

Chapter 7: The findings of the published papers which comprised chapters 3-6 have been synthesised and presented in chapter 7. The findings of these studies have been considered in relation to previous literature and the contribution of this research to existing knowledge has been demonstrated in this chapter.

Chapter 8: The overall strengths and limitations of the research are presented in chapter 8. Furthermore, the future research implications and the clinical and policy implications of this research have also been outlined in this chapter. Finally, the overall contribution of the work presented in this thesis to the field of research on nursing-sensitive adverse events, missed nursing care, patient safety and healthcare quality improvement has been highlighted in this chapter through a series of final concluding statements.

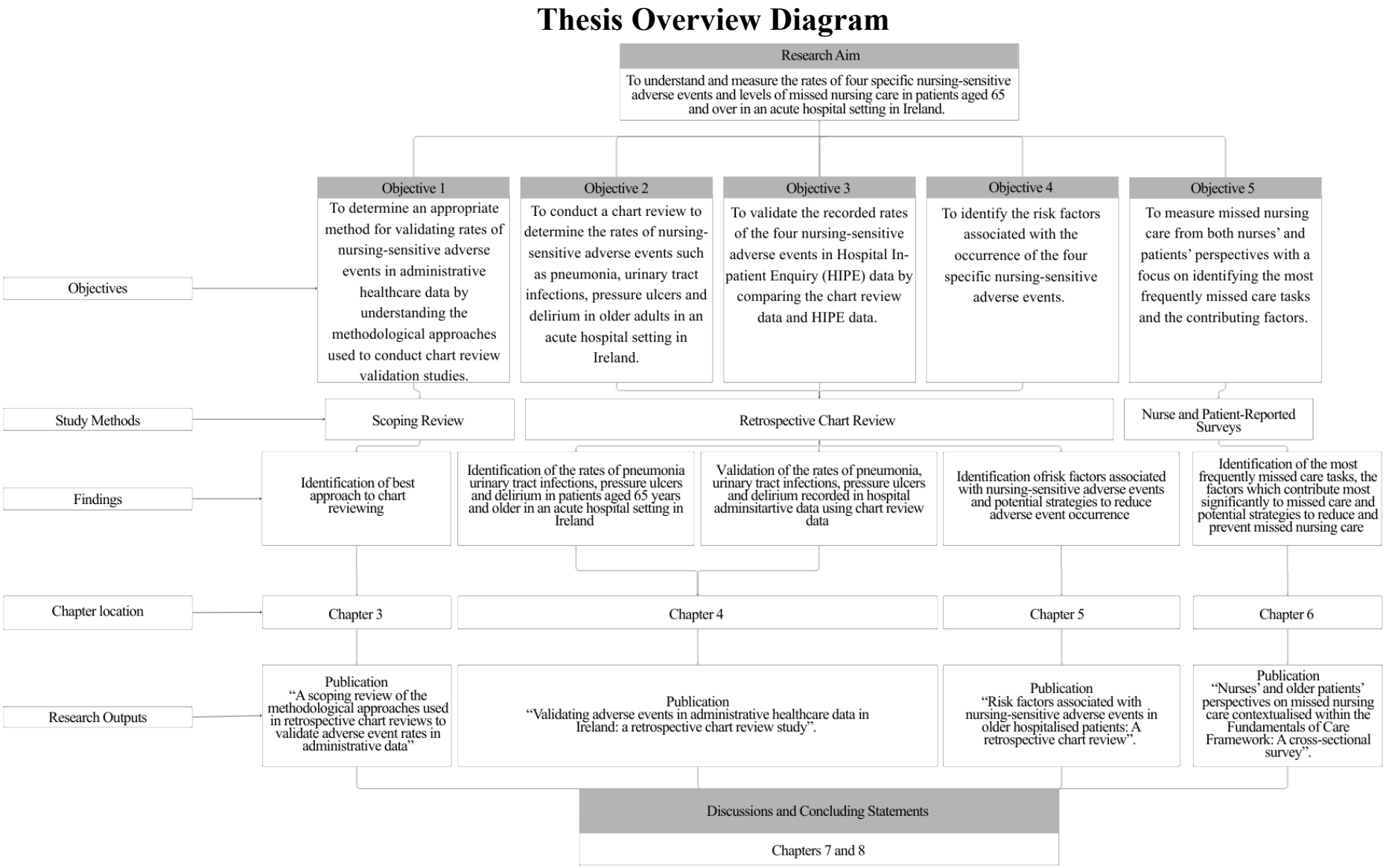


Figure 1.1 Thesis Overview Diagram

1.14 Conclusion

In conclusion, it is clear that nursing care is focal to patient safety. Missed nursing care and care left undone by nurses due to time constraints, understaffing and lack of available resources compromises patient safety and can, in some cases, lead to nursing-sensitive adverse events. The reporting, recording and monitoring of patient safety incidents is key to improving patient safety and healthcare quality. Although administrative healthcare data, such as the HIPE data, are a rich source of patient information, there are issues in relation to the accuracy of these datasets for recording information in relation to secondary diagnoses and more specifically, nursing-sensitive adverse events or patient safety incidents. Validation of the rates of adverse events in these datasets is necessary, and the retrospective chart review provides an optimal method of carrying out such validation. This provides clear rationale for conducting this research and investigating the accuracy of administrative data in Ireland to ensure that these datasets can be used for benchmarking and research purposes for the improvement of patient safety and healthcare quality. Furthermore, the benefits of co-approaches in improving healthcare quality have been increasingly recognised, therefore employing a co-productive approach to improving patient safety and the quality of care is warranted. In order to implement change and improve healthcare quality, listening to the voices of those at the forefront of care delivery is essential. Also, although nursing care is central to the prevention of patient safety incidents, they are ultimately experienced by the patient, therefore the voice of the patient is also key to understanding missed nursing care in hospital settings. This also provides clear rationale for this research and for further exploration of patient and nurse perspectives on missed nursing care in acute hospital settings in Ireland.

Chapter 2 : Methodology

2.1 Chapter introduction

This chapter provides an overview of the methodological approaches used to conduct this research. The philosophical underpinnings of this study are outlined with a discussion on the positivist approach to research. Furthermore, an overview of the quantitative approach to research is outlined with an emphasis placed on the deductive nature of the study. The theoretical frameworks and concepts that have guided this research have also been discussed, in addition to a description of the two main data collection methods employed to conduct this study, the chart review and nurse and patient-reported surveys. In order to provide context to the setting within which this research was conducted, an overview of the characteristics of the participating hospital have been provided. The methods used to meet each of the objectives of this project has been outlined and the processes used to pilot the chart review and surveys has been illustrated. The overall procedure used to carry out this research is outlined and the public and patient involvement aspect of the study has been described. Finally, this chapter concludes with a description of the ethical considerations and processes that were undertaken in order to obtain ethical approval to conduct this research.

2.2 Philosophical underpinnings

Positivism is the school of thought within which quantitative research is grounded (Pierce, 2013). Therefore, as this research uses a quantitative approach to collecting and analysing data, the study's research design is situated within a positivist paradigm. The principal methods used in a positivist approach to research include the collection and analysis of numerical data in order to explain and understand phenomena in real-world situations. The positivist approach was first used by the French philosopher, Auguste Comte, who argued that the aim of social research was to explore human behaviour through the collection and analysis of data derived from measurable and observable evidence. He endeavoured to establish observable empirical associations between variables or phenomena (Rolfe, 2013).

The positivist approach to the study of people is underpinned by the identification of fixed laws which govern human's thoughts, feelings and behaviours. A positivist approach argues that the discovery of these laws allows social scientists to predict and control humans actions (Rolfe, 2013). The positivist approach places emphasis on the use of these laws to explain human and

social behaviour. It is further argued that these laws can accurately predict the probability of the occurrence of specific phenomena (Parahoo, 2014). A positivist approach is appropriate for this study given that this research sought to explore the predictive nature of the variables collected during the chart review phase of the project in relation to the development of nursing-sensitive adverse events.

Positivism offers an approach that allows for the objective measurement of phenomena and is the philosophical approach to scientific research that is most commonly used in epidemiological studies (Bruce, Pope and Stanistreet, 2018). Given that this research sought to explore the rates of nursing-sensitive adverse events in a specific population of patients aged 65 years and identify the determinants of such outcomes for patients, a positivist approach was deemed appropriate.

Positivism places emphasis on the use of empirical data to understand and explore phenomena (Pierce, 2013). This philosophical approach aligns with the objectives of this research which involve the goal of learning and developing understanding of phenomena from gathered and collected data. The measurement and conversion of observations into numbers is central to empirical analysis (Cunningham, Weathington and Pittenger, 2013) and is an appropriate approach which meets the objectives of this research.

2.3 The quantitative approach

A quantitative approach was used to conduct this research. Quantitative health research emerged from the combination of two strands of thought: descriptive, survey-based social enquiry and controlled experimentation. While there are many definitions of quantitative research, there is general consensus that quantitative research refers to research that involves the collection and analysis of numerical data (Rolfe, 2013). The quantitative approach stems from a philosophical paradigm that views human behaviour as phenomena that can be objectively studied and measured. As the main purpose of quantitative research is the objective measurement of variables and concepts and the examination of the relationship between such variables by numerical and statistical procedures (Parahoo, 2014), this was deemed the most appropriate approach for this research study.

Quantitative approaches to research are standardised and structured and produce outcomes that are numerical (Ab Rahman, 2021). Given that a main interest of this research was to identify

the numerical rates of nursing-sensitive adverse events using a structured chart review, a quantitative approach was considered appropriate. Quantitative approaches to research are focused on the collection and interpretation of statistics and by nature, a quantitative approach to research suggests that the information collected will be quantifiable (Pierce, 2013). Therefore, as this study sought to quantify the rates of nursing-sensitive adverse events recorded within patients' medical charts and within routinely collected hospital discharge data, a quantitative approach was used. Furthermore, as the research also aimed to identify the frequency of missed nursing care, a quantitative approach was deemed appropriate.

A deductive quantitative approach was employed in the study. Deductive approaches to research test ideas or hypotheses and can be used to assess whether variables are correlated or whether there is a relationship between them (Parahoo, 2014). The deductive approach involves establishing an idea and then using the research process to obtain data and knowledge (Pierce, 2013).

2.4 Theoretical frameworks and underpinnings

This research has been guided by theoretical frameworks and concepts such as Failure to Maintain, missed nursing care, the Fundamentals of Care Framework and the holistic nature of nursing care. These frameworks and concepts have provided the foundation upon which this research has been built. As this study sought to measure nursing-sensitive adverse events and missed nursing care in older patients in an acute hospital setting, it seemed appropriate to apply the Failure to Maintain theory to this research to explore four specific nursing-sensitive adverse events that occur when the demand for care exceeds supply. As these events occur in environments where fundamental elements of nursing care are missed on a regular basis, the missed nursing care model provided a suitable basis to support this research. The Fundamentals of Care Framework was also used to guide this research as it encompasses the core elements involved in providing adequate, safe and high-quality care to patients. Given that the Fundamentals of Care Framework is grounded in holism with its focus on the multidimensional aspect of nursing, the concept of holistic nursing was also considered to be an important theoretical underpinning of this research.

2.4.1 Failure to Maintain

The research presented in this thesis is underpinned by Bail and Grealish's (2016) theoretical proposition of Failure to Maintain as a conceptual framework which demonstrates the implicit rationing of nursing care. The Failure to Maintain theory proposes that the nursing care that is required for older patients with complex care needs is often missed when the demand for care exceeds the supply of care available as a result of inadequate nurse staffing levels, insufficient skills mix and increased patient acuity. The theory further proposes that this missed care is associated with the functional and cognitive decline of these patients during their hospitalisation. The Failure to Maintain a patient's level of functioning throughout their hospitalisation contributes to the development of four key complications which commonly occur in older hospitalised patients.

The Failure to Maintain theory builds upon two previous research lines. It emerged as an extension of the "failure to rescue" and implicit care rationing concepts. The term failure to rescue refers to the death of a patient following an adverse event or complication that was acquired during their hospital stay (Silber *et al.*, 1992). The concept of Failure to Maintain aligns with the failure to rescue concept in that they are both associated with measurable outcomes that can be seen as indicators of quality and safety within hospital settings.

Implicit rationing of nursing care refers to nursing care that is deemed necessary for the patient but is left undone due to time and resource constraints. Although all aspects of nursing care may be deemed necessary for the patient, in settings where time and resources are limited, nurses must prioritise certain care interventions above others, resulting in care being missed (Kalisch, Landstrom and Hinshaw, 2009), left undone (Aiken *et al.*, 2001), implicitly rationed (Schubert *et al.*, 2008), unfinished (Sochalski, 2004) or incomplete (Kalánková *et al.*, 2020).

The Failure to Maintain conceptual framework puts forward the theory that nursing care that is rationed results in a failure to maintain physiological functioning in older patients and ultimately leads to the development of quantifiable complications that have high cost implications for both patients and healthcare systems. The four nursing-sensitive adverse events that commonly occur in older patients and are indicators of the Failure to Maintain framework include pneumonia, urinary tract infections, pressure ulcers and delirium (Bail and Grealish, 2016).

2.4.2 Missed Nursing Care

Although first recognised as care left undone, the concept of missed care has adopted various nomenclature through its global exploration and has become widely recognised under terms such as unfinished care, implicit care rationing, task incompletion and missed nursing care (Bail and Grealish, 2016). Missed nursing care was initially identified by Kalisch (2006) and further conceptualised within the Missed Nursing Care Model which demonstrates the antecedents and consequences of missed nursing care (Kalisch, Landstrom and Hinshaw, 2009) (Figure 2.1). The antecedents outlined in this model include labour resources, material resources and communication. These antecedents interact with nursing processes and are filtered by nurses' internal processes and therefore, may result in fundamental care interventions being missed. The consequences of missed nursing care in relation to patient outcomes, as demonstrated in the Missed Nursing Care Model, highlight the threat that omitted or delayed care poses to patient safety.

This research is also underpinned by the concept of missed nursing care and the Missed Nursing Care Model. Given the close association between missed nursing care, Failure to Maintain and the onset of adverse events (Willis and Brady, 2021), the use of this model and concept in this research was deemed appropriate. The MISSCARE Survey (Kalisch and Williams, 2009) and MISSCARE Survey-Patient (Kalisch, Xie and Dabney, 2014) are validated tools that can be used to elicit nurse and patient-reported perspectives on missed nursing care. Their previous use has demonstrated the ability of these tools to allow researchers to explore the concept of missed care in various care settings. These tools can provide essential information about the delivery of nursing care and offer a mechanism for evaluating and improving nursing care at the point of delivery. As these tools provide valuable information in relation to the most frequently missed care interventions and the reasons for missed care, they can be beneficial in helping to determine barriers to providing fundamental and essential nursing care and identifying areas requiring immediate attention in improvement processes (Kalisch and Williams, 2009). Therefore, the Missed Nursing Care Model and MISSCARE survey tools have been used in this study to explore the levels of missed nursing care and the factors that contribute to missed care from nurses' and patients' perspectives.

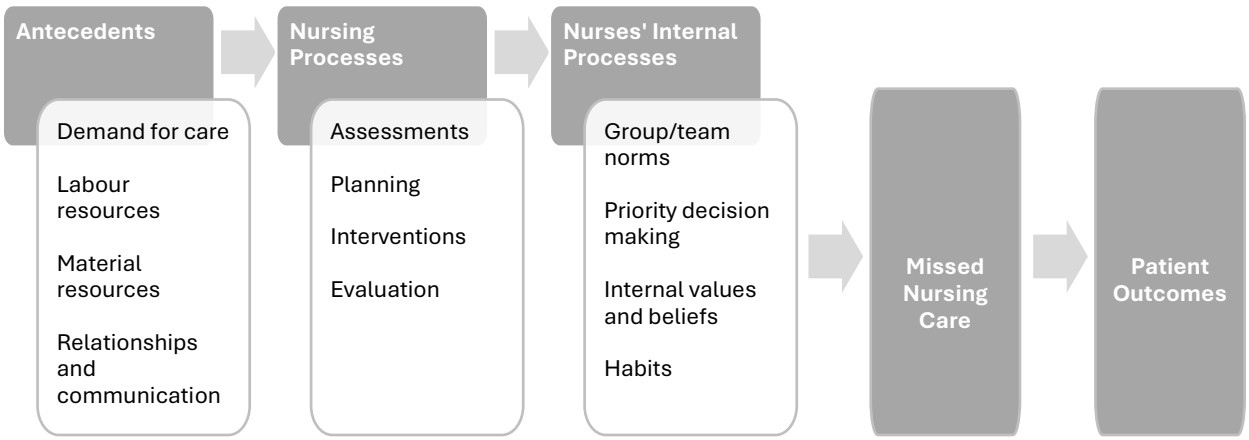


Figure 2.1 Missed Nursing Care Model adapted from Kalisch, Landstrom and Hinshaw (2009)

2.4.3 Fundamentals of Care Framework

The antecedents outlined in the Missed Nursing Care Model, such as labour resources, material resources and communication reflect various elements that are outlined in dimensions of the Fundamentals of Care Framework. This framework provides an overview of the three core dimensions involved in delivering safe and high-quality care to patients in acute healthcare settings. These dimensions include a trusting nurse-patient relationship, the integration of care which outlines patients' physical and psychosocial care needs and the relational care giver actions they require, and the context of care which provides an overview of the contextual factors that perform as system and policy level enablers for the delivery of fundamental care (Kitson *et al.*, 2013). Furthermore, the aspects of care that are measured by the MISSCARE Survey and the MISSCARE Survey-Patient are closely aligned with the physical, psychosocial and relational caregiver activities outlined in the Fundamentals of Care Framework. Given the synergy that has been identified between the missed nursing care and Fundamentals of Care research lines, this research has also used the Fundamentals of Care Framework as a guiding framework in relation to the consideration of the delivery of fundamental and essential nursing care.

The Fundamentals of Care Framework provides a point-of-care nursing theory that highlights the multifaceted nature of nursing (Kitson, 2018). This theory was used to guide the research as it provides a basis for hospital inpatients' fundamental care requirements and places focus on both the practical aspects of caring and the relationship between nurses and their patients (Kitson, 2018). It demonstrates the essential care that patients require to meet their everyday

physical, psychosocial and relational needs and outlines the baseline standard of care which should be upheld in acute healthcare settings (Kitson, 2018). The baseline level of care that this theory provides offers a standard that can be used to measure the quality of care in relation to missed care and the development of adverse events.

2.4.4 The Person-centred Nursing Framework

A person-centred approach to nursing care places the patient at the centre of care delivery and focuses on the patient as a whole, giving consideration to their physical, psychological and sociological needs rather than focusing on their disease or condition (Byrne, Baldwin and Harvey, 2020; McCance and McCormack, 2025). Florence Nightingale was the founder of modern nursing and viewed the provision of nursing care in a holistic perspective and placed emphasis on the biological, psychological and social needs of the patient in relation to their health (Selanders, 2010). The Person-centred Nursing Framework proposed by McCance and McCormack (2025) builds upon Florence Nightingale's holistic approach to nursing care by highlighting key nursing processes that contribute to the delivery of person-centred care, which is associated with enhanced care experiences for both patients and nurses, such as working with a person's beliefs and values, engaging authentically, involving patient's in decision making in relation to their care and being sympathetically present. This framework highlights the importance of including the perspective of both patients and nurses in relation to the evaluation of care (McCance and McCormack, 2025). Therefore, the principles of person-centred care were used in this study to inform the inclusion of the patient perspective in the survey component of the research project. The use of the MISSCARE Survey-Patient tool in this study allowed for person-centred nursing care processes such as active listening and involving patient's in decision-making to be measured from the perspective of the patient.

2.5 Research methods

A quantitative methodology was used to conduct this research. A mixed approach that combined both retrospective and prospective study designs was used to explore the phenomena of nursing-sensitive adverse events and missed nursing care. Both primary and secondary data sources were analysed to meet the aims and objectives of this research. The retrospective phase of the research involved a retrospective chart review, and the prospective phase involved the use of patient and nurse surveys.

2.5.1 Retrospective chart review

A retrospective chart review is a research design that uses pre-recorded, patient-centred data to answer specific research questions. As this study sought to address questions in relation to outcomes of care and the occurrence of adverse events, a retrospective chart review was deemed as an appropriate study design. Such retrospective study designs are practical for studying patterns of diseases and for conducting quality assurance studies, therefore a retrospective chart review was a suitable study design for this phase of the research (Worster and Haines, 2004).

Furthermore, a retrospective chart review was deemed to be an appropriate study design for use in this research as patient's medical records are considered to be the 'gold standard' source of data relating to a patient's stay in hospital (Tirschwell and Longstreth, 2002; Goto *et al.*, 2014; Maass *et al.*, 2015). Patients' notes, care plans and other records kept within their medical charts are reported to be valuable sources of data in retrospective studies (Parahoo, 2014). Therefore, in order to validate the rates of nursing-sensitive adverse events in the routinely collected hospital discharge data, the use of a retrospective chart review to collect 'gold standard' patient data for comparison with the hospital discharge data was considered to be the best method of answering the research question and meeting the research objective.

Additionally, retrospective chart review is a commonly used methodology which has previously been applied in healthcare research studies investigating inpatient care and epidemiology, and assessing quality of care (Vassar and Holzmann, 2013), therefore providing rationale for its use in this research. Given that chart reviews utilize data that is readily available (Thomas and Petersen, 2003) as the data is already collected (Worster and Haines, 2004), this study design offers a more feasible approach than more time-consuming designs such as observational studies which may be more complex in terms of bias and confidentiality (Thomas and Petersen, 2003).

2.5.2 Survey design

A survey research design can utilise one or more methods of data collection, such as questionnaires and interviews. A survey research design allows key aspects of a population to be described using statistical methods. This design was appropriate for this study as rather than testing prespecified hypotheses, the objectives of this research were primarily descriptive (Crosby, Salazar and DiClemente, 2015).

In this study, questionnaires were used to collect data on nurses' and patients' perspectives on missed nursing care in an acute hospital setting. Questionnaires are commonly used methods of survey data collection in social and health research (Parahoo, 2014), which therefore provided rationale for their use in this research. Advantages of using questionnaires included the ability to have multiple options for obtaining data through the use of pen-and-paper questionnaires and electronic questionnaires. Furthermore, questionnaires provided the opportunity to have multiple survey distribution options such as in-person, face-to-face distribution and electronic distribution. Questionnaires were also selected as they were a cost-effective and efficient method of collecting data from a large sample of both patients and nurses (Siedlecki, Butler and Burchill, 2015).

Questionnaires offer an effective method of collecting data on facts and the beliefs, opinions, perceptions and experiences of participants. Understanding nurses' and patients' perceptions and experiences of care is an important line of enquiry given that the main focus of nursing is to provide care to meet the needs of patients. Although behaviour may be best studied using an observational approach, questionnaires allow participants' voices to be heard, and responded to, as their perceptions based on their lived experiences can be gathered (Parahoo, 2014). In light of this, questionnaires were distributed to both nurses and patients to gather data on the same phenomena from both perspectives.

The use of validated survey tools in this study has ensured that the questionnaires have produced valid and reliable data. The MISSCARE Survey (Dabney, Kalisch and Clark, 2019) and MISSCARE Survey-Patient (Kalisch, Xie and Dabney, 2014) were the validated tools used to collect the nurse and patient-reported data in this study. These survey tools were chosen to use in this study for measuring missed nursing care from patient and nurse perspectives as they have been validated extensively and widely used in many previous studies globally (Bragadóttir *et al.*, 2015, 2020; Zelenikova, Gurkova and Jarosova, 2019).

2.5.3 Validity and reliability of the MISSCARE Survey

The MISSCARE survey tool was originally developed by Kalisch and Williams (2009) based on their qualitative study of missed nursing care in two hospitals, which identified elements of missed nursing care and reasons contributing to missed nursing care (Kalisch, 2006). Acceptability, validity and reliability of the original MISSCARE Survey were measured through

psychometric testing (Kalisch and Williams, 2009). Acceptability was measured by the number of respondents who completed the scale without omitting any items. According to Kalisch and Williams (2009), a low proportion of missing data indicated that the original survey was well accepted. The content validity of the instrument was tested through expert panels of staff nurses who reviewed the tool and the relevance and clarity of the items included in the tool. The content validity index of the original tool was 0.89. Furthermore, Kalisch and Williams (2009) conducted interviews with 96 nurses to ensure that all key nursing elements were captured by the tool. The tool was also initially tested with 25 staff nurses to assess the clarity of the instructions and the layout of the survey.

A revised version of the MISSCARE Survey including five additional contributing factors was proposed in 2019 by Dabney, Kalisch and Clark. The acceptability, reliability and validity of the revised version of the MISSCARE survey has also been measured by Dabney, Kalisch and Clark (2019). Tests assessing the accessibility of the tool demonstrated that most participants completed the survey in 10 minutes or less. A total of 90.3% of participants completed part A of the survey without omitting any items and 93.0% completed part B without omitting any items, therefore indicating that the survey was well accepted. For part A of the survey the percentage of items completed ranged from 48.0 to 100.0%, and for part B, 40.9 to 100.0% of the items were completed.

Validity

Factor analysis was deemed not appropriate for part A of the MISSCARE survey as it contains a list of independent nursing actions that are not necessarily related to each other. Exploratory factor analysis was conducted on part B of the original survey which relates to the identification of reasons contributing to missed nursing care. The items in this section of the survey were grouped into subscales (communication, labour resources, and material resources) based on a 3-factor solution with 51.13% of the variance of nurses perceptions in one study and 52.25% of the variance in a second study explained by these 3 factors (Kalisch and Williams, 2009). Exploratory factor analysis was conducted again on the revised part B of the MISSCARE Survey using maximum likelihood, and different factor solutions were compared. A three-factor solution yielded the best result via Bayesian information criterion (BIC) (Dabney, Kalisch and Clark, 2019). The items in this section of the survey were grouped into similar subscales to those

identified through the psychometric testing of the original survey instrument (communication, labour resources, and material resources) based on a 3-factor solution with 44% of the variance of nurses perceptions of the reasons for missed nursing care explained by these 3 factors (Dabney, Kalisch and Clark, 2019).

Reliability

The original MISSCARE Survey was administered to the same sample of nurses, two weeks apart, to examine test-retest reliability. A total of 81% of the questions in Part A were answered identically on both occasions and 97% were within 1 category of the rating scale from always to never. A total of 82% of the questions in Part B were answered identically on both occasions and 96% were within 1 category of the rating scale from significant reason to minor reason. To further measure test-retest reliability, simple additive scores were calculated for the survey. The overall test-retest coefficient for the missed care score between the tests was 0.87 and 0.86 for the reasons for missed care. The internal consistency measured by Cronbach α for part B ranged from 0.64-0.86 (Kalisch and Williams, 2009).

Test-retest reliability of the revised version of the survey was assessed using a sample of twenty-four nurses who completed the survey twice, one week apart (Dabney, Kalisch and Clark, 2019). A total of 94% of the questions in part A were answered identically on both occasions and 99% were within one category of the rating scale. In relation to Part B of the survey, 94% of the questions were answered identically, while 100% were within one category of the rating scale. In relation to subject reliability, the range of item correlation for part A of the survey was 0.70 to 1.00, with a mean item correlation of 0.95 and the range of item correlations for Part B was 0.83 to 1.00, with a mean item correlation of 0.95. In relation to item reliability, the range of person correlations for test A was 0.38 to 1.00, with a mean Pearson correlation of 0.94. The range of Pearson correlations for test B was 0.47 to 1.00, with a mean Pearson correlation of 0.94 (Dabney, Kalisch and Clark, 2019).

The internal consistency measured by Cronbach α was 0.94 for Part A and 0.90 for Part B. Given the multidimensional factor setting of this survey, Dabney, Kalisch and Clark (2019) also used McDonalds Omega to measure reliability. The McDonalds Omega was 0.95 for Part A of the survey and 0.92 for part B, therefore indicating high internal consistency.

2.5.4 Validity and reliability of the MISSCARE Survey-Patient

Previous reliability and validity studies of the MISSCARE Survey-Patient have been conducted by Kalisch, Rochman and Lee in 2013 (unpublished data) (Kalisch, Xie and Dabney, 2014). As reported by Kalisch, Xie and Dabney (2014), the tool was developed through a series of qualitative interviews with nurses and hospitalised patients on medical-surgical wards. During these focus group interviews, nurses and patients were asked to identify elements of care for inclusion in the survey instrument. Furthermore, the ability of patients to report on the completion of these elements of nursing care was assessed in order to refine and confirm the elements included in the survey instrument. The survey was then reviewed by the focus groups for clarity and relevance. The content validity was 0.89 for the nurses involved in the study and 0.88 for the patients, therefore indicating that that the survey was clear and relevant. The construct validity of the tool was assessed using exploratory factor analysis. The items within the survey were grouped into subscales (basic care, communication and time to response) based on a 3-factor solution with factor loadings ranging from 0.605 to 0.869 with 59.2% of the variance of patient perceptions of missed nursing care explained by these 3 factors. The Survey was administered to 30 randomly selected patients to examine test-retest reliability. The patients completed the survey while hospitalised and again two weeks after they were discharged. The test-retest coefficient was 0.818 and internal consistency measured by Cronbach's alpha was 0.838, with scores ranging from 0.708 to 0.834 for the subscales, therefore indicating that the tool was acceptable for the 3 factors.

2.6 Research site

A single model 4 teaching hospital in Ireland was selected for participation in this research project. In 2024, this hospital had over 800 beds on-site and in their off-site post-acute care services ward. The hospital also had an overall nursing complement of approximately 1,800 (further breakdown of nurse complement was not available). The data used to inform the publications included in this report were collected at this hospital site.

2.7 Methods used to meet the specific objectives of the research

Objective 1 – To determine an appropriate method for validating rates of nursing-sensitive adverse events in administrative healthcare data by understanding the methodological approaches used to conduct chart review validation studies. The methodological approaches and

strategies used to understand how chart reviews have been used to validate rates of adverse events in administrative data were explored in this section. The extent to which administrative data can accurately record rates of adverse events, as identified through patient chart review, was also investigated.

In order to meet the first objective of this study, a scoping review was conducted to gather information on the methodological approaches and strategies in previous chart review studies that sought to validate rates of adverse events. Furthermore, the scoping review was conducted to provide an overview of the level of accuracy of the recording of rates of adverse events in administrative healthcare data, as identified by previous chart review studies. The scoping review was conducted in line with the Joanna Briggs Institute methodology for scoping reviews (Peters *et al.*, 2020). A search strategy was developed with assistance from a university librarian and used to conduct searches of four databases in April 2023. Two researchers independently screened the articles that were identified through the database searches, and conflicts were resolved on consultation with a third researcher. A data extraction template was developed and used to extract key variables. The extracted data were exported and charted using Microsoft Excel. The demographics and study characteristics were analysed and presented in a descriptive numerical summary and a qualitative content analysis was conducted on each identified study in order to meet the objective of presenting an overview of the level of accuracy of the recording of adverse events in administrative data. Further detail on the specific methods employed to meet this objective and to conduct the scoping review are outlined in chapter 3 and Appendix B.

Objective 2 – To conduct a chart review to determine the rates of nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium in older adults in an acute hospital setting in Ireland.

Objective 3 - To validate the recorded rates of the four nursing-sensitive adverse events in Hospital In-patient Enquiry (HIPE) data by comparing the chart review data and HIPE data

A structured retrospective chart review was conducted to meet the second and third objectives for this research. A total of 1,000 admissions of patients aged 65 years and over, with a length of stay of 72 hours or longer, who were discharged from hospital in the year 2022 were included in the chart review. A study-specific chart review protocol and data collection instrument were

co-produced by the Cost2Care study team, several healthcare professionals from the participating hospital and a public and patient representative. A chart review expert, who was also a member of the Cost2Care study team, provided a template for the two-stage review tool which was then amended for an Irish context and tailored for use in the participating hospital. The data collected through the chart review were used to validate the recorded rates of the adverse events within the HIPE data, which was obtained from the HIPE department in the participating hospital. The specific methods used to conduct the chart review in relation to the sampling, data collection and data analysis procedures and further information pertaining to the co-productive approach used to develop the study materials are outlined in chapter 4 and Appendix C.

Objective 4 – To identify the risk factors associated with the occurrence of the four specific nursing-sensitive adverse events and to determine the relationship between the presence of a nursing-sensitive adverse event, a patient's discharge situation and in-hospital mortality.

The data that was collected during the chart review component of this research was also used to meet the fourth set of objectives for this study. The potential risk factors that were collected during the chart review and explored in this study were speciality, sex, admission route, admission situation, hours from presentation to admission, number of ward moves, number of bed moves, age, admission to the intensive care unit, length of stay, number of diagnoses and number of procedures. Furthermore, Elixhauser scores were calculated for each patient and investigated as a potential risk factor associated with nursing-sensitive adverse events. The outcomes were pneumonia, urinary tract infections, pressure ulcers and delirium. All 13 potential risk factor variables were screened using univariate analysis to explore the relationship between the predictor and outcome variables and to determine the variables for inclusion in the multivariate analysis. Binary logistic regression was run on each variable and variables with a p value of <0.25 were included for multivariate analysis. This process was repeated for each outcome variable individually, resulting in a total of five models which identified significant predictors of the nursing-sensitive adverse events. Variables with a p value of <0.05 in the multivariate analysis were considered statistically significant.

Univariate analyses were conducted for each of the nursing-sensitive adverse events to determine the relationship between a nursing-sensitive adverse event and in-hospital mortality.

Similarly, variables with a p value of <0.25 were included for multivariate analysis. Variables with a p value of <0.05 in the multivariate analysis were considered statistically significant. The relationship between the presence of a nursing-sensitive adverse event and a patient's discharge destination was also explored using multinomial logistic regression. Further details in relation to the specific methods used to conduct this research and meet the above-mentioned objectives are outlined in chapter 5.

Objective 5 – To measure missed nursing care from both nurses' and patients' perspectives with a focus on identifying the most frequently missed care tasks and the contributing factors and to identify to what extent the *MISSCARE* measurement tools can represent the elements outlined within the Fundamentals of Care framework.

A cross-sectional study using the MISSCARE instruments was conducted to measure patient and nurse perspectives on missed nursing care and meet the final objectives of this research. The MISSCARE Survey and MISSCARE Survey-Patient, developed by Dr. Beatrice Kalisch from the University of Michigan, were adapted for an Irish context and used to collect data on the nurse reported and patient reported missed nursing care. Permission was sought and granted from Dr. Kalisch to modify the survey instruments and use them to collect data for this research project. The final amended instruments can be found in appendices C and D. The nurse survey was composed of a section on demographic information and two further sections relating to the frequency of missed care and the reasons for missed care. The nurse survey also contained two additional questions pertaining to quality and safety. The patients survey included a section relating to communication, timeliness and the provision of basic care which was measured using a five-point Likert scale. Patients were also asked to report on their experiences of adverse events and provide responses relating to demographic questions.

All fully qualified nurses employed on 31 adult inpatient wards were eligible for participation. Patients aged 65 years and over, with a minimum length of stay of 72 hours, who were admitted to the same 31 adult inpatient wards were also eligible to participate in the survey.

A comparative analysis was also conducted to understand the extent to which the MISSCARE instruments can be applied to the Fundamentals of Care Framework and used to measure the delivery of fundamental care. The items measured within the MISSCARE surveys were mapped

to the elements outlined in the Fundamentals of Care Framework and presented in a tabular format as further demonstrated in chapter 6.

Further information in relation to the sampling, recruitment, inclusion and exclusion criteria, data collection and analysis is outlined in chapter 6.

2.8 Piloting

2.8.1 Chart review protocol and data collection instrument

The chart review protocol and data collection instrument were piloted to ensure that all relevant data were collected and to confirm that the reviewers could successfully extract the data using the online patient information system and the paper-based charts. A sample of 72 admissions were included in the pilot. Following the pilot, the researchers met with a retrospective chart review expert for further educational training and to discuss the pilot results. The pilot results were retained in the main study as no major changes were made.

2.8.2 Survey instruments

The versions of the MISSCARE surveys that were amended for an Irish context were piloted by nurses and by members of the public who fit the age criteria for the patients. After piloting the questionnaire, both nurses and patients were asked to answer the following questions:

1. How long did the survey take?
2. Were there any problems with the content?
3. Were there any problems with the instructions provided?
4. Were there any problems with the interface or the flow of the online survey?

The responses from the pilot were considered and any issues in relation to the content, instructions, interface and flow of the surveys that were identified during the pilot were addressed. Example of issue that arose included that the questionnaire did not allow for responses in days or months in relation to questions about experience in their role. In order to ensure that nurses who were in their role for less than a year could provide their response in months, a minor adjustment was made to the nurse survey to allow years and months of experience in their role to be collected. Following the pilot, all necessary amendments were

made, and the surveys were confirmed in advance of being made accessible to interested participants.

2.9 Procedure

Firstly, the retrospective phase of the research was carried out. A retrospective chart review was conducted to determine the rates of four specific nursing-sensitive adverse events: pneumonia, UTI, pressure ulcer and delirium, in older patients in Ireland. The rates of adverse events identified through the chart review were then used to validate the rates of these adverse events available within the HIPE data. In order to do this, the rates of the four nursing-sensitive adverse events available within the HIPE data were quantified. An anonymised set of national level patient administrative data was obtained from the routinely available hospital discharge data using International Classification of Disease codes and the rates of adverse events were calculated. The data collected in the charts was compared to the data available within the HIPE data in order to verify the rates of adverse events and therefore allow the true rates of these events to be uncovered. In order to reduce bias, the chart review was conducted first to ensure that the reviewers were blind to the rates of adverse events available within the HIPE data. The reviewers had no prior knowledge of whether the admission that they were reviewing contained the presence of any of the four adverse events.

Following the collection of the chart review data, the prospective phase of the study was carried out to measure both patients' and nurses' experiences of missed nursing care. Surveys were distributed to both patients and nurses, in the same hospital as where the chart review was conducted, during this phase of the research to explore this phenomenon.

2.10 Public and Patient Involvement

Public and patient involvement (PPI) in health services and health services research has been shown to have significant beneficial impacts on individuals such as patients, decision-makers and the members of the wider community. It has also been associated with health system improvements relating to services provision and public health and positive impacts on decision-making processes and society in general (Fredriksson, Sampaio and Moberg, 2025). In light of these benefits, a PPI component was embedded within the wider COST2CARE project within which this research study is situated. A PPI representative with recent experience as an inpatient in an acute hospital, in addition to experience of working on national projects alongside policy

makers and academic researchers was recruited as a core member of the research team who could provide a patient perspective on the realities of being an older patient in an acute hospital setting in Ireland. Furthermore, a stakeholder advisory group comprised of patient representatives from carer and patient organisations, among additional representatives from hospitals, the Healthcare Pricing Office and professional bodies and organisations was also embedded within the wider COST2CARE project. The PPI representative and members of the stakeholder steering group who were older patient advocates made invaluable contributions to this research and advised the research team on aspects of the study relating to the overall planning and progress of the research and the development of the study materials such as the chart review protocol and data collection instrument and the survey tools.

2.11 Ethical considerations

Attention was given to all ethical considerations associated with conducting this quantitative PhD research. Ethical approval for this research project was granted by the Dublin City University (DCU) Research Ethics Committee (REC) (Appendix F). Ethical approval was also sought and obtained from the participating hospital site via their Institutional Review Board (IRB) (Appendix G). A consent declaration was also obtained from the Health Research Consent Declaration Committee (HRCDC) in order to allow the chart review component of this research project to be conducted (Appendix H).

2.11.1 DCU ethics

Ethical approval from the DCU Research Ethics Committee was sought and obtained during year one of this four-year project. The data protection officers from the data protection unit in DCU were consulted in relation to the application for ethical approval to ensure that consideration was given to all relevant ethical issues such as consent, privacy and confidentiality. A full DCU data protection impact assessment was conducted and submitted to the REC alongside the application for ethical approval. Amendments and conditions requested by the REC were met in full. Provisional ethical approval was granted from the DCU REC on the condition that a consent wavier would be obtained from the HRCDC. The HRCDC granted a waiver and full ethical approval from the DCU REC was granted.

2.11.2 Hospital Site Ethical Approval

Following approval from the DCU REC, ethical approval was sought and obtained from the hospital site in order to allow the research project to take place and data collection to be carried out. The data protection officers from the data protection Unit at the participating hospital site, in addition to the DCU data protection officers, were consulted in relation to this application. A data protection impact assessment for the participating hospital site was also completed and submitted to their IRB alongside the application for ethical approval. The conditions requested by the IRB were met and following a meeting with the IRB, provisional approval was granted on the grounds that a consent waiver was obtained from the HRCDC.

2.11.3 Health Research Consent Declaration Committee

After receiving provisional approval from both the DCU REC and the IRB, a consent declaration was sought from the HRCDC in order to conduct this research project and in particular, the chart review component of the study without explicit consent from each patient to review their chart. Obtaining explicit consent from each patient was not possible due to the large sample size of charts being reviewed therefore, a consent waiver was required. Following meetings with members of the HRCDC, an application with evidence of provisional ethical approval from the DCU REC and the IRB at the participating hospital site was submitted to the HRCDC, and an argument was put forth to demonstrate that the benefits to public interest were greater than the risk of not obtaining explicit consent. The requirements requested by the HRCDC in relation to data protection considerations were met, and a consent exemption was granted for the conduction of this study. The HRCDC determined that the public interest in this research outweighed the need for consent.

After approval had been granted from the DCU REC and the IRB at the participating hospital, and a consent exemption waiver had been obtained from the HRCDC, the research was able to proceed at the participating hospital site and access to the included patients' medical charts was given for the chart review component of the research.

The survey component of the research presented little risk to participants as their participation was completely voluntary. There was little risk to participants who took part in the surveys as they were anonymous surveys that allowed participants to contribute to research without any risk of their identity being revealed. As the surveys dealt with sensitive topics relating to

patients' health and rationed and missed nursing care, there may have been a small risk of emotional upset. Experiences of missed or rationed nursing care themselves may have caused emotional upset to participants however, this research provides participants with the opportunity to volunteer to communicate their experiences and contribute to improvements that may reduce the prevalence and occurrence of adverse events and adverse outcomes in the future.

Nevertheless, special consideration was given to ethical considerations in relation to the inclusion of older hospitalised patients in this research study. Older persons have previously been identified as a vulnerable group in relation to clinical trials (Bracken-Roche *et al.*, 2017) and have often been excluded from research (Goodwin *et al.*, 2023). According to the Council for International Organizations of Medical Sciences (CIOMS) (2016), older persons may be considered potentially vulnerable if they are faced with physical frailty as a result of age or co-morbidities. Given that this study intended to recruit patients aged 65 and over, some of the patients included in the sample for this research may be categorised as older persons and therefore members of a potentially vulnerable group.

Considering all persons over the age of 65 as vulnerable can be problematic as age itself is not consistently a marker of vulnerability. The process of ageing differs from person to person and does not always align with specific experiences of vulnerability. Baring this in mind and in an attempt to minimize stereotyping, Bozarro, Boldt and Schweda (2018) argue that a combined model of vulnerability is more appropriate when it comes to considering older persons vulnerability status in research participation. Although advancing age is associated with characteristics that may contribute to vulnerability, age on its own should not equate to vulnerability. Age should act as an indicator for consideration to be given to whether an older person has any further attributes that define them as vulnerable, such as their social situation or any physical or cognitive conditions.

People living with disabilities and people with incurable conditions or illnesses may also be considered as potentially vulnerable (Council for International Organizations of Medical Sciences (CIOMS), 2016). Given that this study intended to recruit hospital inpatients as participants, it is possible that some participants may be living with disabilities or incurable diseases and therefore may also be considered vulnerable. Some patients who participated in this research may have had experiences of adverse events related to missed or rationed nursing

care and may be considered vulnerable given that they were asked to provide information on their possible ill health and on their experience of the care they received, which for some may not have been sufficient. Although this research may have involved the participation of vulnerable groups, they were fully informed of what was involved in taking part in the research and their consent was sought.

The participants included in this PhD research may not be considered vulnerable based on their age however, due to the sensitive nature of the topics that are covered within the survey component of the study, such as ill health or, in this case specifically, experiences of missed care, they may be considered vulnerable (Alexander, Pillay and Smith, 2018). Although the participants may potentially be considered vulnerable, it is important to actively involve groups of participants who are representative of the sample being studied in order to understand and identify their needs and ultimately enhance their health and the health of other members of society. It is also important to understand the delivery of care from the patient's perspective given their first-hand and lived experience of the care. The level of risk to participants in comparison to the possible benefits that the findings of this research may have for the improvement of quality and timeliness of care for patients provided good rationale for this research to be conducted. According to Alexander, Pillay and Smith (2018), there is a wide range of evidence to suggest that vulnerable populations welcome the opportunity to discuss sensitive topics and engage in research out of altruism and the prospect that their contribution with make a difference for others in the future.

Consideration was also given to the inclusion of nurses, as employees of the participating hospital, in this research. The nurses who participated in the survey component of this study were not considered vulnerable participants. All nurses who were interested in participating in this research project were made aware that this was a voluntary study and that they were in no way obliged to participate in the research. Those who wished to volunteer to participate in the research were informed that their participation in the surveys implied that they consented to taking part in the research. Although the nurses were employees of the hospital site where the research took place, they were not deemed as vulnerable participants on these grounds as the data collected was not shared with the hospital. The data collected was not made available to hospital management and was only made available and accessible to the researchers from Dublin

City University who were involved in collecting and analysing the data. All the data that were collected were anonymous data that could not be linked to the nurse who provided the data as no staff identifiers were collected during this component of the study.

Throughout the course of the overall project and the PhD research, expertise from the Public and Patient Involvement (PPI) representative and the various members of the stakeholder group was sought in relation to the consideration of ethical issues.

Chapter 3 : Publication 1 - A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data

The work presented on pages 45-87 of this chapter has been published the International Journal for Quality in Healthcare:

Connolly A, Kirwan M and Matthews A. (2024) 'A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data', *International Journal for Quality in Health Care*, 36(2), doi: 10.1093/intqhc/mzae037

Pages 42-44 of this chapter contain a signed declaration verifying the author contribution to the research presented in this chapter.

As per DCU guidelines, due to copyright issues across different publishers, the PDF copies of the published articles in their final journal format cannot be included in the PhD thesis therefore, all published work must appear in manuscript format. The content presented in the thesis is correspondent with the content of the published papers, with the exception of minor variations due to formatting.

3.1 Signed declaration verifying author contributions

Section 1: Candidate's Details	
Candidate's Name	Anna Connolly
DCU Student Number	22270478
School	School of Nursing, Psychotherapy and Community Health
Principal Supervisor	Dr. Marcia Kirwan
Title of PhD by Publication Thesis	Nursing-sensitive adverse events and missed nursing care in older hospitalised patients
Section 2: Paper Details	
Title of co-authored paper included in the thesis under examination	A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data
List of authors as in order given on accepted/published version	Connolly A, Kirwan M and Matthews A.
Publication Details (e.g. Year of Publication, Journal Name, Issue Number, Page Numbers, Place of Publication, DOI, ISSN, URL etc.)	2024, International Journal for Quality in Health Care, 36(2), doi: 10.1093/intqhc/mzae037, https://academic.oup.com/intqhc/article/36/2/mzae037/7658312
Publication Status (e.g. Published, Accepted)	Published
Provide a brief statement here on the disciplinary ranking of this publication and the peer-review process involved (e.g. how many reviewers, single blinded or other, initial decision, revision timeline etc and any other details that speak to the rigour of the peer review process)	The International Journal for Quality in Health Care is a double-blinded, peer-reviewed journal. The article was originally submitted in December 2023 and an invitation to revise the manuscript was given in February 2024 following the review of the manuscript by three reviewers. The article was revised and resubmitted on the 8th of March 2024 before being accepted for publication on the 21st of March 2024.

This paper (Chapter 3) is one of four co-authored papers to be submitted as part of the PhD by publication thesis submitted for examination.

Section 3: Candidate's Contribution to the Paper

Provide details below of the **nature** and **extent of your contribution** to the paper (include both your intellectual and practical contributions) and your overall contribution in **percentage terms**. Note that these categories can be customised according to disciplinary norms

The nature and extent of my contribution is outlined below. My overall percentage contribution to the paper was 90%.

Briefly outline your contribution to the **conception** of the work described in this paper:

My co-authors and supervisors led the conceptualisation phase of this study and I contributed to the conception of the work by defining the objectives of the scoping review and identifying the scope of the review based on my reading of previously published literature.

Briefly outline your contribution to the **literature review** in this paper:

I conducted a review of the literature pertaining to the content presented in this chapter. Following my review of the literature, I wrote the background/introduction section and the discussion sections, which were then reviewed by my supervisors and co-authors.

Briefly outline your contribution to the **methodological design**:

The decision to conduct a scoping review was made in conjunction with my supervisors and co-authors. My supervisors advised on the methodological design and the use of tools such as Covidence to conduct the review.

Briefly outline your contribution to **data collection**:

I collected the data by conducting the searches in the databases and importing the retrieved articles into Covidence. My co-authors and I conducted the abstract and title screening and the full-text screening of the articles. Furthermore, in collaboration with my co-authors, I developed the data extraction template, and I extracted the relevant information from the articles using the data extraction template and charted then information in a charting table.

Briefly outline your contribution to **data analysis**:

I conducted the analysis of the data collected. I extracted the data from the articles and inserted it into a charting table. I conducted a descriptive numerical summary of the data and carried out qualitative content analysis on the included studies.

Briefly outline your contribution to the **synthesis and summary of findings**:

I synthesised and summarised the findings under the supervision of my co-authors. I wrote the results, discussion and conclusion sections of the manuscript, which were then reviewed by my co-authors and revised in accordance with their comments and feedback.

Finally, outline your contribution to the **writing** and **revision** of the paper:

I wrote the original manuscript and revised the content as per the feedback and comments from my co-authors and supervisors. Furthermore, I also revised the paper as per the comments from the peer-reviewers and sought approval of these revisions from my co-authors.

Section 4: Signature and Validation

I confirm that the following statements are true:

(a) the information I have provided in this form is correct
(b) this paper is based on research undertaken during my candidature at DCU

Signature of PhD Candidate: Anna Connolly **Date:** 25/05/26

I confirm that the information provided by the candidate is correct:

Signature of Principal Supervisor: Marcia Kirwan **Date:** 25/05/26

In some cases, it may be appropriate for verification to be given by both the principal supervisor **and** the lead/corresponding author of the work (where the lead/corresponding author of the work is not the candidate or the principal supervisor):

Signature of Lead/Corresponding Author: Anna Connolly **Date:** 25/05/26

Nature of Current Post/Responsibilities: PhD Candidate

Home institution: Dublin City University

3.2 Abstract

Patient safety is a key quality issue for health systems. Healthcare acquired adverse events (AEs) compromise safety and quality; therefore, their reporting and monitoring is a patient safety priority. Although administrative datasets are potentially efficient tools for monitoring rates of AEs, concerns remain over the accuracy of their data. Chart review validation studies are required to explore the potential of administrative data to inform research and health policy. This review aims to present an overview of the methodological approaches and strategies used to validate rates of AEs in administrative data through chart review. This review was conducted in line with the Joanna Briggs Institute methodological framework for scoping reviews. Through database searches, 1054 sources were identified, imported into Covidence, and screened against the inclusion criteria. Articles that validated rates of AEs in administrative data through chart review were included. Data were extracted, exported to Microsoft Excel, arranged into a charting table, and presented in a tabular and descriptive format. Fifty-six studies were included. Most sources reported on surgical AEs; however, other medical specialties were also explored. Chart reviews were used in all studies; however, few agreed on terminology for the study design. Various methodological approaches and sampling strategies were used. Some studies used the Global Trigger Tool, a two-stage chart review method, whilst others used alternative single-, two-stage, or unclear approaches. The sources used samples of flagged charts ($n = 24$), flagged and random charts ($n = 11$), and random charts ($n = 21$). Most studies reported poor or moderate accuracy of AE rates. Some studies reported good accuracy of AE recording which highlights the potential of using administrative data for research purposes. This review highlights the potential for administrative data to provide information on AE rates and improve patient safety and healthcare quality. Nonetheless, further work is warranted to ensure that administrative data are accurate. The variation of methodological approaches taken, and sampling techniques used demonstrate a lack of consensus on best practice; therefore, further clarity and consensus are necessary to develop a more systematic approach to chart reviewing.

Keywords: patient safety, healthcare quality, adverse events, administrative data, retrospective chart review

3.3 Introduction

Patient safety is a priority for health systems with 1 in 10 patients experiencing an in-hospital adverse event (AE) in high-income countries annually. The cost of patient harm is estimated at 1–2 trillion US Dollars per year (World Health Organization, 2021), arising from additional resources, increased care, and prolonged hospital stays (Auraaen, Slawomirski and Klazinga, 2018).

Accurate AE data are fundamental to addressing these costs and enabling patient safety and healthcare quality advancements (World Health Organization, 2021). Administrative healthcare data are a valuable source of information on AEs and a potentially efficient tool for monitoring patient safety (Raleigh *et al.*, 2008). Translating chart data into alphanumeric data (Tang, Lucyk and Quan, 2017) provides a coded summary of the patient and their encounter with the health system (Healthcare Pricing Office, 2020c). The International Classification of Diseases (ICD), used for this purpose by all World Health Organization member states, provides a standardized method of reporting and monitoring health-related issues across hospitals, regions, and countries (World Health Organisation, 2023).

Medical knowledge advancements have resulted in many ICD revisions (Boerma *et al.*, 2016). Various derived classifications of ICD and ICD modifications have been developed to monitor conditions and complications in specific areas or settings (WHO, 2024) and address country-specific needs (Jetté *et al.*, 2010).

Administrative data-based AE detection tools have been developed to screen for potential AEs and assess their preventability (Tsang *et al.*, 2012). The Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSIs) demonstrate the potential use of administrative data for benchmarking rates of AEs across the USA (McDonald *et al.*, 2002). Similarly, the Classification of Hospital-acquired Diagnoses (CHADx) in Australia (Jackson *et al.*, 2009) generates patient safety data for monitoring AEs. The increasing popularity of administrative data-based safety indicators has coincided with an increase in validation studies (Tsang *et al.*, 2012).

Inaccurate and poor recording of AEs (Kim *et al.*, 2022; McGuckin *et al.*, 2022) warrants validation of administrative datasets and ICD coding (Nicholls, Langan and Benchimol, 2017).

A systematic and standardized approach to measuring AEs in administrative data would improve dataset accuracy and enable benchmarking across hospitals (Zhan and Miller, 2003) for comparison and improvement (Ettorchi-Tardy, Levif and Michel, 2012).

Whether a single gold standard for the measurement of harms exists is disputed (von Plessen, Kodal and Anhøj, 2012; O'Leary *et al.*, 2013); however, medical charts are often considered a 'gold standard' source of patient information (Tirschwell and Longstreth, 2002; Goto *et al.*, 2014; Maass *et al.*, 2015). Despite their limitations, chart reviews are commonly used to assess healthcare quality and inpatient care (Vassar and Holzmann, 2013) and identify whether administrative data accurately reflect the events of a patient's hospitalization (Nissen *et al.*, 2019). They utilize readily available data and are more feasible than observational studies which are time-consuming, expensive, and complex in terms of confidentiality and bias(Thomas and Petersen, 2003). The Harvard Medical Practice Study (HMPS) and the Global Trigger Tool (GTT) are examples of two-stage chart review approaches (Rafter *et al.*, 2015). Nonetheless, validated administrative data are potentially another valuable source of AE data (Raleigh *et al.*, 2008; Mazzali and Duca, 2015; Van Mourik *et al.*, 2015; Ehrenstein *et al.*, 2016). The need to understand how chart reviews have been conducted to identify optimal practices for measuring administrative data accuracy provides rationale for this review.

3.4 Methods

This review was conducted in line with the Joanna Briggs Institute (JBI) methodology for scoping reviews (Peters *et al.*, 2020). A protocol for this study has previously been published (Connolly, Kirwan and Matthews, 2023). Searches in PubMed (MEDLINE), CINAHL, the JBI Evidence Synthesis, and The Cochrane Database of Systematic Reviews did not identify any similar scoping or systematic reviews.

3.4.1 Objectives

1. To present an overview of chart reviewing approaches and tools used to validate rates of AEs in administrative datasets.
2. To collate and map evidence of chart reviewing to measure the reliability of these datasets.

3.4.2 Inclusion and exclusion criteria

The inclusion and exclusion criteria are outlined in Table 3.1.

Table 3.1 Inclusion and Exclusion Criteria

	Inclusion criteria	**Exclusion criteria**
Population	Hospital inpatients whose medical chart information has been extracted, assigned ICD codes, and recorded in administrative data	Any population other than hospital inpatients
Concept	The validation of the accuracy of rates of AEs in administrative data and the methodological approaches used to conduct retrospective chart review	Sources that do not validate rates of adverse events in administrative data through retrospective chart review
Context	Studies that validated data collected within hospital-based settings	Studies reporting on settings other than hospital-based settings
Types of evidence sources	All sources of evidence other than review articles were included as this review explored the specific methods used to validate rates of AEs in administrative data through patient chart review. Referring to primary research articles only ensured that credit was accurately assigned to each author of the included sources (Dhillon, 2022).	Sources using AI or subsets of AI such as Natural Language Processing (NLP) to conduct chart reviews to validate rates of adverse events in administrative data

3.4.3 Changes since protocol

The exclusion of review articles is a deviation from the study protocol which initially stated that the types of evidence sources would be left open. All available articles were included by searching reference lists of any identified reviews.

3.4.4 Search strategy

Searches in PubMed (MEDLINE) and CINAHL databases, conducted with a university librarian, yielded titles and abstracts from which text words were extracted and used to develop a search strategy (Table 3.2). Using this strategy, PubMed (MEDLINE) and CINAHL were searched on 4 April 2023 and Web of Science and Scopus were searched on 24 April 2023. The reference lists of included sources were searched and a search for grey literature was conducted (Arksey and O'Malley, 2005).

Table 3.2 Search Strategy for Identifying Sources of Evidence for Inclusion in the Scoping Review

Search	Search Terms
S1	“discharge data” OR "hospital discharge data" OR “routinely collected data” OR "routinely collected discharge data" OR “administrative data” OR "administrative health data" OR "healthcare administrative data"
S2	verif* OR valid* OR compar* OR evaluat*
S3	S1 AND S2
S4	"chart review" OR "record review" OR "medical record review" OR "clinical notes" OR "retrospective chart review"
S5	S3 AND S4
S6	"adverse event*" OR "adverse outcome*" OR "healthcare acquired complication*" OR "patient safety incident*"
S7	S5 AND S6

The HMPS was the first large-scale medical record review conducted over 30 years ago (Troyen A. Brennan *et al.*, 1991); therefore, literature published in English between 1991 and 2023 was eligible for inclusion.

3.4.5 Source of evidence screening and selection

Two researchers independently screened study titles and abstracts. Full-text versions of potentially relevant sources were assessed against the inclusion criteria. Excluded sources were assigned an exclusion reason (Fig. 3.1). Conflicts were resolved through discussion and included sources were confirmed. A third researcher consulted on certain sources.

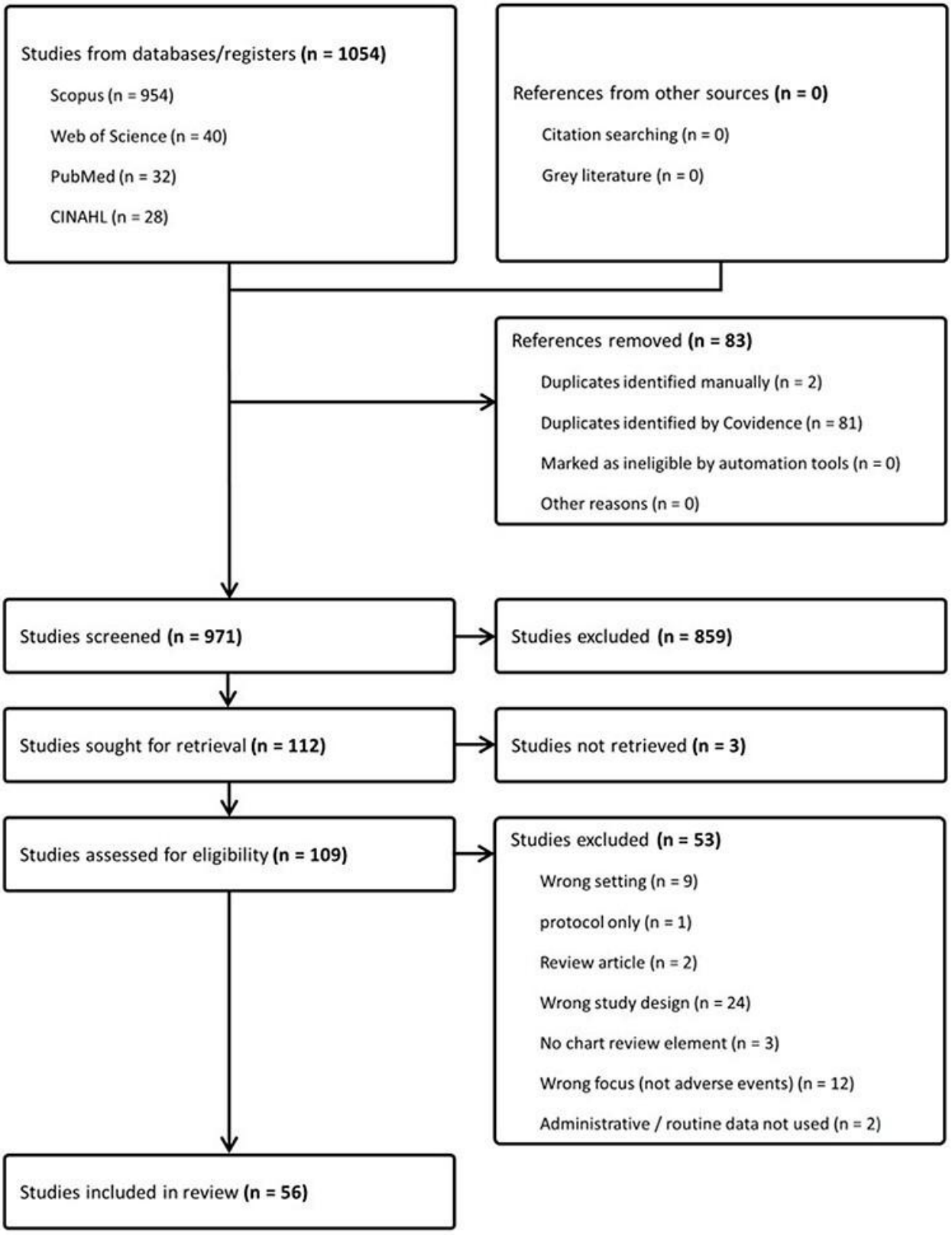


Figure 3.1 PRISMA flowchart of source selection process

3.4.6 Data extraction

A data extraction template was developed and piloted. Key variables included: study title, name of author(s), year of publication, country, study aim, study design, methods, study population, specialty associated with the AE reported on, and key findings relating to the accuracy of the administrative data and administrative data-based detection tools.

3.4.7 Analysis and presentation of results

The extracted data were exported and arranged into a charting table in Microsoft Excel that was continuously updated. A descriptive numerical summary and a qualitative content analysis of the included studies were conducted.

The accuracy of the administrative data or administrative data-based detected tools was determined based on the specificity, sensitivity, positive predictive value (PPV) or negative predictive value (NPV), where reported, and on statements from the authors of each study relating to the validity of the datasets or detection tools and the extent to which they can be used to accurately measure rates of AEs.

3.5 Results

3.5.1 Search results

Following duplicate removal and screening of the search results as outlined in the Preferred Reporting Items for Systematic reviews and Meta-Analyses flowchart (Fig. 1), 56 sources were included. A qualitative content analysis of the literature was conducted, and study findings are presented in a tabular and descriptive format.

3.5.2 Demographics and study characteristics

Studies by country, publication year, specialty, and study design are outlined in Table 3.3. All 56 studies were published between 1997 and 2022 and were conducted in 12 countries with 31 (55%) in the USA. Various specialties were explored; however, 19 studies reported on AEs in surgical specialties and 14 studies validated AEs in all specialties. All studies included a retrospective chart review; however, little consistency in relation to the methods and study design was identified. Of the included studies, 32 measured the accuracy of the administrative

data coding and 24 reported on the accuracy of the administrative data-based AE detection tools (Table 3.3).

Table 3.3 Distribution of included sources according to country, year of publication, clinical specialty associated with the adverse event(s), named study design, methodological approach, and sampling strategy

Country in which the study conducted	**No. of studies**	**Reference number**
USA	31	[34, 63–65, 67, 68, 74, 79, 82, 85–106]
Australia	5	[35, 69, 77, 107, 108]
Canada	6	[76, 83, 109–112]
Belgium	1	[113]
Germany	4	[22, 78, 81, 114]
Italy	2	[75, 115]
Japan	1	[116]
New Zealand	1	[80]
Norway	1	[117]
Sweden	2	[118, 119]
Switzerland	1	[120]
Taiwan	1	[66]
Year of publication	**No. of studies**	**Reference number**
1997–2002	2	[90, 106]
2003–2007	2	[91, 99]
2008–2012	11	[34, 63, 64, 67, 69, 74, 75, 92, 97, 101, 113]
2013–2017	20	[22, 65, 68, 76–78, 85–87, 89, 93, 94, 98, 100, 102–105, 111, 112]
2018–2022	21	[35, 66, 79–83, 88, 95, 96, 107–110, 114–120]
Clinical speciality	**No. of studies**	**Reference number**
All specialities	14	[22, 78, 80, 81, 91, 93, 97, 106, 107, 109, 111–113, 118]
Surgical	19	[34, 35, 64, 67, 68, 74, 75, 83, 86, 87, 92, 96, 100, 102–104, 110, 115, 117]
Paediatrics	4	[63, 77, 88, 99]
Oncology	4	[85, 94, 108, 116]
Pharmacology	4	[65, 66, 79, 114]
Obstetrics	4	[69, 89, 101, 120]
Geriatrics	1	[76]
Orthopaedics	1	[119]
Medical	1	[90]
Medical/surgical/trauma/ED	4	[82, 95, 98, 105]

Named study design	**No. of studies**	**Reference number**
Chart review study	9	[35, 63, 68, 77, 94, 96, 105, 112, 120]
Retrospective chart review study	10	[67, 89, 91–93, 98, 99, 101, 107, 113]
Retrospective chart review validation study	6	[65, 76, 79, 83, 114, 116]
Retrospective cross-sectional study	6	[64, 74, 82, 97, 100, 102]
Other	25	[22, 34, 66, 69, 75, 78, 80, 81, 85–88, 90, 95, 103, 104, 106, 108–111, 115, 117–119]
Methodological approach	**No. of studies**	**Reference number**
Single stage review	39	[22, 34, 35, 67, 68, 74, 76–78, 80–83, 85–87, 89–94, 97–99, 103, 104, 107–116, 118, 120]
Two stage review	7	[65, 66, 75, 79, 88, 95, 106]
Global Trigger Tool (GTT)	3	[105, 117, 119]
Not clear	7	[63, 64, 69, 96, 100–102]
Sampling strategy	**No. of studies**	**Reference number**
Flagged and random	11	[75, 76, 82, 91, 93, 100, 102, 106, 107, 113, 115]
Random	21	[22, 34, 35, 69, 78, 83, 85, 89, 90, 94–96, 103, 105, 109, 110, 116–120]
Flagged	24	[63–68, 74, 77, 79–81, 86–88, 92, 97–99, 101, 104, 108, 111, 112, 114]
Validation of administrative data or administrative data-based AE detection tools	**No. of studies**	**Reference number**
Administrative data coding	32	[34, 35, 65, 66, 69, 76–83, 85, 87, 88, 90, 91, 94–96, 98, 103, 108–111, 113, 114, 116, 117, 120]
Administrative data-based AE detection tool	24	[22, 63, 64, 67, 68, 74, 75, 86, 89, 92, 93, 97, 99–102, 104–107, 112, 115, 118, 119]
Note: Please refer to table 3 for article reference numbers		

Other notable study features include coding classification system, administrative data-based detection tool, type of medical record system used, and number of medical records reviewed (Table 3.4). The accuracy of the AHRQ PSIs was measured in 16 studies. Excluding five studies

that were unclear in relation to the coding classification system used, all other administrative data-based AE detection tools used versions of ICD.

Table 3.4 Key study features of included studies—author, coding classification system, administrative data-based detection tool, type of medical record system used, and number of medical records reviewed

Article reference number	First author and year of publication	Coding classification system used	Patient safety data system	Type of record system	Number of medical records reviewed
76	Ackroyd-Stolarz 2014	ICD-10-CA		Not clear	300
114	Amelung 2022	ICD-10		Not clear	69
65	Ammann 2017	ICD-9 CM		Charts stored on password-protected server	131
79	Ammann 2018	ICD-9 CM		Not clear	75
85	Awad 2015	ICD-9		Electronic medical records	355
87	Bensley 2013	ICD-9		Not clear	1342
67	Borzecki 2011	ICD-9 CM	AHRQ PSI	Electronic medical records—VA (veterans administration) EMR data were accessed using VistAWeb, a program enabling centralized access to EMR data from all VA facilities	119
103	Borzecki 2013	ICD-9 CM		Electronic medical records—VA (veterans administration) EMR data were accessed using VistAWeb, a program enabling centralized access to EMR data from all VA facilities	125
75	Caminiti 2012	ICD-9	AE detection system developed by the authors	Not clear	504
34	Campbell 2011	ICD-9		Hospital patient charts and electronic medical records	100
86	Chen 2013	ICD-9 CM	AHRQ PSIs	Electronic medical records—VA (veterans administration) EMR data	224

				were accessed using VistAWeb, a program enabling centralized access to EMR data from all VA facilities	
66	Cheng 2021	ICD-10 CM		Not clear	1384
107	Duke 2022	Not clear	The national hospital-acquired complication programme developed by the Australian Commission on Safetyand Quality in Healthcare (ACSQHC)	Millenium™ (Cerner Corp., Kansas City, MI, USA) electronic medical records system	722 (462 not flagged and 260 flagged)
109	Eastwood 2022	ICD-11 and ICD-10 CM		Not clear	1009
88	Eisler 2018	ICD-9		Electronic medical records—hospital Clinical Data Warehouse houses all hospital administrative data and electronic health records	254
89	Foglia 2015	ICD-9 CM	Adverse outcome index: an obstetrical quality measure	Electronic medical records	4252
116	Fujiwara 2022	ICD-10		Electronic medical records—EMRs from Kurashiki Central Hospital, Japan, as the reference standard	641 cases
90	Geraci 1997	ICD-9 CM		Not clear	1837
110	Graham 2019	ICD-10-CA		Paper-based and electronic medical records	154
115	Guzzo 2019	ICD-9 CM	AHRQ PSIs	Not clear—the clinical records for data extraction were provided by the Health Hospital Authority	
111	Ho 2017	ICD-10-CA		Not clear—nursing consult documentation	1217

91	Hougland 2006	ICD-9 CM		Not clear	1961—random and 1142 flagged
92	Kaafarani 2011	ICD-9 CM	AHRQ PSI	Electronic medical records—VA (veterans administration) EMR data	336
83	Kandel 2021	ICD-10		Not clear	8844
81	Kuklik 2019	ICD-10 GM		Electronic and paper-based charts	2326 cases
78	Kuklik 2017	ICD-10		Electronic and paper-based charts	807 cases for PPV assessment and 1510 charts for sensitivity assessment
22	Maass 2015	ICD-10 GM	AHRQ PSIs, OECD PSI, Author-developed PSIs	Paper-based charts	3000 cases
119	Magnéli 2019	ICD-10	Instrument based on a set of 13 specific ICD codes and one code category (I-codes: diseases of the circulatory system) defining AEs.	Medical records were obtained as paper copies or were reviewed on location at the hospital	1998
93	Martin 2016	ICD-9 CM	30 harm indicators based on administrative data	Not clear	771
82	Miano 2019	ICD-9 CM		Electronic medical records	1019
94	Miller 2016	ICD-9		Not clear	204
104	Mull 2014	ICD-9 CM	AHRQ PSIs	Electronic medical records—VA EMR system, VistaA	268 771 hospitalizations
105	Mull 2015	Not clear	AHRQ	Electronic medical records—VA Electronic Health Records	273 cases
80	Ng 2018	ICD-10AM		Electronic medical records	140
95	Pellathy 2022	ICD-9 CM		Electronic medical records	3680
96	Peyton 2019	ICD-9 and ICD-10		Not clear	268
112	Quan 2013	ICD-10	AHRQ PSIs	Not clear	490

68	Ramanathan 2013	ICD-9 CM	AHRQ PSIs	Not clear	not clear
35	Reilly 2020	ICD-10-AM		Electronic medical records	482
69	Roberts 2008	ICD-10-AM		Not clear	1184 (393 flagged and 791 random)
97	Rosen 2012	ICD-9 CM	AHRQ PSIs	Electronic medical records—Veterans Health Administration (VA) electronic medical record	1266 cases
98	Saff 2016	ICD-9 CM		Not clear	1634
99	Scanlon 2006	Not clear	AHRQ PSIs	Not clear	1132
63	Scanlon 2008	Not clear	AHRQ PDIs	Not clear	1703
77	Stacey 2014	ICD-10		Not clear	165
117	Storesund 2019	ICD-10		Not clear	700 admissions in 695 patient charts
74	Utter 2009	ICD-9 CM	AHRQ PSI	Electronic and paper-based charts	249
64	Utter 2010	ICD-9 CM	AHRQ PSI	Electronic and paper-based charts	609 cases
100	Utter 2013	ICD-9 CM	AHRQ PSI	Not clear	462 (181 indicator positive and 281 indicator negative)
108	Valentine 2022	ICD-10-AM		Electronic medical records—VERDI Electronic Patient Records system (IPHealth Pty. Ltd.) and the electronic medical record (Epic Systems Corporation,Verona, WI, USA)	151
118	Valik 2020	ICD-10	Sepsis surveillance based on Sepsis-3-clinical criteria	Electronic medical records	1000 admissions
113	Verelst 2010	ICD-9 CM		Not clear	1515 (741 flagged for at least one

					indicator and 774 controls)
101	Walker 2010	ICD-9 CM	Adverse Outcome Index perinatal quality indicator system that was derived from administrative data	Not clear	342 cases
120	Walther 2021	ICD-10 GM		Not clear	332
106	Weingart 2000	Not clear	CSP—a computerized method to identify potentially preventable complications of hospital care using discharge abstract data information	Not clear	1111 cases (831 flagged and 280 unflagged)
102	Zrelak 2013	ICD-9 CM	AHRQ PSIs	Not clear	324 charts (94 flagged and 230 unflagged)

The medical records system used was unclear in 29 studies as the authors did not specify the format of the charts but referenced using a manual chart review or conducting medical record reviews to validate rates of AEs in administrative data. Paper-based charts, electronic medical records, and a mix of both were used in the remaining studies (Table 3.4).

3.5.3 Methodology

Methodological approaches to chart review

The GTT was used in three studies. A further 7 studies used an unspecified two-stage review approach, and 39 studies used a single-stage review process. The methodological approach used in the remaining seven studies was unclear (Table 3.3).

Sampling strategy

The sampling strategies used to identify charts for review are outlined in Table 3.3. Screening programmes were used in 24 studies to select flagged charts, i.e. charts that had been assigned specific codes, indicating that the patient had experienced an AE. A further 11 studies included both flagged charts and non-flagged charts and the remaining 21 studies selected a random sample of non-flagged charts.

3.5.4 Level of accuracy identified by validation

Accuracy

The sensitivity, specificity, PPV, and NPV of the administrative data-based identification of AEs validated against medical records, where found, in addition to the number of AEs detected by chart review and in the administrative data are presented in Table 3.5. Administrative data were reported to be accurate for detecting AEs in 11 studies; however, two studies (Campbell *et al.*, 2011; Reilly *et al.*, 2020) suggested that chart review is a poor method of detecting AEs. The administrative data and detection tools did not accurately represent rates of AEs in 31 studies. Administrative data were reported to be useful for monitoring patient safety and identifying potential patient safety incidents but not for public reporting or measuring performance by four studies. A further 10 studies reported varied or moderate accuracy and suggested that administrative data have potential for monitoring AEs.

Table 3.5 Included studies—author, no. of AEs identified by chart review, no. of AEs identified by administrative data, sensitivity, specificity, PPV, NPV, verbatim statement by authors on validity/usability of data, summarized validation outcome.

First author	No. of AEs by chart review	No. of AEs in administrative data	Sensitivity	Specificity	PPV	NPV	Verbatim statement by authors on validity	Summarized validation outcome
Ackroyd-Stolarz	164	135	67%	89%			It is feasible and valid to identify pressure ulcers, fall-related injuries, and adverse drug events in older hospitalized patients using routinely collected administrative hospitalization data	Accurate
Amelung		41			59%		ICD-10-code-based calculations might overestimate patient harm and economic losses	Not accurate
Ammann 2017	34	131			27%		Position-unspecified diagnoses were unlikely to represent true AIS cases. PPVs for principal and secondary inpatient diagnosis codes were higher, but still meaningfully lower than estimates from prior chart validation studies	Not accurate
Ammann 2018	38	75			61%		Our study indicates that principal-position inpatient	Accurate

							ICD-9 CM diagnosis codes for DVT and PE recorded in the Sentinel Distributed Database (SDD) have a high PPV (90%) for acute venous thromboembolism (VTE)	
Awad	544	195					Both claims data and National Surgical Quality Improvement Program (NSQIP) accurately recorded major complications, but were suboptimal compared to chart abstraction in capturing minor complications. Better systems therefore need to be put in place expeditiously to adequately benchmark the outcomes of surgical management of patients with head and neck cancer	Varied accuracy—accurate for major complications but not for minor complications
Bensley	27	18 true-positive, 8 false-positive, 9 false-negative	66.70%	99.40%	69.20%	99.30%	While perioperative stroke rates were similar between administrative data and chart review, administrative data identified the wrong	Not accurate

							patients and had poor accuracy	
Borzecki 2011	75	119			63%		In its present state, PMD should continue to be used as a screen for patient safety events as opposed to a performance measure	Useful for monitoring patient safety but not as a performance measure
Borzecki 2013	25	0 true-positives, 38 false-negative, 68 true-negative					Despite the high PPV of the postoperative respiratory failure (PRF) PSI algorithm, the relatively high proportion of FNs suggests that publicly reported rates should be interpreted with caution. Improved ventilation/intubation coding will have more of an impact on case identification than adding ICD-9 CM codes to the algorithm	Not accurate
Caminiti	91	189 cases	41%	89%	18%	96%	Screening accuracy was 86%. This approach has the potential to allow the timely identification of AEs, enabling to quickly devise interventions. This detection system could be of true benefit for hospitals	Accurate

							that intend assessing their AEs	
Campbell	19.4% (major complication) and 31.6% (minor complication)	17.4% (major complication) and 43.8% (minor complication)					Both the retrospective review and ICD-9 assessment underreported incidence. These findings illustrate another significant weakness and potential source of inaccuracy in the use of population-based ICD-9 and retrospective data capture methodologies	Not accurate
Chen	192 (97 Postoperative Wound Dehiscence (PWD) and 95 Accidental Puncture or Laceration (APL))	224 admissions					Among the 224 flagged medical records (112 per PSI), a total of 97 true PWD cases and 95 true APL cases were identified	Moderate accuracy—potentially useful
Cheng	789	1384			57%		The PPV of ICD-10 CM T codes analysed in our study was insufficient for identifying ADEs during hospitalization. The sensitivity and specificity of this were inadequate	Not accurate

Duke	60 AEs in 462 non-flagged, 423 AEs in 260 flagged		45%	97%	74%	90%	The predictive value of the current HAC methodology for these adverse events was reasonable, but poor at identifying hospital-related or healthcare errors	Not accurate
Eastwood			31.30%	94.60%			As evidenced by low specificity in Hospital #1 coding, coding harms in ICD-11 was particularly challenging	Not accurate
Eisler	240—any aspiration, 9—perioperative aspiration				95%—any aspiration, 3.5%—perioperative aspiration		International Classification of Diseases, Ninth Revision codes for aspiration used as a secondary data source were nonspecific for perioperative aspiration, but when combined with record review yielded a 30% increase in identified cases of aspiration over quality assurance data alone	Not accurate
Foglia	530	502	81.70%	98.20%	86.30%	97.40%	Caution is advised when using the AOI as an exclusive measure of assessing obstetric quality because it may be heavily influenced by a single	Not accurate

							outcome measure; perineal laceration rates represented twice the frequency of all other outcomes combined. The AOI should be modified to better measure preventable adverse events and include a means of accounting for pre-existing conditions	
Fujiwara					PPV ranged 0–100 %		For AEs, PPV tended to be low overall with a definition based on ICD-10 alone, suggesting that a combination of definitions based on specific treatment modalities for AEs could be more appropriate	Not accurate
Geraci	263	98	14% (Exclusive)	96%	37% (Exclusive)		In conclusion, we found that ICD-9 CM codes in administrative data were poor measures of in-hospital complication occurrence in our study population. Our results suggest that administrative data should not be used at the present time as a primary source of information on	Not accurate

							complication rates or provider practice profiles	
Graham	24	11 true-positives, 2 false-positives and 13 false-negatives	45.80%	95.80%	84.60%	78%	Administrative data demonstrated a lower sensitivity and measure of agreement with the gold standard	Not accurate
Guzzo	4	45					In conclusion, looking at the objectives of this study, one could argue that the use of administrative data is far from being perfect in a context of patient safety management, and this could be important from the medico-legal point of view	Not accurate
Ho	397	163 (definition 1), 670 (definition 2)	27.7% (definition 1), 32.8% (definition 2)	98.8% (definition 1), 95.9% (definition 2)	91.7% (definition 1), 79.3% (definition 2)	73.9% (definition 1) 74.6% (definition 2)	Discharge abstract database (DAD) underestimate pressure ulcer prevalence. Low sensitivity of DAD for identification of pressure ulcer suggests that this data source may not be accurate for determining overall prevalence, and it should be used with caution if it is being compared with other prevalence studies	Not accurate

Hougland	Flagged sample—704 true Adverse drug events (ADEs), 286 in-hospital ADEs. Random sample—224 inpatient ADEs, 58 ADEs causing admission	Flagged sample—1122. Random sample—23 inpatient ADEs, 32 ADEs causing admission	10% 23/224 (inpatient ADEs—random sample). 55% 32/58 (causing admission—random sample)	97% 1689/1737 (inpatient ADEs random sample). 97% 1855/1903 (causing admission random sample)	63% for any ADE and 25% for inpatient ADE		Flagged ADE codes have an overall PPV of 63% and detect just over half of ADEs causing hospital admission. These codes have a positive predictive value of 25% for inpatient ADEs but detect only 10% of overall inpatient ADEs. Flagged ADE codes provide an imperfect but immediately available ADE surveillance system	Not accurate
Kaafarani	48 post-op pulmonary embolism (PE) or deep vein thrombosis (DVT). 82 iatrogenic pneumothoraces. 95 accidental puncture or laceration	112 for each adverse event (post-op PE/DVT, iatrogenic pneumothoraces, accidental puncture/laceration)			43% for PE or DVT. 73% for iatrogenic pneumothora		Until coding revisions are implemented, these PSIs, especially pPE/DVT, should be used primarily for screening and case-finding. Their utility for public reporting and pay-for-performance needs to be reassessed	Useful for screening and case-finding but not for public reporting or performance

					ces. 85% for accidental puncture or laceration.			
Kandel	586 admission and 354 AEs		88% (92% diagnosis and procedure codes combined)	1	78%	100 %	Compared to PJI diagnosis codes, combinations of diagnosis and procedure codes improve the detection of a Prosthetic hip and knee joint infections (PJI) in administrative databases	Accurate
Kuklik 2017	1302 cases	2326					When focusing on specific ADE codes, routine data can be used as markers for npADEs and medication errors, thus providing a meaningful complement to existing drug surveillance systems	Accurate
Kuklik 2019	736 cases had ICD coded	186 AEs with no drug-related causation and 60	37.6% for no drug-related		91.20%		Overall, the results confirm the potential of utilizing ICD-10 GM diagnoses	Accurate

	diagnosis and 525 cases had ADE confirmed for PPV assessment. 495 ADEs were identified in the sensitivity assessment	with drug-related coding. Overall 246 AEs were coded	causation and 12% for drug related coding. Overall sensitivity was 49.7%				coding for ADEs from administrative routine data in hospital monitoring systems	
Maass	456	171	6–100%	99–100%	33–100 %		Indicators based on German administrative data deviate widely from indicators based on clinical data. Therefore, hospitals should be cautious to use indicators based on administrative data for quality assurance. However, some might be useful for case findings and quality improvement	Varied accuracy and hold potential—useful for case finding and quality improvement but not quality assurance
Magnéli	2116 AEs in 1171 patients	1145	5.70%	95.20%			The instrument sensitivity for AEs was very low for both 30 and 90 days, but the specificity was high for both 30 and 90 days. The studied instrument is	Not accurate

							insufficient for valid measurements of AEs after hip arthroplasty	
Martin	297	408	65%	85%	59%	88%	The administrative harm measurement tool (AHMT) is sufficiently accurate for use as a within hospital tool to reliably detect and track harm. Nevertheless, it is not recommended as a tool to make comparisons across institutions, which has policy and payment implications	Useful to track harm but not for public reporting and payment (coding)
Miano	935	815	87.20%	99.60%	91.60%	99.4	We observed higher specificity and lower sensitivity for registry defined VTE compared to administrative data. The low false-positive rate of the registry supports its validity in VTE outcomes research. Further investigation is needed to evaluate the relevance of the variable sensitivity, likely due to definitional differences. Supplementation of registry data with	Accurate

							administrative data may strengthen its validity	
Miller	1122	1202	10.9–99.1%	56.2–99.9%	21.1–98.7%	86–99.9%	The current system of AE reporting for cooperative oncology group clinical trials in paediatric acutemyeloid leukaemia underestimates AE rates	Not accurate
Mull 2014	6005		31–68%	99.1–99.8%	31–72%		These results suggest that the PSIs have moderate criterion validity; however, some surgical PSIs detect different AEs than VASQIP	Moderate accuracy—potentially useful
Mull 2015	109	5 (PSIs), 9 (Veterans Health Administration Quality Improvement Program (VASQIP)), 11 (surgical diagnosis-related group (DRG))					The GTT identified previously undetected AEs at one VA. The GTT has the potential to track AEs and guide quality improvement efforts in conjunction with existing AE surveillance mechanisms	Not accurate
Ng	128	140			91%		CCS is a feasible and reliable approach for the routine monitoring of ADEs in hospitals	Accurate
Pellathy	158	219	55%		40%		ICD-9 CM coding missed diagnostic test-confirmed HA-VTE cases and	Not accurate

							inaccurately assigned cases without confirmed VTE, suggesting dependence on administrative coding leads to inaccurate HA-VTE phenotyping	
Peyton	215 AEs in 122 charts	145 AEs in 80 charts	38.50%	77.40%	58.80%	60.10%	Notwithstanding possible limitations, the level of disagreement of ICD-9 and 10 codes with clinical chart review and the relatively poor performance of code based complication reporting, including underreporting and low sensitivity, show that claims codes are not reliable or complete sources for identifying complications after cystectomy	Not accurate
Quan			12.5–89.5%				Several PSIs had high PPV in the ICD administrative data and are thus powerful tools for true-positive case finding. The tools could be used to identify potential cases from the large volume of admissions for verification through chart reviews. In contrast, their	Moderate accuracy—potentially useful

							sensitivity has not been well characterized and users of PSIs should be cautious if using them for 'quality of care reporting' presenting the rate of PSIs because under-coded data would generate falsely low PSI rates	
Ramanathan	321	388			83%		We conclude that the validity of PSIs is low and could be improved by increased education for clinicians and coders. In their current form, PSIs remain suboptimal for widespread use in public reporting and pay-for-performance evaluation	Not accurate
Reilly	558		0–100%	91.6–99.8%	0–80%	78.8–100%	Using International Statistical Classification of Diseases and Related Health Problems (10th edition) Australian Modification codes to identify postoperative complications at our hospital has high specificity but is likely to underestimate the	Not accurate

							incidence compared to clinical audit	
Roberts	192 (188/393 flagged and 4/791 random)		72.9% (flagged cases)	98.5% (random sample)	47.3 % (flagged cases)	99.5 % (random sample)	PHDS can be used reliably to identify women who suffer a major adverse outcome during the birth admission and have potential for monitoring the quality of obstetric care in a uniform and cost-effective way	Accurate
Rosen	747				28–87%		Overall, PPVs were moderate for most of the PSIs. Implementing POA codes and using more specific ICD-9 CM codes would improve their validity. Our results suggest that additional coding improvements are needed before the PSIs evaluated here in are used for hospital reporting or pay for performance	Moderate accuracy—potentially useful
Saff	444 admissions	1634 admissions					We found that dual coding with a relevant ICD-9 CM code and a relevant E code was found to have a higher likelihood of identifying an allergic drug reaction (76%) compared with	Not accurate (using codes alone)

							coding patients with a possible drug allergy with ICD-9 CM code alone (31%) or an E code alone (12%). Specific ICD-9 CM and E codes can be used in combination to identify allergic drug reactions. Further study of these codes in the inpatient and outpatient settings is necessary to better understand the utility of diagnosis codes for improving epidemiologic research on drug allergy	
Scanlon 2006		1151					The chart review confirmed previous work done with administrative data; the indicators complications of anaesthesia, death in low mortality diagnosis-related groups, and failure to rescue were inaccurate in the paediatric population. Clinician chart reviews to verify paediatric patient safety events suggest that 8 of 11 PSIs are useful for	Useful for quality improvement but not for comparison of hospital performance of accountability

							quality improvement in paediatric patients but are inadequate for public comparison of hospital performance	
Scanlon 2008	1695	1942			PPV for events clearly preventable ranged 0–51.4%. PPV for events clearly/possible preventable rang		A subset of paediatric quality indicators derived from administrative data are reasonable screening tools to help hospitals prioritize chart review and subsequent improvement projects. However, in their present form, true preventability of these complications is relatively low; therefore, the indicators are not useful for public hospital comparison	Not accurate

					ed 20–80.7 %			
Stacey	146	137					Review of ICD-10-coded AMEs can provide valuable information to improve patient safety and quality	Accurate
Storesund	GTT found 331 complications in 212/700 admissions	519 complications in 332/700 admissions. After excluding codes for complications Present on admission (POA), 298 in 141/700 admissions					Crude data with unverified ICD-10 codes significantly overestimate surgical complications within hospitals because complications present on admission are included	Not accurate
Utter 2009	226	249			91% from a coding perspective but 68% from a clini		Although PSI 15 is highly predictive of APL from a coding perspective, the indicator is less predictive of APL that could be considered clinically important	Accurate (in terms of coding)

					cal perspective of cases that involved consequential injuries			
Utter 2010	507	609			59–86%		Although it appears to have high PPV and adequate sensitivity based on a previous study, PSI 11 does not currently appear as promising for its construct validity	Not accurate
Utter 2013	126	181	42%	99.90%	78%	99.70%	Quality indicators based on administrative data carry some degree of inherent inaccuracy as a trade-off for the advantage of capturing information broadly at minimal expense… it seems to hold promise for detecting cases	Moderate accuracy—potentially useful

							of serious and possibly preventable complications	
Valentine	27	151			18%		Although ICD-10-AM data are readily available in Australian healthcare settings, these data are not sufficient for monitoring and reporting of hospital-acquired pneumonia in haematology-oncology patients	Not accurate
Valik	311/674 patient with suspected infection and 2/326 without suspected infection. 343 in total fulfilled sepsis-3 criteria	59					Explicit sepsis ICD-codes seem to underestimate the incidence of sepsis compared to clinical data	Not accurate
Verelst					29.9 – 62.3 %	93.8 – 99.6 %	The B-HDDS has the potential to accurately detect some but not all adverse events. Adding a code 'present on admission' and improving the ICD-9 CM codes might	Not accurate

							already partially improve the correspondence between the B-HDDS and the medical record review	
Walker		279			0–100 % for 10 indicators		The adverse outcome index (AOI) measures that were based on administrative data were of variable accuracy	Varied accuracy—potentially useful
Walther	308		38.2% for Postpartum hemorrhage (PPH) and 36.2% for severe PPH	99.4% for PPH and 99.4% for severe PPH			Hospital discharge data are not accurate enough to assess the incidence of postpartum haemorrhage at hospital or national level	Not accurate
Weingart	458/831 flagged cases and 21/280 unflagged cases. In total 479 complications identified	831					For some types of complications, screening administrative data may offer an efficient approach for identifying potentially problematic cases for physician review	Moderate accuracy—potentially useful

Zrelak	60 (flagged) and 3 (random)	94	67%	99.90%	64% (60/94 charts with correct coding)	99.9% (3/230 false-negative charts)	PSI 10 mostly concerns AKI and currently has moderate criterion validity, which might improve with increased use of 'present on admission' coding, abandonment of the diabetes criteria, and adjustments to the indicator specifications regarding dialysis access and urinary tract obstruction	Moderate accuracy—potentially useful

3.6 Discussion

3.6.1 Statement of principal findings

This review highlights trends in relation to the characteristics of validation studies and presents an overview of the methodological approaches and strategies used to conduct retrospective chart reviews. It also explores the accuracy of AE rates in administrative data.

3.6.2 Strengths and limitations

The focus on breadth rather than depth of knowledge is an inherent limitation of scoping reviews (Tricco *et al.*, 2016); however, this methodology was deemed suitable as it is appropriate for addressing broad research questions and mapping evidence from a variety of sources (Pollock *et al.*, 2021).

3.6.3 Interpretation within the context of the wider literature

Geographical location of the included studies is notable. Previous researchers similarly identified the USA as a leading location where validation studies are being conducted (Tsang *et al.*, 2012; Goto *et al.*, 2014; Redondo-González *et al.*, 2018). The proportion of AHRQ PSI studies included may have contributed to this finding as these indicators are unique to the USA. Collection of administrative data in the USA for billing and insurance claims purposes may be incentive for improving data accuracy and contribute to greater numbers of validation studies. Further global exploration of validating AE rates in administrative data through chart review may allow for broader comparison between health systems.

The upward trend in relation to year of publication demonstrates increasing recognition of administrative data as a source of information on AEs and a momentum towards enhanced accuracy. Retrospective chart review is commonly used to assess quality of care and collect data in clinical epidemiological research (Wu and Ashton, 1997). Therefore, it is unsurprising that chart reviews have been used in response to calls for validating administrative data.

The potential of the chart review methodology to validate rates of AEs in various specialties in administrative data was highlighted by this review. Surgical AEs such as wound infections, post-operative complications, and accidental punctures or lacerations were most commonly validated and are among the most reported in-hospital AEs (Hibbert *et al.*, 2016; Schwendimann *et al.*, 2018). Although reporting surgical AEs may be associated with litigation and

repercussions regarding reputation (Gallagher *et al.*, 2003), their disclosure decreases the chances of a patient filing a lawsuit (Vincent, Young and Phillips, 1994; Kachalia *et al.*, 2003; Mazor *et al.*, 2004; Robbennolt, 2006). Given the informed consent process and the acknowledgement of such AEs as possible complications, few surgical AEs should be considered truly unanticipated (Lipira and Gallagher, 2014); therefore, they are more likely to be readily acknowledged than AEs resulting from negligence or medical error. As surgical AEs are more visible, their detection may be more common than AEs in other specialties with 97% of surgeons reporting that they would definitely disclose such an AE to a patient (Gallagher *et al.*, 2006). The PSIs are largely composed of surgical indicators (Farquhar, 2008); therefore, their inclusion may have contributed to the focus on surgical AEs. Given the burden of surgical outcomes in relation to reputation and litigation, accurate data and a standardized chart review method would be beneficial to surgeons for monitoring AEs.

The various named study designs identified reiterate the lack of standards for reporting chart review study designs and the limited availability of literature on chart review methodologies (Worster and Haines, 2004). Evidently, there has been little progress towards developing a more systematic and standardized review approach. This further highlights the urgency for consensus on best practice for conducting chart reviews.

As this study sought to explore manual chart review methods, sources using Artificial Intelligence (AI) were excluded; however, when discussing study designs, the increasing use of AI is notable (Murff *et al.*, 2011; Karhade *et al.*, 2020; Vermassen *et al.*, 2020; Borjali *et al.*, 2021; Verma *et al.*, 2022; McMaster *et al.*, 2023).

AEs detected through incident reporting systems have recently been compared to those detected using the GTT (Hibbert *et al.*, 2023). This current review explores all methodological chart review approaches used to validate rates of AEs in administrative data. In line with previous research (Rafter *et al.*, 2015), the variation of single-stage and two-stage chart review processes demonstrates a lack of consensus on how to measure AEs. A two-stage review process has been identified as a valid and reliable method of conducting chart reviews (Siems *et al.*, 2020). The HMPS and GTT have frequently been compared with some researchers identifying higher sensitivity and specificity and better AE detection using the GTT (Classen *et al.*, 2011) and

others identifying more AEs using the HMPS (Unbeck *et al.*, 2013). This further demonstrates the lack of consensus in relation to guidelines for best practice.

The strategy for obtaining a chart review sample is a key consideration (Vassar and Holzmann, 2013). Random sampling is the gold standard as each chart has equal chance of being selected. This technique reduces bias and increases the generalizability of results (Vassar and Holzmann, 2013) and should be considered when developing a more systematic chart review approach. Reviewing a random sample of charts allows for detection of all potential AEs and inclusion of false-negatives missed by detection tools if administrative data are inaccurate. A limitation of this method is the large number of medical records required which may not be possible in all chart reviews (Vassar and Holzmann, 2013).

A random process for selecting records is critical when using the GTT (Griffin and Resar, 2009). The included GTT studies used random sampling; however, the use of flagged charts was widespread across other methodological approaches. This further enhances the need for consensus in relation to the chart review method and the strategies used to identify samples. Internal and external validity may be compromised if studies fail to use a random sample or if a sample is selected from an atypical population (Kaji, Schriger and Green, 2014).

Convenience sampling allows charts identified as having an AE by administrative data-based detected tools to be selected. This validates known cases of AEs but may exclude miscoded or unassigned AEs missed by detection tools and underrepresent true AE rates. This method presents limitations in relation to generalizability but is useful when reviewing rare AEs or smaller sample sizes (Vassar and Holzmann, 2013).

Reviewing only flagged charts was identified by several authors as a limitation (Scanlon *et al.*, 2008; Utter *et al.*, 2010; Borzecki *et al.*, 2011; Ramanathan *et al.*, 2013; Ammann *et al.*, 2017; Cheng *et al.*, 2021) as excluding non-flagged charts may have underrepresented AE incidence by omitting false-negatives (Scanlon *et al.*, 2008; Ramanathan *et al.*, 2013). The value of these studies is worth considering as rather than validating administrative data, they explored the validity of indicators used to flag the sample of charts as measures of patient safety (Zhan and Miller, 2003). It may be more valuable to assess the validity of the coding to ensure that the data being screened are accurate.

Including both flagged and non-flagged charts allows true-negatives and false-negatives to be detected and ensures that AE rates are not underestimated (Scanlon *et al.*, 2008). Furthermore, flagged and random samples are advantageous in research investigating rare conditions as an entirely random sample may be inefficient and resource demanding (Roberts *et al.*, 2008).

The range of ICD revisions and variants used contributes to the complexity of comparing coded data and clinical contexts internationally (Otero Varela *et al.*, 2021). The studies that reported on the accuracy of administrative data-based detection tools relied on different modifications and revisions of ICD to create their patient safety data. Therefore, the range of ICD revisions and systems used must be considered as a potential source of result variation. Comparability of AEs internationally is threatened by country-specific modifications of ICD; therefore, a standardized ICD classification that is universally accepted may facilitate benchmarking of AEs using administrative data (Jetté *et al.*, 2010).

Furthermore, the medical record system used and the number of charts reviewed are important features of the studies in this review. Parallel use of both paper-based and electronic medical records may result in inconsistencies between record systems (Mikkelsen and Aasly, 2001) and may have contributed to variation in results. Consequently, researchers may wish to consider the type of medical record system used in future validation studies. Standardized processes for entering data and limiting variation in medical records increase the accessibility and usability of chart data. Furthermore, the development of consistent data collection procedures and more systematic approaches are critical to rigour in chart review studies (Spratling and Powers, 2015).

Sample size is a key sampling consideration in chart review studies. Greater power is associated with studies that have larger sample sizes (Vassar and Holzmann, 2013). The number of charts reviewed may be valuable to researchers planning future studies as chart reviewing can be time-consuming and the feasibility of locating charts and extracting data may require consideration (Johnston *et al.*, 2019).

Although various levels of accuracy were identified, administrative data can potentially provide accurate information. In line with previous research (Van Mourik *et al.*, 2015), while some studies indicated that these datasets can be reliable, others identified inaccuracies when comparing administrative data with chart data. The studies that identified rates of AEs recorded in administrative data with good accuracy (Roberts *et al.*, 2008; Utter *et al.*, 2009; Caminiti *et*

al., 2012; Ackroyd-Stolarz, Bowles and Giffin, 2014; Stacey *et al.*, 2014; Kuklik, Stausberg and Jöckel, 2017; Ammann *et al.*, 2018; Ng *et al.*, 2018; Kuklik *et al.*, 2019; Miano *et al.*, 2019; Kandel *et al.*, 2021) strengthen the case for using administrative data to inform health research and policy. Although further work is warranted, these findings are in agreement with previous claims that with consensus on rigorous methodology for validating and improving existing algorithms, administrative data can provide valuable information on AE rates and patient safety incidents (Van Mourik *et al.*, 2015).

3.6.4 Implications for policy, practice, and research

This review highlights the potential for administrative data to improve patient safety, healthcare quality, and reduce healthcare costs by providing valuable data on AE rates; however, further research is warranted to ensure that administrative data are robust. The lack of consensus on best practice for conducting chart reviews is highlighted. The different methodological approaches and sampling strategies used demonstrate the potential for these studies to differ significantly in relation to the interpretation of their results and their credibility. These inconsistencies mirror previously identified common pitfalls (Vassar and Holzmann, 2013) and may devalue the chart review method of validating rates of AEs in administrative data. The development of a standardized protocol with clear guidelines could enhance the methodological rigour of the retrospective chart review and allow for the accuracy of administrative data to be improved.

3.7 Conclusions

Accurate administrative data will enable researchers to compare hospital environments in the context of patient safety and facilitate benchmarking of AE rates across hospitals, regions, and countries. Further clarity and consensus on chart review methods is necessary to develop a more systematic chart review approach for improving patient safety and healthcare quality.

3.8 Transition between scoping review and validation study

Given the implications of the review presented in the previous chapter in relation to the need to ensure that administrative data are robust, a validation study was required to measure the accuracy of the Hospital In-patient Enquiry (HIPE) data in Ireland for recording the rates of nursing-sensitive adverse events. As identified through the scoping review, administrative data has the potential to be used to improve patient safety and healthcare quality, and to reduce healthcare costs however, it must be robust and accurate. Pneumonia, urinary tract infections, pressure ulcers and delirium were the four measurable nursing-sensitive adverse events that were of interest in this overall research project given their indicative nature in relation to missed nursing care and the nursing interventions that get left undone when the demand for care exceeds the available supply of both human and material resources. These adverse events are measurable indicators of Failure to Maintain and their presence suggests the insufficient delivery of fundamental care for older hospitalised patients. Given that these adverse events may play a role in identifying specific care deficits, it is essential that the rates of their occurrence in the population of older patients be made explicit and their recorded rates within the HIPE data be validated.

The scoping review in the previous chapter also highlighted the lack of consensus on the best practice for conducting chart review studies and demonstrated the requirement for the development of consistent data collection procedures and a more systematic approach to conducting chart reviews. The results of this review indicated that the development of a standardised protocol with clear guidelines to guide a chart review would enhance the methodological rigor in chart review studies. In light of this, a structured chart review protocol (Appendix B) and data collection instrument were co-produced by the academic researchers involved in the Cost2Care project and the healthcare workers from the participating hospital. The protocol guided the chart review process that was used to validate the rates of nursing-sensitive adverse events in the HIPE data set. The development and use of a chart review protocol and data collection instrument in this research study sought to ensure that the process of conducting the chart review followed a systematic approach that could be replicated across hospital settings.

The following chapter presents the validation study that was conducted to understand the true rates of pneumonia, urinary tract infections, pressure ulcers and delirium in patients ages over 65 in an acute hospital setting in Ireland. The rates identified through the chart review were then used to validate the recording of these four key adverse events within HIPE, Ireland's national administrative dataset on discharges from acute hospitals. The validation component of this research sought to provide an in-depth understanding of the current accuracy of these data and highlight potential areas for improvement in order for these data to present an accurate reflection of the experiences of older patients in acute hospitals in Ireland.

Chapter 4 : Publication 2 - Validating adverse events in administrative healthcare data in Ireland: A retrospective chart review study

The work presented on pages 94-118 of this chapter has been published in BMC Health Services Research:

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A. and Kirwan, M. (2025) 'Validating adverse events in administrative healthcare data in Ireland: a retrospective chart review study'. *BMC Health Services Research,* 25(1113) doi:10.1186/s12913-025-13201-x

Pages 91-93 of this chapter contain a signed declaration verifying the author contribution to the research presented in this chapter.

As per DCU guidelines, due to copyright issues across different publishers, the PDF copies of the published articles in their final journal format cannot be included in the PhD thesis therefore, all published work must appear in manuscript format. The content presented in the thesis is correspondent with the content of the published papers, with the exception of minor variations due to formatting.

4.1 Signed declaration verifying author contributions

Section 1: Candidate's Details	
Candidate's Name	Anna Connolly
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School	School of Nursing, Psychotherapy and Community Health
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Title of PhD by Publication Thesis	Nursing-sensitive adverse events and missed nursing care in older hospitalised patients
Section 2: Paper Details	
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List of authors as in order given on accepted/published version	Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A. and Kirwan, M.
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Provide a brief statement here on the disciplinary ranking of this publication and the peer-review process involved (e.g. how many reviewers, single blinded or other, initial decision, revision timeline etc and any other details that speak to the rigour of the peer review process)	BMC Health Services Research is a transparent peer-reviewed journal. The article was originally submitted in January 2025 and an invitation to revise the manuscript was given on the 28th of May 2025 following the review of the manuscript by two reviewers. The revisions required were noted by the journal editor as minor, therefore the article was revised and resubmitted before being accepted for publication on the 10th of July 2025.

This paper (Chapter 4) is one of four co-authored papers to be submitted as part of the PhD by publication thesis submitted for examination.

Section 3: Candidate's Contribution to the Paper

Provide details below of the **nature** and **extent of your contribution** to the paper (include both your intellectual and practical contributions) and your overall contribution in **percentage terms**. Note that these categories can be customised according to disciplinary norms

The nature and extent of my contribution is outlined below. My overall percentage contribution to the paper was 90%.

Briefly outline your contribution to the **conception** of the work described in this paper:

My supervisors, who are also co-authors of this paper, led the conceptualisation phase of this study and I contributed to the conception of the work by working closely with my supervisors, co-authors and the participating hospital to select the variables for inclusion in the chart review and to further develop the conceptualisation of the study.

Briefly outline your contribution to the **literature review** in this paper:

I conducted a review of the literature pertaining to the content presented in this chapter. Following my review of the literature, I wrote the background/introduction section and the discussion sections, which were then reviewed by my supervisors and co-authors.

Briefly outline your contribution to the **methodological design**:

The methodological design used to conduct this research was largely developed by my principal supervisor. As this PhD is embedded within a wider project, the chart review and validation component of the research was decided on in advance of my membership on the research team. However, I contributed to the methodological design approach used to conduct the chart review as it was informed by the research I undertook to complete the scoping review which was presented in the previous chapter. Furthermore, I contributed to the methodological design by working alongside my supervisor to collaborate with one of the co-authors of this publication who is a chart review expert. I also worked closely with my supervisor and healthcare professionals, such as nurses and physicians, from the participating hospital to develop the approach used to conduct this review and co-produce a structure chart review protocol (Appendix C) and data collection instrument that was used to guide the review process.

Briefly outline your contribution to **data collection**:

I contributed to data collection as I collected the conducted the chart review on site in the participating hospital alongside one other member of the research team. Furthermore, working closely with my supervisor, a co-researcher from the Healthcare Pricing Office in the Health Service Executive, and healthcare professionals and the HIPE manager from the participating hospital, I obtained the HIPE data that was validated in this study.

Briefly outline your contribution to **data analysis**:

I conducted the analysis of the data collected. The analysis of the data was supported by the co-author from the Healthcare Pricing Office. I conducted the analysis of the data using Excel and SPSS and my supervisors and co-authors reviewed the analysed data and provided me with feedback.

Briefly outline your contribution to the **synthesis and summary of findings**:

I synthesised and summarised the findings under the supervision of my co-authors. I wrote the results, discussion and conclusion sections of the manuscript, which were then reviewed by my co-authors and revised in accordance with their comments and feedback.

Finally, outline your contribution to the **writing** and **revision** of the paper:

I wrote the original manuscript and revised the content as per the feedback and comments from my co-authors and supervisors. Furthermore, I also revised the paper as per the comments from the peer-reviewers and sought approval of these revisions from my co-authors.

Section 4: Signature and Validation

I confirm that the following statements are true:

(a) the information I have provided in this form is correct
(b) this paper is based on research undertaken during my candidature at DCU

Signature of PhD Candidate: Anna Connolly **Date:** 25/05/26

I confirm that the information provided by the candidate is correct:

Signature of Principal Supervisor: Marcia Kirwan **Date:** 25/05/26

In some cases, it may be appropriate for verification to be given by both the principal supervisor **and** the lead/corresponding author of the work (where the lead/corresponding author of the work is not the candidate or the principal supervisor):

Signature of Lead/Corresponding Author: Anna Connolly **Date:** 25/05/26

Nature of Current Post/Responsibilities: PhD candidate

Home institution: Dublin City University

4.2 Abstract

Background

Pneumonia, urinary tract infections, pressure ulcers and delirium are adverse events that affect older inpatients. Accurate administrative data are key to improving patient safety and healthcare quality. The aim of the study was to validate Hospital In-Patient Enquiry (HIPE) data on the occurrence of pneumonia, urinary tract infections, pressure ulcers and delirium in older patients discharged from an acute hospital in Ireland through retrospective chart review.

Methods

A cohort of one thousand randomly selected admissions of inpatients aged over 65 from a university, tertiary hospital in 2022 were reviewed using a two-stage retrospective chart review. The researchers, healthcare professionals and patient representatives co-produced a study-specific chart review protocol and data collection instrument. HIPE data were validated by comparing the chart review data to the HIPE data. Since HIPE only codes the presence of the respective adverse event once, the comparisons between the HIPE data and the chart review data were carried out at admission level.

Results

Of the 1,000 admissions reviewed, 231 (23.1%) contained at least one adverse event. At event level, 373 adverse events were identified including 133 pressure ulcers in 71 admissions, 101 delirium episodes in 100 admissions, 84 pneumonia episodes in 79 admissions and 55 urinary tract infections in 52 admissions. Of the 302 adverse events found in chart review on admission level, 96 (31.8%) of these were coded in the HIPE data and flagged by the Hospital Acquired Diagnosis indicator. Compared with chart review data, the overall sensitivity of the administrative data was low, and the specificity was high. The positive predictive values varied, and the negative predictive values were generally high. In HIPE data, 42 adverse events were found that were not identified in the chart review.

Conclusions

The results demonstrate that HIPE data may not accurately represent these specific adverse events as experienced by older patients. Improving the accuracy of these data may facilitate

benchmarking of adverse events across hospitals and countries and provide opportunities for improvements in patient safety.

4.3 Introduction

Adverse events (AEs) present ongoing challenges to patient safety and healthcare quality. These events can be defined as incidents that result in harm to patients(WHO, 2009). AEs occur in up to 68.5% of admissions (Eggenschwiler *et al.*, 2022) and are deemed preventable to a high extent (Hibbert *et al.*, 2016). AEs can result from acts of commission, acts of omission or delayed care (Institute of Medicine, 2004). Although some AEs may not be preventable (National Quality Forum, 2004), enhanced policy and practice may decrease AE occurrence and reduce healthcare costs with prevention costs generally much lower than the cost of harm (Auraaen, Slawomirski and Klazinga, 2018).

Nursing-sensitive AEs are patient outcomes that are affected by processes or structures of nursing care, but for which nursing is not exclusively responsible (National Quality Forum, 2004). Needleman et al. (2002) identified 14 common nursing-sensitive patient outcomes including urinary tract infections (UTIs), pneumonia, and pressure ulcers. Along with delirium, these four outcomes are measurable indicators of the 'Failure to Maintain' (F2M) conceptual framework used to indicate the rationing of care that contributes to functional and cognitive decline in older patients during hospitalisation (Bail and Grealish, 2016). These AEs are commonly experienced by older patients (Bail *et al.*, 2013; Yates *et al.*, 2024). However, their visibility, and the visibility of nursing practice, are often limited in administrative data due to coding standards which can rely heavily on medical documentation and less so on nursing documentation (Lucyk, Tang and Quan, 2017). The high incidence of these complications warrants attention, as just these four complications were associated with nearly a quarter of above average length of stay for older patients (Bail *et al.*, 2015), and cost more than other kinds of patient complexity (Bail *et al.*, 2018).

Understanding the true rates of these AEs is key to improving the visibility of nursing care and nursing-sensitive patient outcomes in administrative data, and to better understand potential cost savings for patient safety in hospital decision making.

AEs are disproportionately experienced by older patients in comparison to younger patients. Patients aged over 65 require more complex care due to co-morbidities and emergency admissions (Merten *et al.*, 2013) and may not receive adequate care when the demand for nursing care exceeds supply. The rationing of fundamental nursing care and the associated development of potentially preventable AEs, such as those outlined in the F2M framework (Bail and Grealish, 2016), is underpinned by the concept of missed nursing care which refers to aspects of nursing care that are regularly missed due to factors such as inadequate staffing (Kalisch, 2006).

Administrative healthcare data have been recognised as an efficient tool for monitoring rates of AEs and informing the development and evaluation of targeted prevention strategies (Ackroyd-Stolarz, Bowles and Giffin, 2014). Hospital discharge data in Ireland are an important indicator of hospital activity (HIQA, 2018) and potentially an indicator of quality. The Hospital In-Patient Enquiry (HIPE) Scheme is a national information system for recording information on discharges and deaths from acute hospitals in Ireland (Healthcare Pricing Office, 2024). The details of a patient's care are documented in their clinical medical chart and on discharge, a discharge summary is created. Retrospective administrative data are generated as information is abstracted from chart documentation, such as discharge summaries, and assigned standardised codes by clinical coders using formal classification systems (Tang, Lucyk and Quan, 2017).

The classification system used in HIPE is the International Statistical Classification of Diseases and Health Related Problems, Tenth Revision, Australian Modification (ICD-10-AM) (Healthcare Pricing Office, 2020a). The statistics generated by this system inform epidemiological, quality assurance and market research. The Department of Health and the Health Service Executive in Ireland also use HIPE data to inform the planning, provision and monitoring of healthcare services in acute hospitals (HIQA, 2018). The Hospital Acquired Diagnosis (HADx) is a quality indicator used by HIPE since 2011 to identify and flag diagnoses acquired during the patient's stay in hospital (Healthcare Pricing Office, 2020a).

Whilst concerns over the accuracy of administrative datasets are evident (Reilly *et al.*, 2020; Valik *et al.*, 2020; Walther *et al.*, 2021; Pellathy *et al.*, 2022; Valentine *et al.*, 2022), the potential of administrative data to provide accurate rates of AEs has been demonstrated (Roberts *et al.*, 2008; Utter *et al.*, 2009; Caminiti *et al.*, 2012; Ackroyd-Stolarz, Bowles and Giffin, 2014;

Stacey *et al.*, 2014; Kuklik, Stausberg and Jöckel, 2017; Ammann *et al.*, 2018; Ng *et al.*, 2018; Kuklik *et al.*, 2019; Miano *et al.*, 2019; Kandel *et al.*, 2021). Other researchers recognise the potential of administrative data and acknowledge the need for further research to ensure that such datasets are accurate and robust (Raleigh *et al.*, 2008; Mazzali and Duca, 2015; Van Mourik *et al.*, 2015; Ehrenstein *et al.*, 2016). A common method of measuring quality and safety in healthcare is through retrospective chart review (Vassar and Holzmann, 2013). Chart review has frequently been used to explore the accuracy of administrative data and identify whether it accurately reflects the occurrence of AEs in hospitalised patients (Nissen *et al.*, 2019; Connolly, Kirwan and Matthews, 2023).

Previous literature has identified a research gap in using administrative data to inform patient safety improvements (Ackroyd-Stolarz, Bowles and Giffin, 2014). The aim of the present study was to validate HIPE data on the occurrence of pneumonia, urinary tract infections, pressure ulcers and delirium in older patients discharged from an acute hospital in Ireland through retrospective chart review.

4.4 Methods

4.4.1 Study design and setting

This research study is situated within the wider Cost2Care project which aims to demonstrate the potential for safer hospital care and reduced healthcare costs associated with older patients in acute hospitals in Ireland through routine measurement of missed nursing care, and sustainable and accurate reporting of nursing-sensitive adverse events using routinely collected hospital discharge data.

This was a retrospective cohort study using retrospective medical chart review and administrative healthcare data. A single university, tertiary hospital in Ireland with over 800 beds was selected for participation. In the year 2022, this hospital had over 100,000 patient presentations to the emergency department and over 25,000 inpatient discharges.

4.4.2 Sample and study size

Admissions of inpatients aged 65 years and over who were discharged from 31 inpatient adult wards in the participating hospital between the 1 st of January 2022 and the 31 st of December 2022 were eligible for inclusion. Only charts of patients who were admitted for 72 h and longer

were included to capture patients who experienced AEs, which are most likely to occur 48–72 h after admission (Tess *et al.*, 1993; Kalil *et al.*, 2016). According to the Healthcare Pricing Office who oversee the national HIPE dataset, 6,575 admissions met these criteria in 2022 in the participating hospital. A simple simulation run in R using a range of AE rates identified that a sample size of 400 admissions abstracted gave an acceptably precise estimate. In order to support subgroup analysis, larger numbers were needed, therefore the sample was stratified into two categories of care homogeneity: medical and surgical admissions, consistent with DRG coding. The relative size of the groups, and the expected differences between them in terms of prevalence was not known. Therefore, a sample size of approximately 500 per category, giving 1,000 admissions in total would give reasonable power to detect moderately large differences between groups and allow for the exploration of the range of likely outcomes (Fig. 4.1).

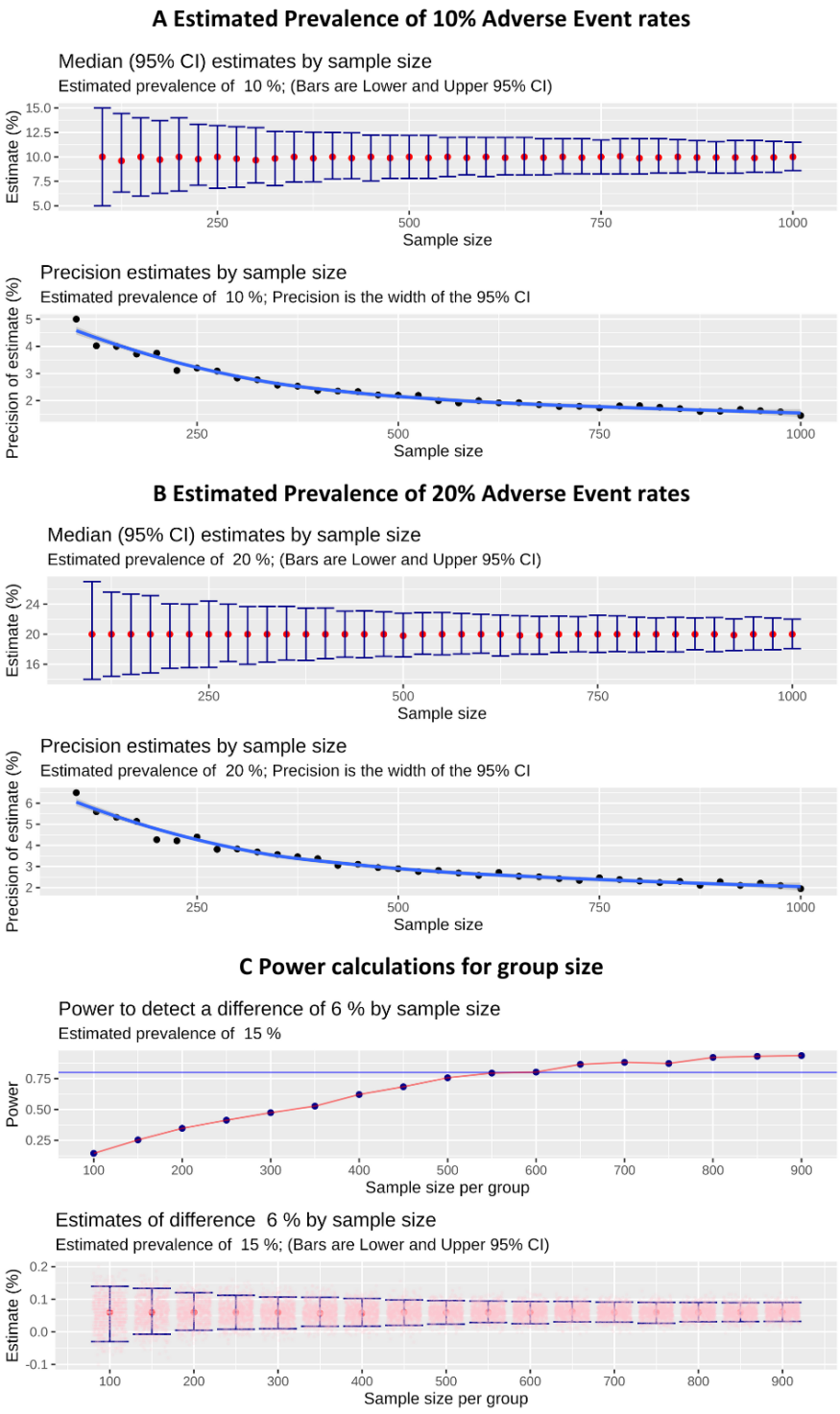


Figure 4.1 Sample size calculations.

(A) Estimated prevalence of 10% adverse event rates, (B) Estimated prevalence of 20% adverse event rates, (C) power calculations for group size.

4.4.3 Subject selection and data source

A random sample of admissions fulfilling the eligibility criteria was generated by the HIPE Department in the participating hospital. This sampling process resulted in a list of 1,000 admissions identifiable by Medical Record Number, episode number, admission date and discharge date. The participating hospital's Medical Records Department made the charts available to the researchers during the chart review, in accordance with the ethical approval procedures described below.

4.4.4 Co-production of chart review protocol and data collection instrument

A study-specific chart review protocol and data collection instrument were developed in collaboration with a public and patient involvement representative and representatives from the participating hospital to guide the chart review and data extraction process. These study materials were also developed in collaboration with project collaborator and retrospective chart review expert (MU), who provided a template for the primary and secondary review stages, and co-researcher (FB) from the Healthcare Pricing Office who provided expertise in relation to data protection considerations and the variables for inclusion in the primary review. A co-productive approach was then used to work with healthcare professionals from the participating hospital to further develop these study materials to tailor them to the context of the hospital. The Director of Nursing, Assistant Directors of Nursing (ADoN), an advanced nurse practitioner, a consultant geriatrician, a clinical nurse manager, a tissue viability nurse, a clinical nurse specialist, a consultant microbiologist and the hospital's HIPE department manager were involved in the co-production of the chart review materials. An ADoN was appointed as coordinator of the research project in the participating hospital and facilitated this co-production process. Direct contact was made with the hospital representatives involved in the co-production process via meetings, arranged by this ADoN, where individual expertise was provided in relation to each of the AEs being investigated.

4.4.5 Delirium

As the term "delirium" is not always used to document delirium in patients' notes in the charts (Chuen *et al.*, 2021), various other terms such as "confusion" were deemed acceptable for identifying delirium through chart review, consistent with the literature (Puelle *et al.*, 2015). This was agreed on consultation with relevant clinicians during the co-production process.

Therefore, in this study, episodes of delirium were confirmed through the presence of the term "delirium" in addition to unconfirmed cases of delirium that were captured through the presence of alternative acceptable terms.

Due to the complex and interconnected relationship between delirium and dementia and the increased vulnerability/susceptibility of patients with dementia to developing delirium (Fong and Inouye, 2022), patients with dementia were included. Patients who presented on admission with dementia who also experienced an episode of delirium, as per the chart review, had their pre-existing dementia documented during the secondary review.

4.4.6 Pressure ulcer

A stage one pressure ulcer can be defined as intact skin with non-blanchable redness (HSE, 2018). Based on this definition and communication with the healthcare professionals involved in the co-production process, documentation within the chart that denoted non-blanching redness was accepted as a stage one pressure ulcer. Stage 2, 3 and 4 pressure ulcers were recorded in the chart review when their staging was clearly documented in the clinical chart.

4.4.7 Pneumonia and UTI

The World Health Organisation healthcare-associated infections case definitions were used to confirm the presence of pneumonia and UTIs throughout the chart review (World Health Organisation, 2024b). These definitions were provided to the research team by representatives from the participating hospital during the co-production process. These case definitions rely on radiology reports, symptoms and microbiology reports. A pneumonia or UTI was captured during the chart review if the patient met the criteria within the case definitions and was prescribed antibiotics to treat their condition.

4.4.8 Inclusion and exclusion criteria of events in the chart review

The inclusion and exclusion criteria for each of the selected AEs are outlined in Table 4.1. Further information in relation to the inclusion and exclusion criteria for ICD-10 codes for identifying adverse events in the HIPE data can be found in Table 4.2.

Table 4.1 Inclusion and exclusion criteria for identification of adverse events in chart review

Adverse event	Inclusion criteria	Exclusion criteria
Pneumonia	Occurred 48 h after admission	Present on admission Occurred within 48 h of admission
Urinary Tract Infection	Occurred 48 h after admission	Present on admission Occurred within 48 h of admission
Pressure Ulcer	Occurred at any time after admission Deterioration of existing pressure ulcer	Present on admission with no worsening
Delirium	Occurred at any time after admission Deterioration of existing delirium	Present on admission with no worsening

Table 4.2 Inclusion and exclusion criteria for ICD-10 codes for identifying adverse events in the HIPE data

Inclusion Criteria		
Adverse event	**Inclusion**	**Description**
	ICD-10 Code (Secondary)	
Urinary tract infection	N39.0	Urinary tract infection, site not specified
	T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
Delirium	F05.0	Delirium not superimposed on dementia, so described*
	F05.1	Delirium superimposed on dementia*
	F05.8	Other delirium*
	F05.9	Delirium, unspecified
	R40.1	Stupor
	R40.2	Coma, unspecified
	*Recommended update (not in original Needleman approach)	
Pressure ulcer	L89^	Pressure ulcer
	^Includes all subsets of L89, e. g., L89.0, L89.1, L89.2 etc.	
Pneumonia	J14	Pneumonia due to Haemophilus influenzae
	J15	Bacterial pneumonia, not elsewhere classified

	J18	Pneumonia, organism unspecified
	J69.0	Pneumonitis due to food and vomit
	J95.8	Other postprocedural respiratory disorders
	J95.9	Postprocedural respiratory disorder, unspecified
Exclusion Criteria		
Urinary tract infection	**Exclusion**	**Description**
	ICD Code (Principal)	
	A40	Streptococcal sepsis
	A42	Actinomycosis
	A49.9	Bacterial infection, unspecified
	N39.0	Urinary tract infection, site not specified
	T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
	Exclusion	**Description**
	Diagnose Code (Any)	
	O08.8	Other complications following abortion and ectopic and molar pregnancy
	O23.4	Unspecified infection of urinary tract in pregnancy
	O23.9	Other and unspecified genitourinary tract infection in pregnancy
	O86.2	Urinary tract infection following delivery
	O86.3	Other genitourinary tract infections following delivery
	Exclusion MDC	**Description**
	11	Diseases & Disorders of the Kidney & Urinary Tract
	12	Diseases & Disorders of the Male Reproductive System
	13	Diseases & Disorders of the Female Reproductive System
	14	Pregnancy, Childbirth & the Puerperium
	15	Newborns & Other Neonates
Delirium	**ICD-10 Exclusion - Principal Diagnosis**	**Description**
	F43.2	Adjustment disorders
	F43.9	Reaction to severe stress, unspecified
	F44.88	Other specified dissociative [conversion] disorders
	F05.9	Delirium, unspecified
	R40.1	Stupor

	R40.2	Coma, unspecified
	Exclusion MDC	Description
	1	Diseases & Disorders of the Nervous System
	19	Mental Diseases & Disorders
	20	Alcohol/Drug Use & Alcohol/Drug Induced Organic Mental Disorders
Pressure ulcer	**ICD-10 Exclusion - Principal Diagnosis**	**Description**
	L89	Pressure ulcer
	ICD-10 Exclusion - Any Diagnosis	**Description**
	G80	Cerebral palsy
	G81	Hemiplegia
	G82	Paraplegia and tetraplegia
	G83	Other paralytic syndromes
	Exclusion MDC	Description
	9	Diseases & Disorders of the Skin, Subcutaneous Tissue & Breast
Pneumonia	**ICD-10 Exclusion - Principal Diagnosis**	**Description**
	J10	Influenza due to other identified influenza virus
	J11	Influenza, virus not identified
	J12	Viral pneumonia, not elsewhere classified
	J13	Pneumonia due to Streptococcus pneumoniae
	J14	Pneumonia due to Haemophilus influenzae
	J15	Bacterial pneumonia, not elsewhere classified
	J17	Pneumonia in bacterial diseases classified elsewhere
	J18	Pneumonia, organism unspecified
	J69.0	Pneumonitis due to food and vomit
	J95.8	Other postprocedural respiratory disorders
	J95.9	Postprocedural respiratory disorder, unspecified
	ICD-10 Exclusion - Any Diagnosis	**Description**
	B20	Human immunodeficiency virus [HIV] disease resulting in infectious and parasitic diseases
	B21	Human immunodeficiency virus [HIV] disease resulting in malignant neoplasms

	B22	Human immunodeficiency virus [HIV] disease resulting in other specified diseases
	B23	Human immunodeficiency virus [HIV] disease resulting in other conditions
	B24	Unspecified human immunodeficiency virus [HIV] disease
	D80	Immunodeficiency with predominantly antibody defects
	D81	Combined immunodeficiencies
	D82	Immunodeficiency associated with other major defects
	D83	Common variable immunodeficiency
	D84	Other immunodeficiencies
	D86	Sarcoidosis
	D89	Other disorders involving the immune mechanism, not elsewhere classified
	M35.9	Systemic involvement of connective tissue, unspecified
	Exclusion MDC	**Description**
	4	Diseases & Disorders of the Respiratory System

4.4.9 Review team pilot test and data collection process for chart review

The review team consisted of two reviewers: a clinical research nurse with previous chart review experience, and a PhD student. Both reviewers received training from the chart review expert (MU).

4.4.10 Pilot

A pilot of the chart review was conducted in November 2023 to ensure that all relevant data were being collated and to confirm that the reviewers were able to locate the information using the online patient information systems and in the paper-based charts. A sample of 72 admissions were included in the pilot and the results of the pilot were communicated to the healthcare professionals involved in the co-production process. Following the pilot, the researchers met with a retrospective chart review expert (MU) for further educational training and to discuss the pilot results. The pilot results were retained in the main study as no major changes were made.

4.4.11 Overall process

The retrospective chart review commenced in October 2023 and was completed in April 2024. The review of 1,000 admissions using paper-based charts took place on site at the participating hospital. Record notes from all clinicians within the clinical chart were reviewed. Access to the online patient information system was granted for reviewing laboratory results, imaging records, prescriptions and referral data. Additionally, access to the intensive care unit or the high dependency unit specific online systems was granted for patient admissions that had used these services.

A two-stage review process was used to conduct the retrospective chart review. The co-produced and agreed chart review protocol was used to guide the chart review process and included definitions, inclusion and exclusion criteria and step-by-step instructions on the data extraction process and the selected variables.

4.4.12 Review stage 1

All 1,000 admissions included in the random sample were subject to Review Stage 1. There was no cut-off for maximum length of stay therefore, charts were reviewed for patients admitted for at least 72 h up until discharge. All notes pertaining to the admissions selected were screened by the reviewers. Admission and discharge times, number of bed and ward moves, and frailty scores were collected. If a potential AE was identified, the admission was forwarded to Review Stage 2.

4.4.13 Review stage 2

Further information in relation to the identification and treatment of the AE, such as severity, antibiotic use, interventions and referrals were collected during review stage 2.

All abstracted data was entered into the study-specific data collection instrument using a spreadsheet in the Excel software. The data collection instrument consisted of a series of variables relating to the patients' encounter with the hospital. The data was entered into Excel using either open-text or, for variables with standardised data, a drop-down menu with preset responses such as "yes" and "no".

4.4.14 Reliability and validity

Interrater reliability

Interrater reliability was determined by double review of 10% of the charts to assess the agreement between the chart reviewers' decisions in relation to whether a chart was to be considered for secondary review, whether an AE was identified and whether the reviewer independently identified the same specific AE. The double review was overseen by a senior member of the research team (MK) who was external to the review team. Any discrepancies between the two reviewers and the senior member of the research team were discussed, and consensus was achieved. The consensus data was included in the data analysis for the double reviewed charts.

The review process was monitored by a senior member of the research team (MK) who ensured that the review was conducted in adherence to the guidelines outlined in the chart review protocol and was available for queries from the reviewers. Consistency between the reviewers was supported throughout the chart review as the reviewers shared a designated room on site at the participating hospital and were able to promptly discuss any queries. Any escalated queries were resolved via discussions between the reviewers and the senior member of the research team (MK). The chart review expert (MU) was also available for questions from the reviewers throughout the review process.

4.4.15 Analysis

The percentage of admissions that contained at least one AE was calculated in addition to the numbers of each of the AEs identified in the chart review. An AE was included in the HIPE data sample if a HADx flag was assigned to one of the predetermined ICD-10 codes in an admission. All included and excluded ICD-10 codes can be found in Table 4.2.

The chart review was conducted blindly as the reviewers did not have access to the corresponding HIPE data until after the chart review had been completed. On completion of the review, the HIPE data pertaining to each of the 1,000 admissions that were reviewed was received from the HIPE department at the participating hospital. The chart review data and corresponding HIPE data with procedure codes, diagnosis codes and HADx flags for each of the 1,000 admissions were merged in Microsoft Excel to allow for a comparison of the two data

sources. Each AE identified in the chart review was investigated in the HIPE data to determine whether the event was assigned an ICD-10 code and a HADx flag. Although certain patients may experience multiple episodes of the same type of AEs, HADx data does not measure incidence, therefore the presence of the AEs is only coded for once in the HADx data. As a result, the comparisons between the HADx data and the chart review data were carried out at admission level. Furthermore, the number of AEs recorded in the HADx data but not identified through the chart review was also explored. The percentage of events that were identified in the chart review and were assigned HADx flags was also calculated.

Descriptive statistics such as frequencies were used. The sensitivities, specificities, positive predictive value and negative predictive values of the HADx data were calculated using the chart review as gold standard. Sensitivity represents the proportion of admissions with an AE identified during the chart review that were correctly recorded in the HIPE data using a HADx flag. Specificity represents the proportion of admissions without an AE according to the chart review that were correctly classified in the HIPE data without a HADx flag. The positive predictive value (PPV) represents the proportion of admissions that were captured in the HIPE data and confirmed by the chart review data. The negative predictive value (NPV) represents the proportion of admissions predicted by the HIPE data to not have an AE that were confirmed by the chart data to have not had an AE. Confidence intervals of 95% were set for sensitivity, specificity, PPVs and NPVs. Cohen's Kappa and percentage agreement were calculated to establish inter-rater reliability between the reviewers. All statistical calculations were performed using IBM SPSS Statistics version 29.

4.5 Results

4.5.1 Participants

The study population consisted of 6,575 admissions of patients that met the inclusion criteria of being aged 65 and over with a length of stay of 72 h or longer and discharged in 2022. A sample of 1,000 admissions pertaining to 959 patients were included in the chart review. The demographics for the study cohort can be seen in Table 4.3.

Table 4.3 Patient demographics

Demographic variables	**Total study cohort** ***n*** **= 1,000**	**Surgical admissions** ***n*** **= 505**	**Medical admissions** ***n*** **= 495**
Gender			
Male, n (%)	534 (53.4%)	278 (55%)	256 (51.7%)
Female, n (%)	466 (46.6%)	227 (45%)	239 (48.3%)
Age, mean (SD)	77.2 (7.6)	76.3 (7.3)	78.1 (7.8)
Length of stay, days, median (min-max)	9 (3-200)	10 (3-200)	9 (3-172)
Type of admission			
Emergency, n (%)	769 (76.9%)	307 (60.8%)	462 (93.3%)
Elective, n (%)	231 (23.1%)	198 (39.2%)	33 (6.7%)

4.5.2 Identified AEs and rates of AEs in Chart Review

In total, 373 AEs were found in 231 (23.1%) of the 1,000 reviewed admissions. There were 133 pressure ulcers, 101 cases of delirium, 84 cases of pneumonia and 55 UTIs identified by the chart review in 71, 100, 79 and 52 admissions, respectively. The 133 pressure ulcers occurred in 71 admissions with 62 secondary pressure ulcers (e.g. heel as well as sacrum) experienced in 27 of these admissions. Similarly, the 101 cases of delirium occurred in 100 admissions with one admission containing two episodes of delirium 16 days apart. The 84 cases of pneumonia occurred in 79 admissions as five admissions contained two episodes of pneumonia. The 55 UTIs occurred in 52 admissions with three admissions containing two UTIs.

Since HADx data codes the presence of the respective AE once, the comparisons between the HADx data and the chart review data were carried out at admission level. Of the 302 AEs found in chart review on admission level, a HADx flag was found for 96 (31.8%) of the AEs. The AEs that had the highest representation of HADx flags, was delirium at 44%. The AE that the lowest representation within the HADx data was pressure ulcers, with 10 (14%) cases (Fig. 4.2). There were 42 AEs (20 pneumonias, 3 pressure ulcers, 4 UTIs and 15 delirium) in 38 admissions recorded in the HIPE data that were not identified through the chart review. The overlap between the chart review data and the HIPE data for AEs captured at admission level can be seen in the Venn diagrams in Fig. 4.3.

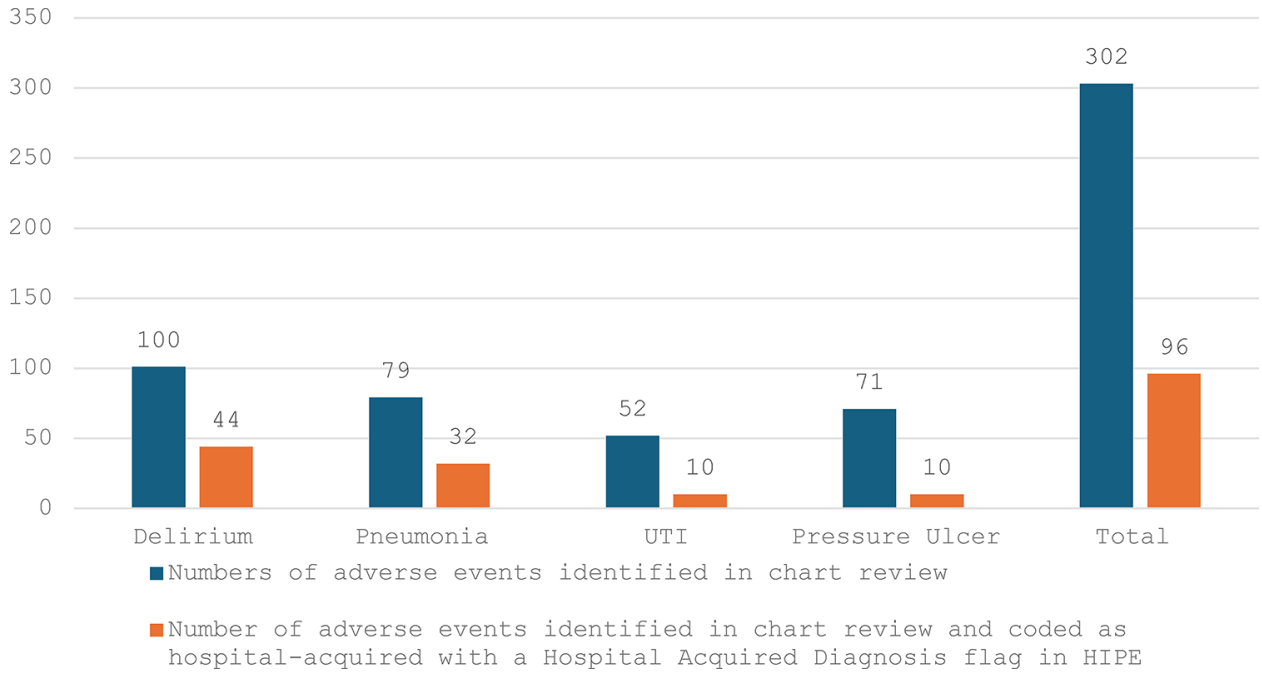


Figure 4.2 Admission level comparison between chart review data and HADx data

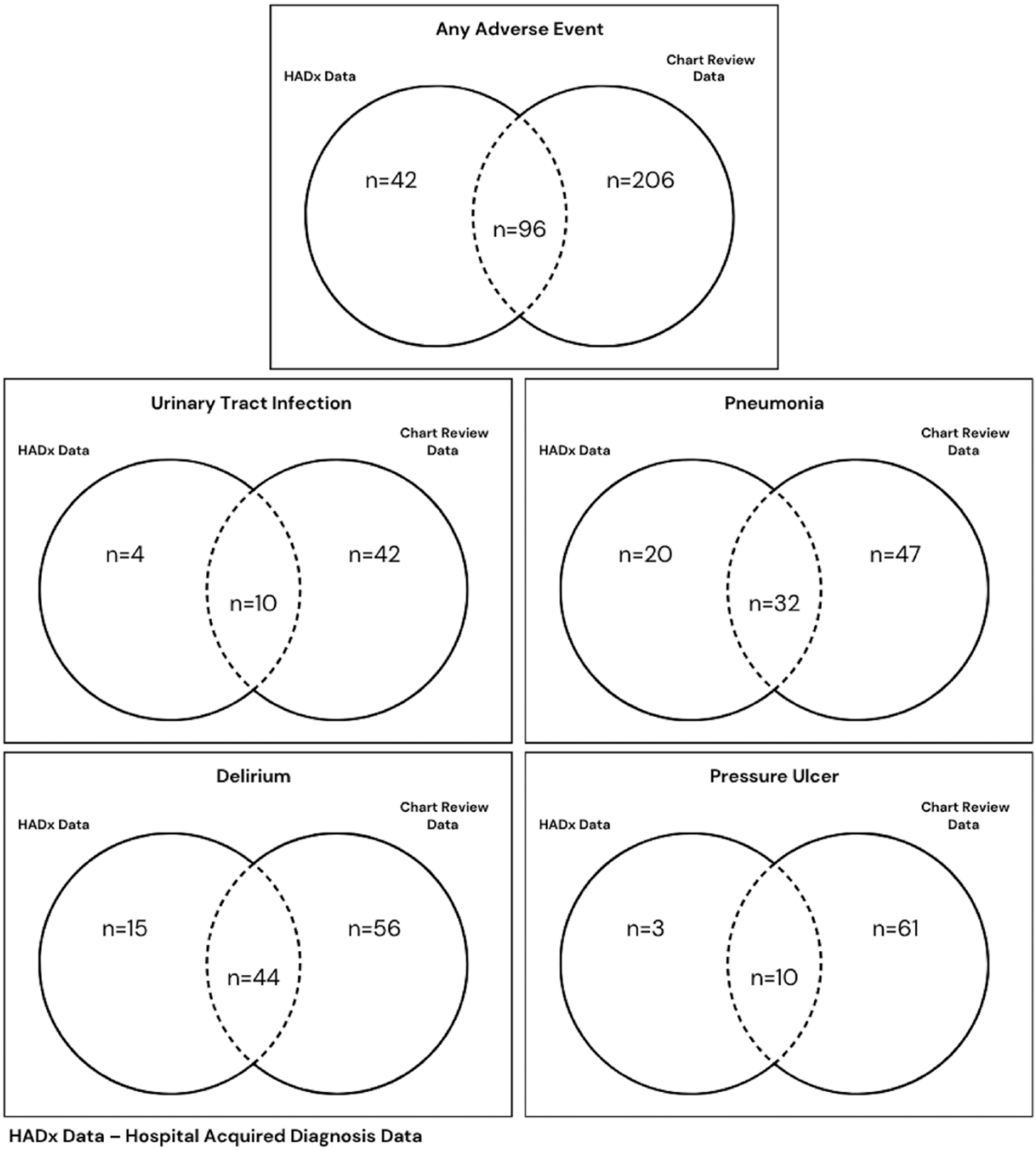


Figure 4.3 Adverse events as captured at admission level within chart review data and HIPE data

4.5.3 Sensitivity, specificity, positive predictive value and negative predictive value

Overall, the sensitivity of the HADx data was low and the specificity was high. The PPVs of the HADx data varied whereas the NPVs were generally high (Table 4.4). The HADx data

performed relatively well in relation to correctly identifying admissions without AEs however the results demonstrate that HADx did not accurately identify the AEs as captured through the chart review based on the lower sensitivity and positive predictive values.

Table 4.4 Sensitivity, specificity, PPV and NPV for HIPE data

Type of adverse event	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Any adverse event	38.1 (32.0-44.5)	97.9 (9.67–98.8)	84.6 (76.9–90.7)	84.0 (81.5–86.3)
UTI	19.2 (10.1–30.3)	99.6 (99.0-99.9)	71.4 (45.5–90.1)	95.7 (94.4–96.9)
Pneumonia	40.5 (30.1–51.5)	97.8 (96.8–98.6)	61.5 (48.0–74.0)	95.0 (93.5–96.3)
Pressure Ulcer	14.1 (7.3–23.4)	99.7 (99.2–99.9)	76.9 (50.5–93.7)	93.8 (92.2–95.2)
Delirium	43.0 (33.6–52.8)	98.3 (97.4–99.0)	74.1 (62.0-84.2)	93.9 (92.3–95.4)
CI, confidence interval; NPV, negative predictive value; PPV, positive predictive value				

4.5.4 Inter-rater reliability

A total of 100 charts (10%) were double reviewed blindly by a third researcher. The inter-rater reliability of the reviewers' judgements in relation to whether at least one AE was present at review stage 1, therefore indicating that a secondary review of the admission was to be carried out was $\kappa = 0.740$ and the percentage agreement was 90%. The inter-rater reliability of the reviewers' judgements in relation to whether a specific AE was identified was $\kappa = 0.793$ with a 97% percentage agreement.

4.6 Discussion

In this validation study, a total of 373 AEs within 231 admissions were identified at event level. Given that HADx data only codes for the presence of a condition once per admission, a total of 302 AEs with 100 episodes of delirium, 79 cases of pneumonia, 71 pressure ulcers and 52 UTIs were identified at admission level through the chart review. In relation to the 302 AEs found

through the chart review, the HADx data matched to only 31.8% of these with 44 episodes of delirium, 32 cases of pneumonia, 10 UTIs, and 10 pressure ulcers assigned diagnostic codes and HADx flags. Overall, the sensitivity of the HADx data for identifying at least one AE of any of the studied AEs was low, but the specificity was high. The PPVs of the HADx data varied whereas the NPVs were generally high.

The AEs investigated in this study are nursing-sensitive patient outcomes which appear to be generally underreported in administrative data. Accurate reporting of these outcomes is essential for benchmarking and addressing rates of these specific AEs, but also for increasing the visibility of nursing within administrative data. Nursing care and the nurse workforce are vital to improving patient outcomes. Therefore, increased visibility of nursing-sensitive patient outcomes within administrative datasets is key to ensuring accurate information to guide and inform decision-making in the context of workforce planning which may improve patient outcomes (Twigg *et al.*, 2016).

The rates of AEs identified through this chart review are in line with international studies that estimate AE occurrence in 7-68.5% of admissions (Hibbert *et al.*, 2016; Eggenschwiler *et al.*, 2022). The age profile of the patients in this study and their increased vulnerability to experiencing hospital-acquired conditions given the clinical complexity of their care is attributable to the rates of AEs identified in this study. Many previous studies have reported that older patients are affected by AEs to a higher extent than younger patients (Thomas and Brennan, 2000; Sari *et al.*, 2007; Szlejf *et al.*, 2012). Older patients are particularly vulnerable to the four AEs explored in this study, as demonstrated in previous work (Szlejf *et al.*, 2012; Ackroyd-Stolarz, Bowles and Giffin, 2014; Burton *et al.*, 2016).

The results of this study demonstrate a high level of variation between the rates of the four AEs captured through the chart review and the rates of these AEs as recorded in the HIPE data. Similar to the findings from previous chart review validation studies (Magneli *et al.*, 2019; Storesund *et al.*, 2019; Reilly *et al.*, 2020; Valentine *et al.*, 2022), these findings suggest that the ICD-10 coding of these AEs within the HIPE data are a poor measure of hospital-acquired pneumonia, UTIs, pressure ulcers and delirium. Coding education is critical to maximising recognition and capture of common conditions. It is possible that recent changes in terminology have affected capture, for example, the change in nomenclature from pressure ulcer to pressure

injury in some countries, though not globally. Coders benefit from interprofessional collaborative workshops, and also effective digital systems for information retrieval and reduced duplication (Weller *et al.*, 2022).

The high variation in accuracy of discharge coding (Burns *et al.*, 2012) has led researchers to explore the use of information technology to improve clinical coding accuracy and quality. Computer-assisted clinical coding has been reported to be valuable for improving on the accuracy, quality and efficiency of manual coding (Campbell and Giadresco, 2020). Although there are various challenges associated with introducing automated tools into clinical coding environments (Dong *et al.*, 2022), their potential to enhance efficiency, quality and safety and reduce costs within healthcare settings is promising (Campbell and Giadresco, 2020). Artificial intelligence (AI) algorithms such as natural language processing (NLP) are successful methods of identifying AEs that can potentially be used to reduce the subjectivity of manual chart reviewing however, such methods were not feasible in this study given that the charts reviewed were paper-based. Although promising, AI tools are not without limitations and algorithms such as NLP should be validated using various sample sizes and settings (Verma *et al.*, 2022).

Overall, the HIPE data had low sensitivity and high specificity in relation to the identification of the AEs investigated in this study. Similar results have been identified by Maass et al. (2015) who found low sensitivity and high specificity when comparing ICD coding to chart review data. Caution is recommended when relying on hospital acquired complication flags in hospital data repositories, and in the quest for absolute activity-based funding approaches (Duckett *et al.*, 2018).

A notable finding was the identification of AEs in the HADx data that were not identified through the chart review. The variation between the inclusion criteria used for the respective AE by the chart reviewers and the inclusion criteria used by the clinical coders may have contributed partly to this divergence. Coding errors, which can contribute to administrative data inaccuracies (Smith *et al.*, 2018), are also a potential source of variation in this study. Also, it is possible that human error, which is a well-acknowledged limitation of chart reviews (Panacek, 2007), resulted in AEs being omitted.

Clinical coders must adhere to guidelines when abstracting information from patients' clinical records. Due to the complex and multifaceted nature of coding clinical data, challenges such as

unclear documentation, variation in terminology and legibility, incomplete charts, variability in coder interpretation and a high workloads with quota expectations can impact administrative data quality (Tang, Lucyk and Quan, 2017; Alonso *et al.*, 2020b, 2020a; Doktorchik *et al.*, 2020). Imprecise documentation may contribute to under-reporting of conditions in administrative data (Tang, Lucyk and Quan, 2017) due to unspecified diagnoses or an inability to code specific conditions. According to HIPE coding standards, coders cannot assign HADx flags to conditions where it is unclear in the clinical documentation if they arose during or prior to admission (Healthcare Pricing Office, 2021). This may be cause for the low visibility of the four AEs in the HIPE data. Incomplete documentation may be driven by the time pressure that physicians are under to submit health information. Additionally, coders also experience time pressure when generating administrative data in a fast-paced environment with quota expectations. This limits their ability to devote excess time to re-checking charts with organisational issues (Tang, Lucyk and Quan, 2017). To address this, clear and thorough documentation by clinicians of conditions that occurred during a patient's admission is required.

The ability of HIPE data to capture hospital-acquired diagnoses using HADx flags demonstrates the potential of HIPE to accurately measure these four AEs. Although the rates at which HADx flags were assigned to the AEs identified through the chart review was low, improved documentation may make information more accessible to coders and therefore enhance the coding and visibility of these AEs within the HIPE data. As demonstrated by Chapman et al. (2023) who found a moderate level of agreement between the clinical gold standard and coding processes for in-hospital stroke, this current study also highlights the possibility for HADx flags to accurately record hospital-acquired conditions with improved documentation and coding.

As highlighted by Hughes et al. (Hughes *et al.*, 2019), education of junior physicians, who are responsible for completing clinical documentation, on the importance of clear and accurate documentation is key to improving the visibility of hospital-acquired diagnoses and ensuring accuracy of hospital activity in HIPE data. Administrative burden on healthcare services in relation to clinical coding can also be alleviated through the streamlining of clinical documentation workflows (Ayer, 2023). Efficient clinical documentation workflows may provide a solution to the organisational issues that have been previously identified by coders (Tang, Lucyk and Quan, 2017). Furthermore, collaborative workshops where clinicians and

coders can share their perspectives have been shown to improve coders' knowledge for classifying health conditions and improve clinicians' understanding of the information required when documenting health conditions in clinical notes (Weller *et al.*, 2022). Improved accuracy will result in high quality data that can be used to inform research, improve patient safety and healthcare quality and ensure appropriate funding (HIQA, 2018).

Although these findings indicate that hospital-acquired conditions may be underestimated in HIPE data, further research to improve the visibility of these AEs within HIPE data will allow for improved healthcare management, performance and planning. Improved visibility of nursing-sensitive patient outcomes may inform future research and decision-making in relation to nursing (Twigg *et al.*, 2016). Furthermore, inaccurate data has a negative impact on hospital reimbursement (Hughes *et al.*, 2019) therefore, improved accuracy will further facilitate and enable accurate activity-based funding. Timon et al. (2023) previously reported a funding deficit of €40,293 due to the underreporting of AEs in 23 patients. The economic impact of high quality and accurate reporting of AEs has been demonstrated by Lee et al. (2017) who identified a total of €61,956 in missed funding for AEs following joint arthroplasty after only 15 AEs were identified in the HIPE data in comparison to 114 AEs which were identified through a prospectively implemented AE form. In addition to the considerable human cost of the four AEs explored in this study, the financial cost of these AEs is particularly burdensome for the health service (Bail *et al.*, 2015, 2018). This highlights the importance of accurate administrative data for hospital reimbursement and further demonstrates the need to improve the visibility of AEs in administrative data. The economic cost of these adverse events will be further explored in future publications related to the wider Cost2Care project.

4.6.1 Strengths and limitations

A strength of this study was the ability of the chart reviewers to discuss chart related queries by conducting the review side-by-side in a room at the participating hospital. Furthermore, although Cohen's Kappa is commonly used to test interrater reliability, its limitations include that it may overly lower the estimate of agreement. Therefore, based on best practices (McHugh, 2012), both the percentage agreement and kappa statistic have been used to measure the interrater reliability of the chart review. All interrater reliability kappa values were classified as substantial and percentage agreement scores were ≥ 90%, demonstrating the high quality of the

review. The large sample size and random selection of charts for review reduced bias and enhanced the generalisability of the results (Vassar and Holzmann, 2013).

The co-production of the data collection instrument and the study-specific chart review protocol with clear objectives and data extraction guidelines is another strength of this research which reduced variability and ensured accuracy, reliability and consistency (Vassar and Holzmann, 2013; Siems *et al.*, 2020). Additionally, 'Co' approaches are promising methods for improving healthcare (Grindell *et al.*, 2022) that allow academics and healthcare professionals to combine their skills in the research process (McCabe *et al.*, 2021) and provide a framework for bridging the gap between research and practice (Banks *et al.*, 2016).

The reliability and validity of chart reviews can depend on the subjectivity of the review variables (Siems *et al.*, 2020), such as the determination of pressure ulcers based on the amount of redness in an affected area (McHugh, 2012). Reduced agreement and validity are a limitation of subjective review variables however, the use of a chart review protocol and the ability of the reviewers to discuss any queries mitigated the risk of reduced validity due to the subjective nature of chart reviewing.

Furthermore, it is not known whether the 42 AEs identified only in the HIPE data were true or false positives as it was not feasible to gain access to the charts pertaining to these events once the chart review and HIPE data had been merged. While the potential explanations for these 42 AEs have been outlined, the uncertainty in relation to these events is a limitation of this study.

Lastly, the inclusion of only one tertiary university hospital is also a limitation of this study. Including different hospital models may have increased the generalisability of the findings however, conducting chart reviews at multiple hospital sites was not feasible due to labour and resource limitations.

4.7 Conclusion

In conclusion, the variation between the chart review findings and the ICD codes demonstrates that HIPE data may not currently represent accurate rates of the four studied AEs. Improvements and education in relation to both coding and clinical documentation processes is necessary to allow the potential of these data as safety indicators to be fulfilled. Increased visibility of nursing within administrative data will contribute to improved patient outcomes as accurate

measurement of nursing-sensitive patient outcomes may inform future research and nursing-related decision-making. Improved data accuracy will facilitate benchmarking of AE rates across hospitals and countries and provide opportunities to improve patient safety and healthcare quality and reduce the human and economic cost of AEs.

4.8 Transition between validation study and predictions paper

Following the identification of the rates of adverse events identified through the study presented in the previous chapter, further exploration of the factors that contribute to the development of the four studied adverse events was deemed to be important.

The validation study indicated that adverse events occur in 23.1% of admissions. In order to reduce the occurrence of adverse events and promote patient safety, it is important to understand the factors that may influence the likelihood of a patient developing an adverse event. Older patients are particularly vulnerable to experiencing adverse events due to the complexity of care that they require as a result of having multiple co-morbidities in addition to their presenting condition. Although age is a well-recognised predictor of adverse event occurrence in hospitalised patients, there are various other contributing factors which require further exploration. Therefore, various variables were collected during the retrospective chart review with an aim of identifying potentially significant relationships between the occurrence of an adverse event and specific risk factors.

Previous research has indicated that sex, age, patient complexity, length of stay, admission to intensive care units and admission to surgical units, among other variables, are risk factors for the development of adverse events in hospitalised patients. However, the impact of these factors on the four Failure to Maintain events is not well understood in an Irish context. Therefore, it was considered important to explore the relationship between the variables collected during the retrospective chart review and the likelihood of older patients experiencing adverse events such as pneumonia, urinary tract infections and delirium in an acute hospital setting in Ireland. Also as demonstrated in the previous chapter, administrative datasets may under-report nursing-sensitive adverse events, therefore given the availability of the data collected during the retrospective chart review, it seemed appropriate to utilise this data and identify whether it could potentially offer a more accurate analysis of the impact of the collected variables on the rates of adverse events as identified through the chart review.

Given the projected increase in the proportion of people aged over 65 in the Irish population and the signalled increase in the demand for long-term care and home support services, it is important to understand the needs of older patients who are discharged from hospital. During the retrospective chart review, data in relation to patients' discharge situations was collected in

order to determine the relationship between the experience of an adverse event and a patient's care needs on discharge. According to the results of the chart review, which have been presented in the previous chapter, almost a quarter of patients aged 65 and older experience adverse events in hospital. Therefore, in order to ensure that there is sufficient infrastructure in place to cope with potential additional care needs of those who experience adverse events, it was considered important to understand whether patients who experience adverse events are more likely to be discharged into situations where they require additional care outside of hospital settings. In light of this, this research sought to explore whether adverse events themselves were considered to be predictors of additional care requirements on discharge. More specifically, this research sought to investigate whether patients who experienced adverse events were more likely to be discharged with home care packages, or to be discharged to destinations such as nursing homes, other hospitals and rehab facilities than to be discharged home with no additional care requirements. This information was considered to be relevant and important in relation to the development of policy to ensure adequate funding, staffing and resources to support the care needs of an ageing Irish population.

Additionally, in-hospital mortality was another variable that was collected during the retrospective chart review. This variable was collected in order to identify whether patients who experienced adverse events were more likely than those without adverse events to experience die in-hospital. As previous studies have indicated a significant relationship between adverse events and an increased risk of in-hospital mortality, it was considered important to explore this risk in an Irish context to truly understand the burden of adverse events on patient outcomes and the extent to which prevention strategies are required.

Chapter 5 : Publication 3 - Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review

The work presented on pages 126-158 of this chapter has been published in the International Journal of Nursing Studies Advances.

Connolly A., Staines, A., Matthews A., Unbeck, M., Bail, K. and Kirwan M. (2026) 'Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review', *International Journal of Nursing Studies Advances*, 10 (100527), doi:10.1016/j.ijnsa.2026.100527

Pages 122-125 of this chapter contain a signed declaration verifying the author contribution to the research presented in this chapter.

As per DCU guidelines, due to copyright issues across different publishers, the PDF copies of the published articles in their final journal format cannot be included in the PhD thesis therefore, all published work must appear in manuscript format. The content presented in the thesis is correspondent with the content of the published papers, with the exception of minor variations due to formatting.

5.1 Signed declaration verifying author contributions

Section 1: Candidate's Details	
Candidate's Name	Anna Connolly
DCU Student Number	22270478
School	School of Nursing, Psychotherapy and Community Health
Principal Supervisor	Dr. Marcia Kirwan
Title of PhD by Publication Thesis	Nursing-sensitive adverse events and missed nursing care in older hospitalised patients
Section 2: Paper Details	
Title of co-authored paper included in the thesis under examination	Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review
List of authors as in order given on accepted/published version	Connolly A., Staines, A., Matthews A., Unbeck, M., Bail, K. and Kirwan M.
Publication Details (e.g. Year of Publication, Journal Name, Issue Number, Page Numbers, Place of Publication, DOI, ISSN, URL etc.)	(2026) 'Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review', *International Journal of Nursing Studies Advances*, 10 (100527), doi:10.1016/j.ijnsa.2026.100527
Publication Status (e.g. Published, Accepted)	Published
Provide a brief statement here on the disciplinary ranking of this publication and the peer-review process involved (e.g. how many reviewers, single blinded or other, initial decision, revision timeline etc	The International Journal of Nursing Studies Advances is a double-blinded, peer-reviewed journal. The article was originally submitted on the 12th December 2025 and an invitation to revise the manuscript was given on the 14th January 2026 following the review of the manuscript by four reviewers. The article was revised and resubmitted

and any other details that speak to the rigour of the peer review process)	on the 6th of February 2026. The journal expressed an interested in publishing the manuscript on the 4th of March 2026 subject to minor revisions. A revised manuscript was resubmitted on the 10th of March 2026, and the article was accepted for publication on the 19th of March 2026.
This paper (Chapter 5) is one of 4 co-authored papers to be submitted as part of the PhD by publication thesis submitted for examination.	

Section 3: Candidate's Contribution to the Paper

Provide details below of the **nature** and **extent of your contribution** to the paper (include both your intellectual and practical contributions) and your overall contribution in **percentage terms**. Note that these categories can be customised according to disciplinary norms

The nature and extent of my contribution is outlined below. My overall percentage contribution to the paper was 90%.

Briefly outline your contribution to the **conception** of the work described in this paper:

My supervisors, who are also co-authors of this paper, led the conceptualisation phase of this study and I contributed to the conception of the work by working closely with my supervisors, co-authors and the participating hospital to select the variables for inclusion in the chart review and to further develop the conceptualisation of the study.

Briefly outline your contribution to the **literature review** in this paper:

I conducted a review of the literature pertaining to the content presented in this chapter. Following my review of the literature, I wrote the background/introduction section and the discussion sections, which were then reviewed by my supervisors and co-authors.

Briefly outline your contribution to the **methodological design**:

The methodological design used to conduct this research was largely developed by my principal supervisor. As this PhD is embedded within a wider project, the chart review component of the research was decided on in advance of my membership on the research team. However, I contributed to the methodological design approach used to conduct the chart review as it was informed by the research I undertook to complete the scoping review which was presented in the previous chapter. Furthermore, I contributed to the methodological design by working alongside my supervisor to collaborate with one of the co-authors of this publication who is a chart review expert. I also worked closely with my supervisor and healthcare professionals, such as nurses and physicians, from the participating hospital to develop the approach used to conduct this review and co-produce a structure chart review protocol (Appendix C) and data collection instrument that was used to guide the review process. I also contributed to the decision making in relation to variable selection based on my review of the literature. Furthermore, I contributed to the methodological design of the analysis approach by reviewing previously published literature which has similar aims in relation to predictive modelling and assessing risk factors for their association with adverse events.

Briefly outline your contribution to **data collection**:

I contributed to data collection as I collected the conducted the chart review on site in the participating hospital alongside one other member of the research team. Furthermore, the collection of the data was also monitored by my supervisors who were available for consultation throughout the review process.

Briefly outline your contribution to **data analysis**:

I conducted the analysis of the data collected using Excel and SPSS and my supervisors and co-authors reviewed the analysed data and provided me with feedback. The analysis of the data was particularly supported by one of the co-authors who is a statistician. He reviewed the analysis of the collected data and provided feedback on the work.

Briefly outline your contribution to the **synthesis and summary of findings**:

I synthesised and summarised the findings under the supervision of my co-authors. I wrote the results, discussion and conclusion sections of the manuscript, which were then reviewed by my co-authors and revised in accordance with their comments and feedback.

Finally, outline your contribution to the **writing** and **revision** of the paper:

I wrote the original manuscript and revised the content as per the feedback and comments from my co-authors and supervisors. Furthermore, I also revised the paper as per the comments from the peer-reviewers and sought approval of these revisions from my co-authors.

Section 4: Signature and Validation

I confirm that the following statements are true:

(a) the information I have provided in this form is correct
(b) this paper is based on research undertaken during my candidature at DCU

Signature of PhD Candidate: Anna Connolly **Date:** 25/05/26

I confirm that the information provided by the candidate is correct:

Signature of Principal Supervisor: Marcia Kirwan **Date:** 25/05/26

In some cases, it may be appropriate for verification to be given by both the principal supervisor **and** the lead/corresponding author of the work (where the lead/corresponding author of the work is not the candidate or the principal supervisor):

Signature of Lead/Corresponding Author: Anna Connolly **Date:** 25/05/26

Nature of Current Post/Responsibilities: PhD Candidate

Home institution: Dublin City University

5.2 Abstract

Background: Approximately 10% of hospitalised patients experience adverse events. Older patients are particularly vulnerable to developing nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium. However, various predictors which further increase their risk of acquiring such adverse events are not well understood.

Objectives: To identify factors associated with nursing-sensitive adverse events in patients aged 65 and over in one acute Irish hospital and to determine the relationship between a nursing-sensitive adverse event, a patient's discharge destination and in-hospital mortality.

Design: A retrospective study using healthcare chart data.

Methods: A cohort of 1000 admissions of inpatients aged 65 and over who were discharged from a single university, tertiary hospital in Ireland in 2022 were included. A two-stage retrospective chart review was conducted on each of the 1000 admissions to extract data pertaining to their hospitalisation and to identify the presence of pneumonia, urinary tract infections, pressure ulcers and delirium. Univariate analysis was used to screen 13 collected variables to identify those with significant relationships with the nursing-sensitive adverse events. Variables with a p value of <0.25 were included in the multivariate analysis which was used to identify significant risk factors for any nursing-sensitive adverse event and each of the studied events in isolation.

Results: A statistically significant association between medical speciality, an increase in age, length of stay, female sex, the number of diagnoses and procedures and a patient's admission situation and the nursing-sensitive adverse events investigated in this study was identified. Furthermore, time from first presentation to admission and number of ward moves were also associated with nursing-sensitive adverse events but yielded some contradictory findings. A significant association between in-hospital mortality and pressure ulcers was also identified. Patients who experienced nursing-sensitive adverse events were more likely to be discharged with home care packages or to be discharged to nursing homes, other hospitals, rehabilitation facilities or destinations within the 'other' category than be discharged home independently.

Conclusions: This study offers valuable insights for the prevention of nursing-sensitive adverse events. Investment in strategies that are focused on medical patients, older patients, patients with

multiple co-morbidities and those with longer lengths of stay is required to reduce nursing-sensitive adverse events. Further exploration of the association between waiting times from presentation to admission and ward moves and nursing-sensitive adverse events given that these factors may be potentially impacted by key nursing-modifiable interventions.

Keywords: Patient safety, Adverse event, Risk factors, Nursing, Older adult patients

What is already known about the topic?

- Older patients are increasingly vulnerable to experiencing hospital-acquired adverse events.
- Length of stay, age and frailty are well-established predictors of in-hospital adverse events.

What this paper adds?

- This builds on existing research exploring the predictors of nursing-sensitive adverse events in older patients by measuring the impact of additional hospital and patient-level factors.
- Medical speciality, an increase in age, length of stay, the number of diagnoses and procedures, female sex and a patient's admission situation were significantly associated with the nursing-sensitive adverse events investigated in this study. Time from presentation to admission and number of ward moves were also associated with nursing-sensitive adverse events. Pressure ulcers and in-hospital mortality were significantly associated and patients with nursing-sensitive adverse events were more likely to be discharged with further care requirements.
- This study provides an insight into potential clinical and policy implications that may reduce nursing-sensitive adverse events in older patients and improve patient safety and healthcare quality.

5.3 Introduction

An adverse event is an incident resulting in patient harm that is healthcare-associated rather than arising from underlying disease or injury (World Health Organisation, 2009). Older patients are particularly vulnerable to adverse events due to their complex care needs (Gupta *et al.*, 2025)

with approximately 6-60% of older patients affected (World Health Organisation, 2024a). They require basic but fundamental nursing care to manage pre-existing conditions in addition to their acute presenting conditions however, when the demand for nursing care exceeds supply, care is prioritised according to clinical requirements to the detriment of fundamental cares (Bail and Grealish, 2016). Pneumonia, urinary tract infections, pressure ulcers and delirium commonly occur in older patients and contribute to functional and cognitive decline. They are measurable indicators of the 'Failure to Maintain' conceptual framework which indicates rationed nursing care for older patients (Bail and Grealish, 2016). Therefore, these nursing-sensitive adverse events have been explored in this study. Nurse shortages, inadequate staffing and patient acuity contribute to prioritisation of certain nursing tasks over others (Gong *et al.*, 2025). Consequently, essential nursing tasks are frequently missed, resulting in nursing-sensitive adverse events (He *et al.*, 2025). Nursing-sensitive adverse events, or nurse-sensitive outcomes, are affected by nursing care processes, however nursing is not exclusively responsible for them (National Quality Forum, 2004). System-level and organisational factors such as resource constraints, workflow disruptions, inefficient procedures and processes, inadequate or absent policies and regulations and economic pressures may also contribute to their occurrence (World Health Organization, 2023).

Sex, age, length of stay, intensive care unit admissions (Ahmed *et al.*, 2015) and patient complexity, often underpinned by co-morbidities, older age and healthcare utilisation (Schaink *et al.*, 2012), have been associated with adverse events. More specifically, length of stay, Charlson index scores, operation length and intensive care unit admission are common predictors of pneumonia (Mukhtar *et al.*, 2025) which affects approximately 5.8-7.9% of older patients (Burton *et al.*, 2016; Connolly *et al.*, 2025). Older patients are particularly vulnerable to urinary tract infections (Gajdács *et al.*, 2021), which occur in approximately 5.2% of admissions (Connolly *et al.*, 2025), due to age-related deterioration of immune system responses, exposure to healthcare-associated pathogens and an increasing number of comorbidities however, those with a history of urinary tract infections are at high-risk of re-occurrence (Caljouw *et al.*, 2011; Rodriguez-Mañas, 2020). Sex, age, admission method and consciousness status are associated with pressure ulcers (Han *et al.*, 2018), which occur in 8.4% of hospitalised adults (Li *et al.*, 2020). Although often considered reversible, delirium, which occurs in 10-32% of admissions (Fuchs *et al.*, 2020; Connolly *et al.*, 2025), can result in long-

lasting cognitive decline (Fong, Tulebaev and Inouye, 2009). According to Ormseth et al. (2023), non-modifiable delirium risk factors include dementia, age, functional impairment, multiple co-morbidities, and male sex, among others. Modifiable risk factors include immobilisation, medications, co-existing illnesses, anaemia, dehydration and poor nutritional status, metabolic derangement, surgery, environment, pain, emotional distress and sleep deprivation. The nursing-modifiable nature of some of the precipitating factors associated with adverse events, including those investigated through this study, are potential targets for prevention.

Pneumonia, urinary tract infections, pressure ulcers and delirium can potentially predict patient outcomes. Delirium and pressure ulcers are associated with prolonged hospitalisation, an increased likelihood of death within six months and discharge with further care needs (Mudge *et al.*, 2019). Delirium is an independent predictor of length of stay, mortality, nursing home placement and further functional and cognitive decline (Fong, Tulebaev and Inouye, 2009). Urinary tract infections and pneumonia are associated with higher rates of in-hospital mortality, prolonged hospitalisation and increased healthcare costs (Gidey *et al.*, 2023). These events can impact a patient's recovery and result in increased healthcare costs with approximately 15% of total health expenditure spent on managing patient harm consequences in high-income countries (World Health Organisation, 2024a). In Ireland, the estimated cost of hospital-acquired urinary tract infections, pressure ulcers or pneumonia is €694 per event (Murphy *et al.*, 2021).

Given their clinical and financial burden, understanding the predictors of nursing-sensitive adverse events is key to preventing them, improving healthcare quality and decreasing healthcare expenditure (Dziegielewski *et al.*, 2021). Insights into potential risk factors may help clinicians and healthcare providers develop more targeted interventions (Caljouw *et al.*, 2011; Mei *et al.*, 2023; Liu *et al.*, 2024; Mukhtar *et al.*, 2025). The rapid ageing of the Irish and global population suggests that health systems worldwide need to prepare to meet the care demands associated with this demographic change (World Health Organisation, 2025a). Therefore, understanding the factors associated with nursing-sensitive adverse events in older patients is important in an Irish and global context. Although the factors contributing to adverse events in long-term care settings have been investigated (McGrane, Dunbar and Keyes, 2024), few studies have explored the factors associated with pneumonia, urinary tract infections, pressure ulcers

and delirium in older patients in acute Irish hospital settings. Furthermore, although administrative data often under-report nursing-sensitive adverse events (Connolly *et al.*, 2025), many studies rely on them to identify risk factors (Hassan *et al.*, 2010; Toye *et al.*, 2019; Georgiev *et al.*, 2025; Mukhtar *et al.*, 2025). Chart review has shown to be a more valid method for identifying adverse events (Connolly, Kirwan and Matthews, 2024). Therefore, the use of a large retrospective chart review to identify rates of nursing-sensitive adverse events and nursing-modifiable risk factors offers a potentially more accurate analysis of the impact of these factors.

Considering this knowledge gap, the use of chart review as the data collection method and the potentially predictive nature of these conditions in relation to patient outcomes, this study aimed to investigate the factors associated with pneumonia, urinary tract infections, pressure ulcers and delirium in patients aged 65 and over in an acute Irish hospital setting. This research also aimed to determine the relationship between nursing-sensitive adverse events, a patient's discharge destination and in-hospital mortality.

5.4 Methods

5.4.1 Study design, setting and participants

This study is situated within a wider project which aimed to demonstrate the potential for safer hospital care and reduced healthcare costs associated with older patients in acute hospitals in Ireland through accurate reporting of nursing-sensitive adverse events using hospital administrative data. Further information is available at [website added following review, to preserve anonymity].

Retrospective chart review data was collected for a cohort of 1,000 admissions of inpatients aged 65 and over who were discharged from a single university, tertiary hospital in Ireland with over 800 beds and 25,000 inpatient discharges in 2022. Irrespective of their discharge destination, patients discharged from inpatient adult wards, including intensive care units between the 1st of January 2022 and the 31st of December 2022 were included. In line with previous research by Mudge et al. (2019), only patients admitted for 72 hours or longer were eligible for inclusion to limit adverse events to those that were hospital-acquired. A total of 6,575 admissions met these criteria. A simple simulation run in R using various adverse event rates indicated that a sample of 400 admissions provided an acceptably precise estimate. Larger

numbers were required to facilitate subgroup analysis, therefore the sample was stratified into two categories: medical and surgical admissions, consistent with DRG coding. The relative size of the groups, and the expected differences between these categories in terms of prevalence was not known. Therefore, a sample size of approximately 500 per category, resulting in 1,000 admissions, was appropriate to give reasonable power to detect between groups and allow for the exploration of the range of likely outcomes (Fig. 5.1).

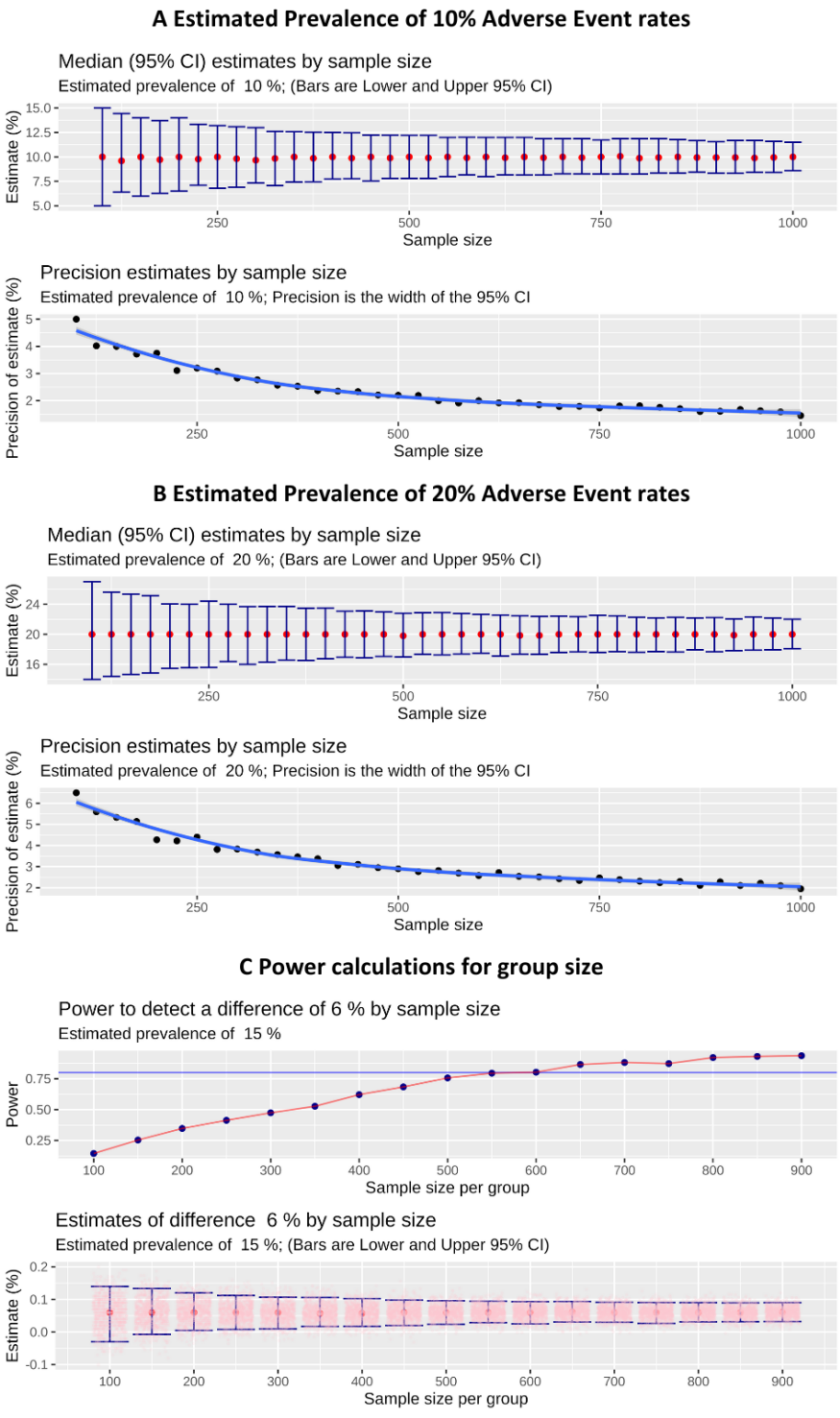


Figure 5.1 Sample size calculations.

(A) Estimated prevalence of 10% adverse event rates, (B) Estimated prevalence of 20% adverse event rates, (C) power calculations for group size.

5.4.2 Variables

Outcomes and definitions

The outcomes measured were pneumonia, urinary tract infections, pressure ulcers, delirium or the presence of any of these during hospitalisation.

Delirium

Delirium was confirmed by the term "delirium" and other alternative acceptable terms such as "confusion", in line with previous literature (Puelle *et al.*, 2015) and as agreed on consultation with participating clinicians.

Pressure ulcer

Based on Irish health service guidelines (HSE, 2018), and on consultation with the involved healthcare professionals, documentation of non-blanching redness was accepted as a stage one pressure ulcer. Stage 2, 3 and 4 pressure ulcers were recorded as per the staging documented within the patients' clinical charts.

Pneumonia and UTI

The World Health Organisation (2024b) healthcare-associated infections case definitions were provided by the healthcare professionals involved and used to confirm the presence of pneumonia and urinary tract infections.

The inclusion and exclusion criteria for each of the adverse events are outlined in Table 5.1.

Table 5.1 Inclusion and exclusion criteria for ICD-10 codes for identifying adverse events in the HIPE data

Inclusion Criteria		
Adverse event	**Inclusion**	**Description**
	ICD-10 Code (Secondary)	
Urinary tract infection	N39.0	Urinary tract infection, site not specified
	T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
Delirium	F05.0	Delirium not superimposed on dementia, so described*
	F05.1	Delirium superimposed on dementia*
	F05.8	Other delirium*
	F05.9	Delirium, unspecified
	R40.1	Stupor

	R40.2	Coma, unspecified
	*Recommended update (not in original Needleman approach)	
Pressure ulcer	L89^	Pressure ulcer
	^Includes all subsets of L89, e. g., L89.0, L89.1, L89.2 etc.	
Pneumonia	J14	Pneumonia due to Haemophilus influenzae
	J15	Bacterial pneumonia, not elsewhere classified
	J18	Pneumonia, organism unspecified
	J69.0	Pneumonitis due to food and vomit
	J95.8	Other postprocedural respiratory disorders
	J95.9	Postprocedural respiratory disorder, unspecified
Exclusion Criteria		
Urinary tract infection	**Exclusion**	**Description**
	ICD Code (Principal)	
	A40	Streptococcal sepsis
	A42	Actinomycosis
	A49.9	Bacterial infection, unspecified
	N39.0	Urinary tract infection, site not specified
	T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
	Exclusion	**Description**
	Diagnose Code (Any)	
	O08.8	Other complications following abortion and ectopic and molar pregnancy
	O23.4	Unspecified infection of urinary tract in pregnancy
	O23.9	Other and unspecified genitourinary tract infection in pregnancy
	O86.2	Urinary tract infection following delivery
	O86.3	Other genitourinary tract infections following delivery
	Exclusion MDC	**Description**
	11	Diseases & Disorders of the Kidney & Urinary Tract
	12	Diseases & Disorders of the Male Reproductive System
	13	Diseases & Disorders of the Female Reproductive System
	14	Pregnancy, Childbirth & the Puerperium
	15	Newborns & Other Neonates
Delirium	**ICD-10 Exclusion - Principal Diagnosis**	**Description**
	F43.2	Adjustment disorders
	F43.9	Reaction to severe stress, unspecified
	F44.88	Other specified dissociative [conversion] disorders

	F05.9	Delirium, unspecified
	R40.1	Stupor
	R40.2	Coma, unspecified
	Exclusion MDC	Description
	1	Diseases & Disorders of the Nervous System
	19	Mental Diseases & Disorders
	20	Alcohol/Drug Use & Alcohol/Drug Induced Organic Mental Disorders
Pressure ulcer	**ICD-10 Exclusion - Principal Diagnosis**	**Description**
	L89	Pressure ulcer
	ICD-10 Exclusion - Any Diagnosis	**Description**
	G80	Cerebral palsy
	G81	Hemiplegia
	G82	Paraplegia and tetraplegia
	G83	Other paralytic syndromes
	Exclusion MDC	Description
	9	Diseases & Disorders of the Skin, Subcutaneous Tissue & Breast
Pneumonia	**ICD-10 Exclusion - Principal Diagnosis**	**Description**
	J10	Influenza due to other identified influenza virus
	J11	Influenza, virus not identified
	J12	Viral pneumonia, not elsewhere classified
	J13	Pneumonia due to Streptococcus pneumoniae
	J14	Pneumonia due to Haemophilus influenzae
	J15	Bacterial pneumonia, not elsewhere classified
	J17	Pneumonia in bacterial diseases classified elsewhere
	J18	Pneumonia, organism unspecified
	J69.0	Pneumonitis due to food and vomit
	J95.8	Other postprocedural respiratory disorders
	J95.9	Postprocedural respiratory disorder, unspecified
	ICD-10 Exclusion - Any Diagnosis	**Description**
	B20	Human immunodeficiency virus [HIV] disease resulting in infectious and parasitic diseases
	B21	Human immunodeficiency virus [HIV] disease resulting in malignant neoplasms

	B22	Human immunodeficiency virus [HIV] disease resulting in other specified diseases
	B23	Human immunodeficiency virus [HIV] disease resulting in other conditions
	B24	Unspecified human immunodeficiency virus [HIV] disease
	D80	Immunodeficiency with predominantly antibody defects
	D81	Combined immunodeficiencies
	D82	Immunodeficiency associated with other major defects
	D83	Common variable immunodeficiency
	D84	Other immunodeficiencies
	D86	Sarcoidosis
	D89	Other disorders involving the immune mechanism, not elsewhere classified
	M35.9	Systemic involvement of connective tissue, unspecified
	Exclusion MDC	**Description**
	4	Diseases & Disorders of the Respiratory System

5.4.3 Co-production of chart review protocol and data collection instrument

A two-stage retrospective chart review was guided by a study-specific chart review protocol that was co-produced by the researchers, a public and patient involvement representative and hospital representatives. Retrospective chart review expert (MU) provided a review template and advised on variable selection. Furthermore, meetings arranged by the participating hospital's project coordinator facilitated variable selection discussions with the Director and Assistant Directors of Nursing, an advanced nurse practitioner, a consultant geriatrician, a tissue viability nurse, a clinical nurse specialist and a consultant microbiologist.

5.4.4 Overall chart review process

The review took place at the participating hospital between October 2023 and April 2024. Paper-based documentation from nurses, doctors and allied healthcare professionals were reviewed. Laboratory results, imaging records, prescriptions and referral data were accessed via an online information system. Access to the intensive care unit online system was also given. Elixhauser scores were calculated for each patient. A clinical research nurse with previous chart review experience and a PhD student with no chart review experience received training from the chart

review expert (MU) and conducted the chart review. A senior research team member monitored the review process.

Review stage 1

All admissions were subject to review stage 1. Sex, age, time of admission and discharge, admission situation, discharge destination, number of bed and ward moves, frailty scores, length of stay, hours from presentation to admission, admissions to intensive care unit, speciality and admission route were collected. Ward moves, as outlined by Blay et al. (2017), referred to any transfer of a patient between wards or clinical units such as intensive care units. In line with previous research, the number of bed moves referred to the number of bed changes a patient experienced throughout their admission, including bed transfers between or within wards (Ranasinghe *et al.*, 2017). If one of the predefined adverse events was identified, the admission was forwarded to review stage 2.

Review stage 2

Further data pertaining to the identification and treatment of the adverse event, such as severity, antibiotic use, interventions and referrals were collected during review stage 2. The data were entered into the data collection instrument in Excel using either open-text or drop-down menus with preset responses.

5.4.5 Data sources and quantitative variables

Exposure

The exposure variables were speciality (medical/surgical), sex, admission route (elective/emergency), admission situation, hours from presentation to admission, number of ward moves, number of bed moves, age, admission to the intensive care unit, length of stay, number of diagnoses, number of procedures and Elixhauser score. Variable selection was guided by the chart review expert (MU) and the hospital representatives and was informed by previous literature which provided empirical rationale for the included variables. As patient complexity is indicated by age, multimorbidity and healthcare utilisation (Schaink *et al.*, 2012), variables such as age, number of diagnoses and number of procedures were considered important. Previous studies exploring predictors of adverse events indicated that the selected variables were relevant and potentially important (Fong, Tulebaev and Inouye, 2009; Webster *et al.*, 2016;

Ranasinghe *et al.*, 2017; Han *et al.*, 2018; Liu *et al.*, 2024; Itoh *et al.*, 2025; Mukhtar *et al.*, 2025).

5.4.6 Statistical methods

The methods used to analyse the relationships between the outcome and exposure variables were of an exploratory and associate nature, rather than causal, given that reverse causation cannot be excluded for certain variables.

All variables were screened using univariate analysis to determine variables for inclusion in the multivariate analysis. Binary logistic regression was run on each variable and a p-value cut-off point of <0.25 was used to ensure that important variables were not excluded in the multivariate analysis (Bursac *et al.*, 2008; Zhang, 2016; Chowdhury and Turin, 2020). This process was repeated for each outcome individually, resulting in five models. Variables with a p-value of <0.05 in the multivariate analysis were considered statistically significant. The odds ratio was used to indicate the ratio-change in the odds of a nursing-sensitive adverse event occurring per one-unit increase in the predictor variable.

Univariate analyses were conducted for each nursing-sensitive adverse events to determine their relationship with in-hospital mortality. Similarly, variables with a p-value of <0.25 were included for multivariate analysis and a p-value of <0.05 in the multivariate analysis was considered statistically significant. The relationship between a nursing-sensitive adverse event and a patient's discharge destination was also explored using multinomial logistic regression. All statistical calculations were performed using IBM SPSS Statistics version 30.

5.5 Results

5.5.1 Participants and descriptive data

A total of 6,575 admissions were eligible for review. The sample included 1,000 admissions of patients aged 65 and over with a minimum length of stay of 72 hours who were discharged in 2022. Descriptive statistics and the characteristics of the participants are shown in Table 5.2.

Table 5.2 Descriptive statistics

Descriptive Statistics (Scale variables)					
	Median	Minimum	Maximum	Mean	Std. Deviation

Time from first presentation to admission (hours)	7.23	0	98.62	12.03	14.30
Age discharge	76	65	98	77.22	7.61
Length of stay	9	3	200	17.26	22.94
Elixhauser score	.00	-7	17	2.68	4.76
Number of diagnoses	6	1	30	7.22	5.24
Total number of procedures	4	0	20	4.53	3.52

Descriptive statistics (categorical variables)		
		N (%)
Speciality	Medical	505 (50.5%)
	Surgical	495 (49.5%)
Sex	Male	534 (53.4%)
	Female	466 (46.6%)
Admission route	Emergency	769 (76.9%)
	Elective	231 (23.1%)
Admission situation	Home, independent	638 (63.8%)
	Home, with homecare package	155 (15.5%)
	Nursing home	51 (5.1%)
	Other hospital	110 (11%)
	Rehab*	10 (1%)
	Other*	35 (35%)
Discharge Destination	Home, independent	580 (58%)
	Home, with homecare package	156 (15.6%)
	Nursing home	56 (5.6%)
	Other hospital	64 (6.4%)
	Rehab	93 (9.3%)
	Death**	38 (3.8%)
	Other**	10 (1%)
Admitted to ICU		86 (8.6%)
Age	65-74	429 (42.9%)
	75-84	362 (36.2%)
	85+	207 (20.7%)
Length of stay	≤ 7 days	387 (38.7%)
	8-14 days	284 (28.4%)
	≥15 days	327 (32.7%)

*For analysis purposes the rehab and other categories were combined.
**For analysis purposes the death and other categories were combined.
ICU = Intensive Care Unit

5.5.2 Outcomes

A nursing-sensitive adverse event was identified in 231 (23.1%) admissions. A total of 79, 52, 71 and 100 patients experienced at least one pneumonia, urinary tract infection, pressure ulcer or delirium, respectively. A total of 176 admissions contained one adverse event, 40 admissions contained two adverse events, 14 admissions contained three adverse events, and one admission contained all four. As some patients experienced more than one adverse event, a model assessing the association between the exposure variables and any of the four adverse events was run in addition to four individual event-specific models. Differences were identified between the variables that were associated with any adverse event and those which were associated with the individual adverse events.

5.5.3 Variable selection and model performance

The true positive and false positive rates for each model, demonstrating the number of cases that correctly identified in comparison to the chart review data is outlined in Table 5.3.

Table 5.3 True positive and false positives rates for each model

	True positive	**False positive**
Any Nursing-sensitive Adverse Event	226	5
Pneumonia	76	3
Urinary Tract Infection	51	1
Pressure Ulcer	70	2
Delirium	100	-

Any nursing-sensitive adverse event

A total of 13 potential risk factors were explored in relation to the nursing-sensitive adverse events. A total of 11 variables demonstrated statistical significance ($p<0.25$) in the univariate analysis. The multivariate analysis indicated that four of these variables were statistically significant.

The full model containing all predictors was statistically significant, X^2 (14, N = 988) = 272.718, $p < .001$, indicating that the model was able to distinguish between patients who experienced a nursing-sensitive adverse event and patients who did not. The model correctly classified 82.2% of cases. As shown in Table 1, four of the independent variables significantly contributed to the model. Time from presentation to admission had an odds ratio of .981, indicating that patients

with longer waiting times were less likely to experience nursing-sensitive adverse events during their hospitalisation. An odds ratio of 1.142 for number of diagnoses demonstrated that patients with more comorbidities were more likely to experience a nursing-sensitive adverse event. Furthermore, an odds ratio of 1.034 demonstrated that patients with a longer length of stay were more likely to experience a nursing-sensitive adverse event. Finally, an odds ratio of 1.041 for age demonstrated that older patients were more likely to experience a nursing-sensitive adverse event. The precision of these odds ratios is indicated by the relatively narrow confidence intervals (Table 5.5).

The model had an overall accuracy of 82.2% and demonstrated good fit with a Hosmer-Lemshow of p=0.097 and pseudo R^2 values between 0.241 and 0.366. An ROC curve (Figure 5.2) was generated to assess how well the model could distinguish between patients with and without nursing-sensitive adverse events. The area under the curve (Table 5.4) was 0.836, demonstrating that the model had an 83.6% chance of correctly classifying patients with and without nursing-sensitive adverse events.

Table 5.4 Area under the curve (AUC) for each logistic regression model

Outcome	AUC (95% CI)	Standard error	Asymptotic sig.
Any nursing-sensitive Adverse Event	0.836 (0.807–0.865)	0.015	0.000
Pneumonia	0.858 (0.816–0.899)	0.021	0.000
Urinary Tract Infection	0.834 (0.779–0.890)	0.029	0.000
Pressure Ulcer	0.867 (0.826–0.909)	0.021	0.000
Delirium	0.811 (0.768–0.854)	0.022	0.000

Pneumonia

All 13 potential risk factors were explored in relation to pneumonia. A total of 10 variables demonstrated statistical significance ($p<0.25$) in the univariate analysis with four of these variables identified as statistically significant in the multivariate analysis.

The full model containing all significant predictors from the univariate analysis was statistically significant, X^2 (13, N = 988) = 131.955, $p < .001$, indicating that the model was able to distinguish between patients who experienced a pneumonia and patients who did not. The model

correctly classified 92.5% of cases. As shown in Table 5.5, four of the independent variables made a statistically significant contribution to the model. An odds ratio of .518 for speciality demonstrated that surgical patients were less likely than medical patients to experience a pneumonia. An odds ratio of 1.107 for number of diagnoses demonstrated that patients with more comorbidities were more likely to experience a pneumonia. Furthermore, an odds ratio of 1.093 for a number of procedures demonstrated that patients with more procedures were more likely to experience a pneumonia. Finally, an odds ratio of 1.013 for length of stay, demonstrated that patients with a longer length of stay were more likely to develop a pneumonia. The narrow confidence intervals for the odds ratio for number of diagnoses, number of procedures and length of stay demonstrate the precision of the effect however, the relatively broad confidence intervals for speciality indicate a level of uncertainty in relation to the effect (Table 5.5).

The model had an overall accuracy of 92.5% and demonstrated good fit with a Hosmer-Lemshow of p=0.121 and pseudo R^2 values between 0.125 and 0.293. An ROC curve (Fig. 1) was generated and the area under the curve (Table 5.4) was 0.858, demonstrating that the model had an 85.8% chance of correctly classifying patients with and without a pneumonia.

Urinary tract infection

All 13 potential risk factors were explored in relation to urinary tract infections. A total of 7 variables demonstrated statistical significance ($p<0.25$) in the univariate analysis. The multivariate analysis indicated that three of these variables were statistically significant.

The full model containing all significant predictors from the univariate analysis was statistically significant, $X^2 (10, N = 994) = 82.621$, $p < .001$, indicating that the model was able to distinguish between patients with and without urinary tract infections. The model correctly classified 94.8% of cases. As shown in Table 5.5, three variables made a statistically significant contribution to the model. Sex had an odds ratio of 2.290, demonstrating that females were more likely than males to develop urinary tract infections. An odds ratio of 1.143 suggested that patients with more diagnoses were more likely to experience a urinary tract infection. Finally, an odds ratio of 1.022 for length of stay, demonstrated that patients with a longer length of stay were more likely to experience a urinary tract infection. The relatively narrow confidence intervals for length of stay and number of diagnoses indicate the precision of the effect size. However,

although the association between sex and urinary tract infection is significant, the confidence intervals were broad (Table 5.5).

The model had an overall accuracy of 94.8% and demonstrated good fit with a Hosmer-Lemshow of p=0.774 and pseudo R^2 values between 0.08 and 0.237. An ROC curve (Fig. 5.2) was generated and the area under the curve (Table 5.4) was 0.834, demonstrating that the model had an 83.4% chance of correctly classifying patients with and without urinary tract infections.

Pressure Ulcer

The same 13 potential risk factors were investigated in relation to pressure ulcers. A total of 11 variables demonstrated statistical significance ($p<0.25$) in the univariate analysis. The multivariate analysis indicated that five of these variables were statistically significant (Table 5.5).

The full model containing all significant predictors from the univariate analysis was statistically significant, X^2 (14, N = 990) = 136.253, $p < .001$, indicating that the model was able to distinguish between patients with and without pressure ulcers. The model correctly classified 93.2% of cases. As shown in Table 5.5, five variables made a statistically significant contribution to the model.

Furthermore, the odds ratio of 1.151 for number of diagnoses demonstrated that patients with more comorbidities were more likely to experience a pressure ulcer. Admission situation was also identified as a predictor of pressure ulcers with patients with homecare packages and those who were transferred from other hospitals more likely to develop pressure ulcers than those living independently given the odds ratios of 2.408 and 2.614, respectively. An odds ratio of 1.017 for length of stay demonstrated that patients with a longer length of stay were more likely to experience a pressure ulcer. An odds ratio of 0.659 for number of ward moves demonstrated that patients with more ward moves were less likely to experience a pressure ulcer. Finally, age was a significant predictor with an odds ratio of 1.051, demonstrating that the chance of developing a pressure ulcer increases with age. The confidence intervals for each of these odds ratios, as outlined in Table 5.5, demonstrate the precision of the effect size of each of these variables.

The model had an overall accuracy of 93.2% and demonstrated good fit with a Hosmer-Lemshow of p=0.158 and pseudo R^2 values between 0.129 and 0.319. An ROC curve (Fig. 5.2) was generated and the area under the curve (Table 5.4) was 0.867, demonstrating that the model had an 86.7% chance of correctly classifying patients with and without pressure ulcers.

Delirium

The 13 potential risk factors were also investigated in relation to delirium. A total of 10 variables demonstrated statistical significance ($p<0.25$) in the univariate analysis. The multivariate analysis indicated that three of these variables were statistically significant.

The full model containing all significant predictors from the univariate analysis was statistically significant, X^2 (13, N = 988) = 113.785, $p < .001$, indicating that the model was able to distinguish between patients with and without delirium. The model correctly classified 90% of cases. As shown in Table 5.5, three of the variables made a statistically significant contribution to the model. Patients with more comorbidities were more likely to experience delirium with an odds ratio of 1.119. An odds ratio of 0.712 for number of ward moves demonstrated that patients with more ward moves were less likely to experience a delirium. Finally, age was a significant predictor with an odds ratio of 1.052, demonstrating that the chance of developing delirium increases with age. The confidence intervals which demonstrate the precision of the effect size of the association between these variables and delirium is outlined in Table 5.5.

The model had an overall accuracy of 90.2% and demonstrated good fit with a Hosmer-Lemshow of p=0.553 and pseudo R^2 values between 0.109 and 0.230. An ROC curve (Fig. 5.2) was generated and the area under the curve (Table 5.4) was 0.811, demonstrating that the model had an 81.1% chance of correctly classifying patients with and without delirium.

Table 5.5 Multivariate logistic regression outputs

	Outcome variables									
	Any Nursing-Sensitive Adverse Event		**Pneumonia**		**Urinary Tract Infection**		**Pressure Ulcer**		**Delirium**	
Predictor variables	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***	**OR (95% CI)**
Speciality (Reference category = medical)	0.824	1.051 (0.677-1.632)	0.048	0.518 (0.269-0.995)			0.486	1.260 (0.657-2.417)	0.074	1.659 (0.952-2.891)
Sex (Reference category = male)	-	-	-	-	0.012	2.290 (1.201-4.365)	0.133	1.554 (0.874-2.761)	-	-
Admission route (Reference category = elective)	0.982	1.007 (0.573-1.768)	-	-	-	-	0.783	0.879 (0.349-2.210)	-	-
Hours from first presentation to admission	0.028	0.981 (0.965-0.998)	0.200	0.984 (0.961-1.008)	-	-	-	-	0.257	0.988 (0.968-1.009)
Number of ward moves	0.899	1.019 (0.763-1.361)	0.437	1.162 (0.796-1.695)	0.123	1.446 (0.905-2.31)	0.044	0.659 (0.44-0.988)	0.043	0.712 (0.512-0.99)
Number of bed moves	0.859	1.017 (0.841-1.231)	0.919	1.013 (0.789-1.301)	0.055	0.712 (0.504-1.007)	0.158	1.199 (0.932-1.542)	0.100	1.196 (0.966-1.481)
Age	0.003	1.041 (1.014-1.068)	0.734	0.993 (0.954-1.034)	-	-	0.018	1.051 (1.008-1.095)	0.003	1.052 (1.017-1.088)
ICU admission (Reference category = not admitted to ICU)	0.158	1.684 (0.817-3.472)	0.866	1.081 (0.437-2.675)	-	-	0.100	2.448 (0.843-7.106)	0.054	2.283 (0.985-5.294)
Length of stay	<.001	1.034 (1.021-1.047)	0.028	1.013 (1.001-1.024)	<.001	1.022 (1.010-1.034)	0.003	1.017 (1.006-1.028)	0.332	1.005 (0.995-1.015)
Number of diagnoses	<.001	1.142 (1.093-1.192)	<.001	1.107 (1.049-1.169)	<.001	1.143 (1.075-1.215)	<.001	1.151 (1.090-1.216)	<.001	1.119 (1.067-1.174)
Number of procedures	0.202	1.049 (0.975-1.13)	0.040	1.093 (1.004-1.189)	0.091	0.913 (0.821-1.015)	0.719	0.982 (0.891-1.083)	0.104	1.067 (0.987-1.153)
Admitted from Home independent (reference category)	0.913		0.355		0.124		0.049		0.241	
Admitted from Home care package	0.745	1.091 (0.645-1.845)	0.323	0.646 (0.271-1.537)	0.231	0.573 (0.231-1.424)	0.023	2.408 (1.131-5.13)	0.202	1.544 (0.792-3.008)
Admitted from Nursing home	0.546	1.262 (0.593-2.686)	0.221	0.275 (0.035-2.17)	0.191	0.254 (0.033-1.978)	0.090	2.392 (0.873-6.554)	0.272	1.663 (0.670-4.124)
Admitted from Other hospital	0.650	1.159 (0.613-2.189)	0.193	1.658 (0.774-3.555)	0.975	1.016 (0.368-2.809)	0.026	2.614 (1.124-6.081)	0.353	0.689 (0.314-1.512)
Admitted from Other	0.430	1.404 (0.605-3.26)	0.825	1.143 (0.35-3.735)	0.072	2.633 (0.916-7.567)	0.714	0.679 (0.086-5.391)	0.110	2.198 (0.836-5.783)
Elixhauser score	-	-	-	-	-	-	-	-	-	-
ICU = Intensive Care Unit										

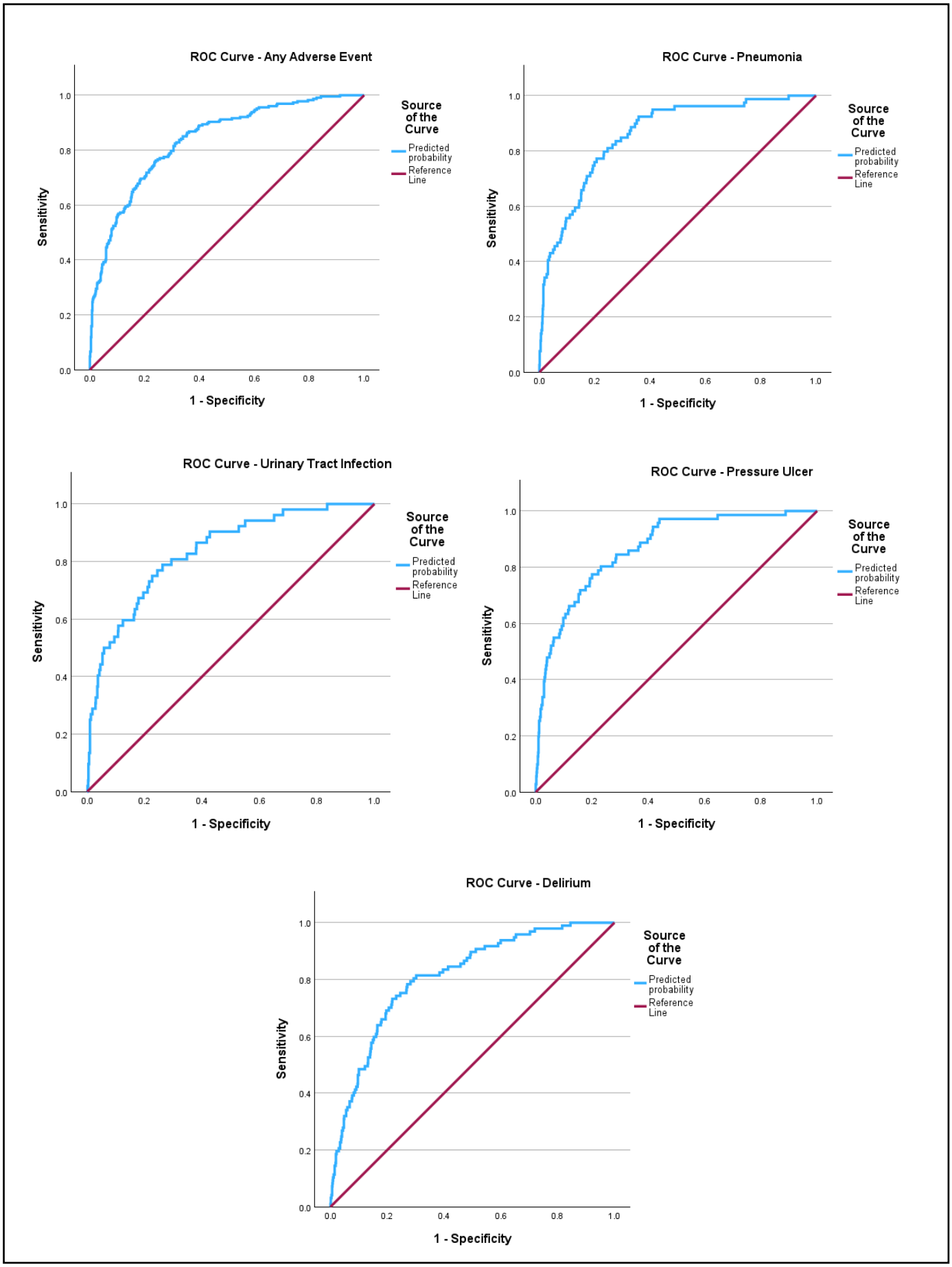


Figure 5.2 ROC Curves demonstrating the area under the curve for each predictive model.

The area under the curve for the model predicting any adverse event was 0.836. The models predicting pneumonia, urinary tract infections, pressure ulcers and delirium had area under the curve values of 0.858, 0.834, 0.867 and 0.811, respectively. Further detail in relation to the area under the curve values, such as confidence intervals, for each logistic regression model is available in table 5.4.

5.5.4 Relationship between the presence of a nursing-sensitive adverse event and in-hospital mortality and discharge destination

In-hospital mortality

Binary logistic regression indicated that in-hospital mortality was 4.954 times more likely to occur in patients with any nursing-sensitive adverse event (Table 5.6). Univariate analysis on each nursing-sensitive adverse event individually demonstrated that patients complicated with pneumonia, pressure ulcers and delirium were significantly ($p<0.25$) more likely to experience in-hospital mortality. Although urinary tract infections were not statistically significant, due to their clinical significance, they were included in the model. Multivariate analysis results indicated that pressure ulcers, with an odds ratio of 6.864, were the only statistically significant contributor to in-hospital mortality (Table 5.6). The confidence intervals were relatively wide, therefore indicating that although the association is significant, the effect size is uncertain. The full model containing all significant predictors from the univariate analysis was statistically significant, X^2 (4, N = 1,000) = 28.145, p < .001, indicating that the model was able to distinguish between patients who died in hospital and patients who did not.

Table 5.6 Binary and multivariate logistic regression demonstrating the association between nursing-sensitive adverse events and in-hospital mortality

Binary logistic regression model to test the association between any nursing-sensitive adverse event and in-hospital mortality		
Outcome variable	*p*	OR (95%)
Any Nursing-sensitive Adverse Event	<.001	4.954 (2.555-9.604)
Multivariate logistic regression model to test the association between each of the studied nursing-sensitive adverse events and in-hospital mortality		
Outcome variables	*p*	OR (95% CI)
Pneumonia	0.102	2.127 (0.862-5.25)

Urinary Tract Infection	0.867	0.894 (0.240-3.324)
Pressure Ulcer	<.001	6.864 (3.177-14.83)
Delirium	0.730	1.177 (0.465-2.982)

The model had an overall accuracy of 96.2% and demonstrated good fit with a Hosmer-Lemshow of p=0.504 and pseudo R^2 values between 0.028 and 0.101. An ROC curve (Fig. 5.3) was generated and the area under the curve (Table 5.7) was 0.7, demonstrating that the model had a 70% chance of correctly classifying patients who died in hospital.

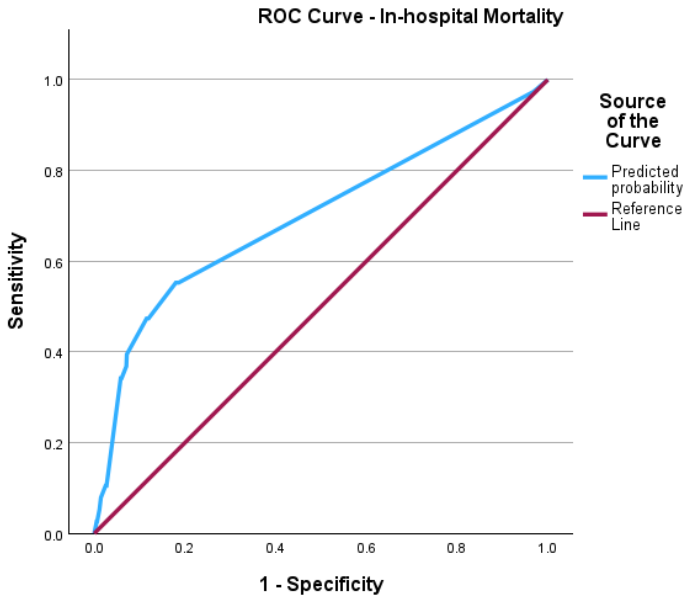


Figure 5.3 ROC Curve for in-hospital mortality

Table 5.7 Area under the curve (AUC) for in-hospital mortality

Outcome	AUC (95% CI)	Standard error	Asymptotic sig.
In-hospital mortality	0.697 (0.596–0.798)	0.051	0.000

Discharge destination

The multinomial logistic regression suggested that patients with a nursing-sensitive adverse event were significantly more likely than those without to be discharged with a homecare package (OR=2.295, p=<0.001), to a nursing home (OR=4.164, p=<0.001), to another hospital (OR=4.404, p=<0.001) or rehabilitation facility (OR=4.648, p=<0.001) or to fall within the 'other' category (OR=6.996, p=<0.001) than to be discharged home independently (Table 5.8). The associations identified are statistically significant however, the confidence intervals are relatively broad (Table 5.8).

Table 5.8 Multinomial logistic regression demonstrating association between nursing-sensitive adverse event occurrence and discharge destination

Discharge Destination		**Std. Error**	***p***	**OR (95% CI)**
Homecare package	Intercept	0.103	<.001	
	[Any NSAE Multinomial=Yes]	0.219	<.001	2.295 (1.494-3.524)
	[Any NSAE Multinomial=No]	-	-	-
Nursing Home	Intercept	0.177	<.001	
	[Any NSAE Multinomial=Yes]	0.299	<.001	4.164 (2.316-7.490)
	[Any NSAE Multinomial= No]	-	-	-
Other hospital	Intercept	0.168	<.001	
	[Any NSAE Multinomial= Yes]	0.282	<.001	4.404 (2.533-7.655)
	[Any NSAE Multinomial= No]	-	-	-
Rehabilitation facility	Intercept	0.143	<.001	
	[Any NSAE Multinomial= Yes]	0.243	<.001	4.648 (2.888-7.481)
	[Any NSAE Multinomial= No]	-	-	-
Other	Intercept	0.213	<.001	
	[Any NSAE Multinomial= Yes]	0.314	<.001	6.996 (3.784-12.933)
	[Any NSAE Multinomial= No]	-	-	-
Note: The reference category is home independent NSAE = Nursing-sensitive adverse event				

A multinomial logistic regression was conducted to determine any association between the four nursing-sensitive adverse events and a patient's discharge destination, with all events adjusted for within the same model (Table 5.9). Patients with pneumonia were significantly more likely than those without to be discharged to another hospital (OR=2.791, p=<0.009)

or to fall within the ‘other’ category (OR=3.512, p=<0.003) than to be discharged home independently. Patients with urinary tract infections had an increased likelihood of being discharged to a rehabilitation facility (OR=5.920, p=<0.001) in comparison to being discharged home independently. Pressure ulcers were associated with an increased odds of being discharged with a homecare package (OR=6.105, p=<0.001) or being discharged to a nursing home (OR=7.582, p=<0.001), other hospital (OR=9.774, p=<0.001), rehabilitation facility (OR=5.85, p=<0.001) or to a destination within the ‘other’ category (OR=16.246, p=<0.001) than to be discharged home independently. Patients with delirium were significantly more likely than those without to be discharged with a homecare package (OR=2.697, p=<0.002) or to be discharged to a nursing home (OR=3.945, p=<0.001), other hospital (OR=3.604, p=<0.001) or rehabilitation facility (OR=4.435, p=<0.001). These associations were statistically significant however, the confidence intervals for some variables are relatively broad.

Table 5.9 Multinomial logistic regression demonstrating association between each individual nursing-sensitive adverse event and discharge destination

Discharge Destination		**Std. Error**	***p***	**OR (95% CI)**
Homecare package	Intercept	0.101	<.001	
	[Pneumonia Multinomial=Yes]	0.466	0.212	0.559 (0.224-1.394)
	[UTI Multinomial= Yes]	0.490	0.670	1.232 (0.471-3.222)
	[Pressure Ulcer Multinomial= Yes]	0.418	<.001	6.105 (2.690-13.854)
	[Delirium Multinomial= Yes]	0.314	0.002	2.697 (1.457-4.994)
Nursing Home	Intercept	0.168	<.001	
	[Pneumonia Multinomial= Yes]	0.492	0.445	1.456 (0.555-3.817)
	[UTI Multinomial= Yes]	0.589	0.219	2.062 (0.65-6.542)
	[Pressure Ulcer Multinomial= Yes]	0.509	<.001	7.582 (2.796 -20.565)
	[Delirium Multinomial= Yes]	0.400	<.001	3.945 (1.803-8.633)
Other hospital	Intercept	0.163	<.001	
	[Pneumonia Multinomial= Yes]	0.394	0.009	2.791 (1.288-6.048)
	[UTI Multinomial= Yes]	0.598	0.454	1.564 (0.485-5.049)
	[Pressure Ulcer Multinomial= Yes]	0.466	<.001	9.774 (3.919-24.374)
	[Delirium Multinomial= Yes]	0.385	<.001	3.604 (1.696-7.657)
Rehabilitation facility	Intercept	0.140	<.001	
	[Pneumonia Multinomial= Yes]	0.384	0.141	1.761 (0.829-3.742)
	[UTI Multinomial= Yes]	0.382	<.001	5.920 (2.801-12.51)
	[Pressure Ulcer Multinomial= Yes]	0.467	<.001	5.85 (2.344-14.602)
	[Delirium Multinomial= Yes]	0.330	<.001	4.435 (2.321-8.477)
Other	Intercept	0.192	<.001	
	[Pneumonia Multinomial= Yes]	0.423	0.003	3.512 (1.533-8.047)
	[UTI Multinomial= Yes]	0.623	0.303	1.901 (0.561-6.444)
	[Pressure Ulcer Multinomial= Yes]	0.469	<.001	16.246 (6.475-40.763)
	[Delirium Multinomial= Yes]	0.483	0.133	2.067 (0.802-5.326)
UTI = Urinary Tract Infection				

5.6 Discussion

This research identified important factors associated with nursing-sensitive adverse events in patients aged 65 and over in an acute Irish hospital. A significant associative relationship was identified between speciality, time from presentation to admission, age, number of diagnoses, length of stay, number of procedures, sex, admission situation and number of ward moves and the nursing-sensitive adverse events. Patient complexity, as indicated by age, multimorbidity and number of procedures (Schaink *et al.*, 2012), was significantly associated with adverse events. This research also identified an association between in-hospital mortality and pressure ulcers. Furthermore, patients with nursing-sensitive adverse events were more likely to be discharged with additional care needs as rather than home independently.

In this study, surgical patients were less likely than medical patients to develop pneumonia. In addition to a higher incidence of hospital-acquired pneumonia in medical departments in comparison to surgical departments (Sopena *et al.*, 2014), an association between medical admissions and adverse events such as pressure ulcers, falls and aspiration pneumonia has previously been demonstrated (Adamuz *et al.*, 2020). As medical patients tend to be older patients with chronic diseases and other co-morbidities (Adamuz *et al.*, 2018), they may have poorer health than surgical patients, and may more vulnerable to pneumonia. Exploration of nursing-modifiable interventions tailored to medical patients' needs may result in more positive patient outcomes.

In this study, increasing age was associated with an increased likelihood of any nursing-sensitive adverse event, and pressure ulcers and delirium, in particular. An association between greater mean age and an increased likelihood of adverse events has also been identified by San Jose-Saras et al. (2022). The findings relating to pressure ulcers are supported by previous research which found that the likelihood of a pressure ulcer increased 1.04 times per year of age (Han *et al.*, 2018). These findings suggest that efforts to reduce nursing-sensitive adverse events should focus on older and therefore, more vulnerable patients.

Length of stay is another widely recognised risk factor for adverse events (Hassan *et al.*, 2010; Rosman *et al.*, 2015; Mukhtar *et al.*, 2025). Longer admissions are often inevitable in patients with underlying co-morbidities who require complex procedures that increase their likelihood of adverse events (Mukhtar *et al.*, 2025). In line with previous literature

identifying an increased risk of infection and pressure ulcers for each overnight hospital stay (Hauck and Zhao, 2011), this study demonstrated an association between increased length of stay and an increased likelihood of pneumonia, urinary tract infections and pressure ulcers or any nursing-sensitive adverse event. Therefore, patients with increased lengths of stay should be prioritised to reduce their vulnerability to nursing-sensitive adverse events. However, the bidirectional relationship between length of stay and adverse events must be acknowledged as adverse events may result from and contribute to prolonged hospitalisation. Reverse causation cannot be excluded, therefore the associative, rather than causal, nature of this relationship is emphasised as adverse events may significantly prolong length of stay (Hoogervorst-Schilp *et al.*, 2015; Tessier *et al.*, 2019; Fan *et al.*, 2024). Given the potential for an adverse event-related increased length of stay to result in poor-patient outcomes and increased healthcare costs, it is essential that adverse events are prevented.

Similar to figures from Violan et al. (2014), 94.9% of admissions in this study were affected by multimorbidity. A patient's number of diagnoses was associated with an increased likelihood of any nursing-sensitive adverse event and each event when considered in the individual models. These findings reflect findings of a 1.4-fold increased risk of adverse events in patients with two or more comorbidities (Nghiem *et al.*, 2022). Hospitals should focus their efforts on prioritising particularly vulnerable patients, such as those with multiple comorbidities. Furthermore, additional research exploring a transition from single-disease specific interventions to bundles of interventions to prevent multiple nursing-sensitive adverse events is required.

The likelihood of pneumonia was associated with an increased number of procedures. This finding is unsurprising given that patients with longer lengths of stay who require more complex procedures inevitably have an increased likelihood of adverse events (Mukhtar *et al.*, 2025). This finding suggests that hospitals should focus pneumonia prevention strategies on post-procedural periods as patients appear to be particularly vulnerable at this stage of their treatment. Post-procedural patient care is a nursing-modifiable factor that should be further explored in terms of reducing nursing-sensitive adverse events in older patients.

In this study, patients receiving homecare and those transferred from other hospitals were more likely to develop pressure ulcers. Inter-hospital transfers have been associated with poor patient outcomes and increased risks of in-hospital mortality (Song *et al.*, 2024). These findings suggest that specific strategies and interventions targeted towards patients who are

transferred from other hospitals and those receiving help with daily living may be beneficial for reducing nursing-sensitive adverse events. The care given to transferred patients is a nursing-modifiable factor which should be considered in relation to the development of prevention strategies.

Although there is limited research exploring sex differences in patient harm (World Health Organisation, 2024a), research suggests that women are disproportionately affected (Institute for Health Metrics and Evaluation, 2024). In line with previous research (Al Qahtani *et al.*, 2024), this study identified that females were more likely than males to develop urinary tract infections. In terms of clinical implications, this finding demonstrates that sex-specific strategies may be required in order to prevent urinary tract infections.

Although many factors in this study are supported by previous literature, some findings are inconsistent with previous research. Prolonged emergency department stays and increased waiting times to admission due to bed unavailability, increased care demands and slow patient flow has been associated with adverse events (do Nascimento Rocha, da Costa Farre and de Santana Filho, 2021). Conversely, longer waiting times to admission in this study was significantly associated with a reduction in nursing-sensitive adverse events. Triage processes in Irish hospitals ensure that the sickest patients are identified and treated first (Health Service Executive, 2025), therefore patients who are less vulnerable to adverse events, may experience longer wait times. The clinical implication of this suggests that patients with acute conditions and an increased risk of adverse events should be prioritised and admitted sooner than those who are healthier and less susceptible to adverse events. However, this is a strictly exploratory hypothesis that requires further investigation. This contradictory finding must be considered with caution given the associative, rather than causal, relationship. Further investigation is required given the weakness of the association which indicated a 1.9% reduced chance of any nursing-sensitive adverse event.

A significant association between ward moves and delirium and pressure ulcers was also identified. However, in contrast to previous research, an increased number of ward moves was associated with a reduced risk of delirium. Again, as reverse causation cannot be excluded, it is important to consider that the relationship identified between ward moves and adverse events is associative rather than causal. Previous research demonstrates that ward transfers are associated with an increased likelihood of falls, wound infections, and delirium (Webster *et al.*, 2016; Blay *et al.*, 2017; Ranasinghe *et al.*, 2017; Toye *et al.*, 2019). However,

complex clinical journeys have been associated with ward transfers, with patients with co-occurring clinical needs requiring ward transfers for more specialised treatment. (Mendelsohn *et al.*, 2023). The reduced risk of delirium and pressure ulcers in relation to ward moves may reflect the movement of patients to speciality services tailored to their needs, therefore mitigating their risk of delirium or pressure ulcers. As ward move locations were not recorded, their reflection of movement for more specialised care is a strictly exploratory hypothesis rather than a definitive mechanism to explain this contradictory finding. Furthermore, non-clinical ward moves, where patients are temporarily transferred to different wards, are a short-term solution to overcrowding in hospitals (George and Wilkinson, 2016). Therefore, patients who are healthier, and less vulnerable to adverse events, may experience more ward moves when bed capacity is limited. It is also possible that as patients become healthier, and less susceptible to adverse events, they may experience more transfers to less specialised wards. Again, these interpretations are strictly exploratory hypotheses that have not been investigated. Therefore, further research is required to explore these associations. A more in-depth understanding of the impact of factors, such as communication and coordination during ward transfers may also yield interesting findings for mitigating adverse events.

Similar to previous findings (Nghiem *et al.*, 2022; San Jose-Saras *et al.*, 2022), patients with at least one nursing-sensitive adverse event in this study were more likely to die in hospital than those who did not. Furthermore, and in line with previous research (Song *et al.*, 2019; Pang *et al.*, 2025), pressure ulcers in this study were associated with a higher risk of mortality. Although increased severity of pressure ulcers has been associated with an increased risk of in-hospital mortality (Labeau *et al.*, 2021), this study did not explore the effect of pressure ulcer severity on in-hospital mortality and therefore stage 1, 2, 3 and 4 pressure ulcers were grouped together in the analysis. Nevertheless, this highlights the impact of nursing-sensitive adverse events on patient outcomes and emphasises the importance of developing strategies to prevent their occurrence and the subsequent further decline in health outcomes for patients.

Patients with nursing-sensitive adverse events were more likely to be discharged with additional care needs as opposed to being discharged home independently. These findings have significant implications in relation to the availability and financial impact of such resources for health systems and patients. These findings, in addition to the projected increase in the demand for long-term care and home support services in Ireland (Walsh and

Kakoulidou, 2025) have significant policy implications as adequate funding, staffing and infrastructure will be required to deliver these additional services. In order to reduce the economic impact and the burden to the patient of requiring additional care on discharge, the prevention of nursing-sensitive adverse events should be prioritised in terms of a patient safety agenda.

As highlighted by the World Health Organization (2024a), strategies targeting infections and pressure ulcers are essential in terms of reducing patient harm and the economic burden of patient safety incidents globally. Due to the increased risk of harm for vulnerable populations with complex care needs indicated by their increasing age, comorbidity burden and the various procedures they require, patient safety issues must be addressed (World Health Organisation, 2024a). Nursing-sensitive adverse events can significantly increase the cost and duration of hospital stays. Substantial investments in strategies to prevent nursing-sensitive adverse events may reduce the economic and human cost of patient safety incidents for both health systems and patients (Tessier *et al.*, 2019). Hospitals should focus their efforts on vulnerable populations such as medical patients, older patients, patients with multiple co morbidities and those with longer lengths of stay.

Strategies focused on incorporating continuous risk assessments throughout patients' hospitalisations may be useful for preventing adverse events given that patients with longer lengths of stay and those who have had procedures appear to be at an increased risk. Furthermore, targeted screening of medical patients and those transferred from other hospitals may also be beneficial. Strategies that ensure additional monitoring of patients who are deemed at risk of adverse events may also reduce the impact of adverse events. However, such interventions require additional nursing demand, therefore investment in strategies focused on nurse workforce planning and sufficient nurse-patient ratios is essential. Understanding the factors associated with adverse events may also inform strategies for optimising resource allocation and ensure that resources are distributed to high-risk patients.

The increasing rate of population ageing demonstrates that health systems worldwide need to be prepared to meet the care demands associated with this demographic shift (World Health Organisation, 2025a). Therefore, the results of this study are relevant in an international context, offering insights into the aspects of care for older patients which require immediate attention to reduce patient safety incidents. Furthermore, as the need to validate administrative datasets globally has previously been identified (Connolly, Kirwan

and Matthews, 2024), this study offers researchers internationally an insight into the benefits of using a chart review to identify adverse events rates and their associated risk factors, as opposed to relying on administrative data which are often inaccurate (Connolly *et al.*, 2025).

Furthermore, research is required to develop and evaluate the effectiveness of care bundles aimed at preventing multiple nursing-sensitive adverse events as previous research has demonstrated their effectiveness in preventing hospital-acquired pressure ulcers (Demir and Karadag, 2025). Care bundles that combine the effective preventative nursing interventions outlined by Bail and Grealish (2016) could potentially prevent nursing-sensitive adverse events.

5.6.1 Strengths and Limitations

A strength of this study was the inclusion of a large university teaching hospital with a large population of secondary care and tertiary care patients, as well as some national speciality patients, which provided a sample that was representative of a diverse range of patient complexities. Furthermore, the participating hospital is reflective of healthcare settings with large patient populations both nationally and internationally facing similar challenges such as patient acuity, resource and staff shortages and the management of both complex and routine cases. Additionally, the retrospective chart review component is a strength of this study as rather than relying on administrative datasets with potentially inaccurate rates of nursing-sensitive adverse events (Connolly *et al.*, 2025), the rates in this study were identified by chart reviewers who adhered to a structured protocol and received training from a chart review expert.

Although the large number of reviewed charts is a methodological strength of this study, the relatively rare outcome occurrence may limit the predictive ability and strength of the power of the study. A limitation of retrospective chart data, which must be considered in relation to these findings, includes the underreporting of delirium (Titlestad *et al.*, 2024) however, all efforts were made to capture both confirmed and unconfirmed delirium. The relatively weak evidence of association between the predictor variables and the nursing-sensitive adverse events somewhat limits these findings. Nevertheless, the findings yielded statistical significance, therefore indicating that the variables investigated may contribute to nursing-sensitive adverse events. Furthermore, the univariate analyses demonstrate that many variables were considered statistically significant predictors of nursing-sensitive adverse events to some extent, with p-values of <0.25. Further research is warranted to explore the

weight of contribution that these factors have to the development of nursing-sensitive adverse events in older hospitalised patients.

The inclusion of only one hospital limits the generalisability of these findings. Including additional hospital models may have increased the applicability of these findings to other healthcare settings however, this was not possible due the limited labour resources available. A methodological consideration and limitation of this study is the potential collinearity among the variables indicating clinical complexity such as number of diagnoses and procedures and Elixhauser comorbidity score. The conceptual overlap of these variables and their potential correlation may reduce the precision of the multivariate logistic regression model (Ranganathan, Pramesh and Aggarwal, 2017). Furthermore, another limitation is the potential interrelation between the nursing-sensitive adverse events. Although separate event-specific mutlivariable models were used, as some patients experienced more than one adverse event, these outcomes may be interdependent and therefore limit the precision of the models.

5.7 Conclusion

This study demonstrates the association between various risk factors and nursing-sensitive adverse events. The findings offer valuable insights into reducing nursing-sensitive adverse events and their associated healthcare costs. Given the impact of nursing-sensitive adverse events on patient outcomes, their prevention is imperative. Investment in strategies focused on vulnerable populations such as medical patients, older patients, patients with multiple co-morbidities and those with longer lengths of stay is required. A focus on risk assessments, continuous monitoring of patients and allocation of resources and nursing care to those at most risk may be useful. However, nurse workforce planning and adequate nurse-patient ratio policies are pivotal to implementing such strategies. The development and implementation of care bundles aimed at preventing multiple adverse events may also yield more positive patient outcomes. A focus on nursing-modifiable factors such as post-procedural care and care tailored to the needs of medical patients and transfer patients is also required to reduce nursing-sensitive adverse events. Additionally, funding and workforce planning policies are required to meet the care demands of the ageing population who are particularly vulnerable to nursing-sensitive adverse events.

5.8 Transition between predictions paper and missed nursing care survey paper

The chart review results presented in the previous chapters highlight the rates of adverse events and the burden that hospital-acquired cases of pneumonia, urinary tract infections, pressure ulcers and delirium have on older patients in Ireland and on the Irish health service. The development of nursing-sensitive adverse events is often attributable to missed nursing care or care that is left undone. Therefore, it seemed appropriate to include the aim of measuring missed care and understanding the frequency at which it occurs in the participating hospital where the chart review was conducted and where the rates of adverse events were identified.

The significant rates of adverse events identified in the previous chapter indicate that missed nursing care may be a potentially significant issue in acute hospital settings. Given the association between missed nursing care and the occurrence of nursing-sensitive adverse events, and the well-recognised challenges in relation to nurse shortages in Irish healthcare settings, an important objective of this research was to understand and measure the delivery of fundamental care in an acute hospital setting in Ireland. In order to understand the extent to which fundamental care is delivered, both nurses' and patients' perspectives of missed nursing was measured using the MISSCARE surveys.

A clear association between missed nursing care and the Fundamentals of Care research lines has been demonstrated in previous research with efforts made to measure the delivery of fundamental care using the MISSCARE Survey. The study presented in the following chapter sought to build upon this previous research by applying both the nurse-reported and patient-reported MISSCARE Survey tools to all aspects of the Fundamentals of Care Framework.

Whilst most previous research has focused on measuring missed nursing care from the nurses' perspectives, this study sought to recognise the importance of the patient voice by measuring both nurses' and patients perspectives. Although nurses are evidently instrumental in the provision and delivery of care, missed nursing care is ultimately experienced by patients. Therefore, as experts based on their first-hand experience of care, listening and responding to the patient voice was considered essential in this research.

Consideration and inclusion of the patient's perspective does not seek to diminish the value of nurses' contribution to this research on missed nursing care. As frontline workers who have first-hand experience of the pressures associated with working in acute hospital settings

and in environments which are often challenged by short staffing of nurses and high levels of demand for patient care, the nurse perspective carries significant meaning. In addition to providing information in relation to the frequency of missed care, the survey component of this research was considered valuable as it offered nurses the opportunity to voice their opinions on the factors that contribute to missed nursing care. This was considered to be an important part of this research as the findings may contribute to the development of strategies to improve working conditions and reduce nursing-sensitive adverse events in acute hospital settings in Ireland.

Chapter 6 : Publication 4 - Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework: A cross-sectional survey

The work presented on pages 166-194 of this chapter has been published the International Journal of Nursing Studies Advances.

Connolly A., Matthews A. and Kirwan M. (2025) 'Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework: A cross-sectional survey', *International Journal of Nursing Studies Advances*, 9(100452), doi: 10.1016/j.ijnsa.2025.100452

Pages 162-165 of this chapter contain a signed declaration verifying the author contribution to the research presented.

As per DCU guidelines, due to copyright issues across different publishers, the PDF copies of the published articles in their final journal format cannot be included in the PhD thesis therefore, all published work must appear in manuscript format. The content presented in the thesis is correspondent with the content of the published papers, with the exception of minor variations due to formatting.

6.1 Signed declaration verifying author contributions

Section 1: Candidate's Details	
Candidate's Name	Anna Connolly
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School	School of Nursing, Psychotherapy and Community Health
Principal Supervisor	Dr. Marcia Kirwan
Title of PhD by Publication Thesis	Nursing-sensitive adverse events and missed nursing care in older hospitalised patients
Section 2: Paper Details	
Title of co-authored paper included in the thesis under examination	Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework: A cross-sectional survey
List of authors as in order given on accepted/published version	Connolly A., Matthews A. and Kirwan M.
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Provide a brief statement here on the disciplinary ranking of this publication and the peer-review process involved (e.g. how many reviewers, single blinded or other, initial decision, revision timeline etc and any other details that speak to the rigour of the peer review process)	The International Journal of Nursing Studies Advances is a double-blinded, peer-reviewed journal. The article was originally submitted in on the 26th May 2025 and an invitation to revise the manuscript was given on the 16th July 2025 following the review of the manuscript by three reviewers. The article was revised and resubmitted on the 15th of August 2025 with an expression of interest in publishing given on the 14th October 2025, subject to further revisions based on the comments of two reviewers. A further revised manuscript was submitted on the 3rd November 2025 before being accepted for publication on the 10th of November 2025.

This paper (Chapter 6) is one of four co-authored papers to be submitted as part of the PhD by publication thesis submitted for examination.

Section 3: Candidate's Contribution to the Paper

Provide details below of the **nature** and **extent of your contribution** to the paper (include both your intellectual and practical contributions) and your overall contribution in **percentage terms**. Note that these categories can be customised according to disciplinary norms

The nature and extent of my contribution is outlined below. My overall percentage contribution to the paper was 90%.

Briefly outline your contribution to the **conception** of the work described in this paper:

My supervisors, who are also co-authors of this paper, led the conceptualisation phase of this study and I contributed to the conception of the work by working closely with my supervisors, co-authors to define the study objectives and to identify a theoretical framework to be used to guide the research. Furthermore, my review of the literature identified research gaps and therefore allowed me to further contribute to the conception of this study by identifying ways in which this study could contribute to the current missed nursing care and fundamentals of care framework research lines.

Briefly outline your contribution to the **literature review** in this paper:

I conducted a review of the literature pertaining to the content presented in this chapter. Following my review of the literature, I wrote the background/introduction section and the discussion sections, which were then reviewed by my supervisors and co-authors.

Briefly outline your contribution to the **methodological design**:

The methodological design used to conduct this research was largely developed by my principal supervisor. As this PhD is embedded within a wider project, the decision relating to the use of the MISSCARE Survey instruments was decided on in advance of my membership on the research team. However, I contributed to the methodological design of the surveys as alongside my supervisor and the nurses from the participating hospital, I amended the surveys for use in an Irish context and for the context of the participating hospital. Furthermore, I contributed to the methodological design by working closely with my supervisors and the participating hospital to develop an appropriate strategy for recruiting both nurses and patients to participate in the surveys. I also contributed to the methodological design by conducting a review of the previous literature to identify the best methods of analysis for the nurse and patient surveys and for using the MISSCARE Surveys to measure the elements of care outlined in the Fundamentals of Care framework.

Briefly outline your contribution to **data collection**:

I contributed to data collection as I was based on site in the participating hospital throughout the duration of the data collection period. I maintained a presence on the wards within the hospital and spoke with staff nurses and nurse managers each day in relation to their participation in the survey. Furthermore, although the patients were invited to complete the survey independently, many required help with reading and writing and requested my help in their completion of the surveys. Therefore, I contributed to the collection of the data by being present on the wards everyday to sit with patients and assist them with their completion of the survey.

Briefly outline your contribution to **data analysis**:

I conducted the analysis of the data collected using Excel and SPSS and my supervisors and co-authors reviewed the analysed data and provided me with feedback. My supervisors and co-authors and I worked closely together to carry out the analysis used to measure the elements of care within the Fundamentals of Care Framework. I initially independently mapped the surveys onto the framework and then worked alongside my supervisors to review their mapping of the surveys and the framework components. We worked closely together to ensure that our mapping of the elements aligned and that we reached a consensus in relation to the coverage of the framework using the surveys.

Briefly outline your contribution to the **synthesis and summary of findings**:

I synthesised and summarised the findings under the supervision of my co-authors. I wrote the results, discussion and conclusion sections of the manuscript, which were then reviewed by my co-authors and revised in accordance with their comments and feedback.

Finally, outline your contribution to the **writing** and **revision** of the paper:

I wrote the original manuscript and revised the content as per the feedback and comments from my co-authors and supervisors. Furthermore, I also revised the paper as per the comments from the peer-reviewers and sought approval of these revisions from my co-authors.

Section 4: Signature and Validation

I confirm that the following statements are true:

(a) the information I have provided in this form is correct
(b) this paper is based on research undertaken during my candidature at DCU

Signature of PhD Candidate: Anna Connolly **Date:** 25/05/2026

I confirm that the information provided by the candidate is correct:

Signature of Principal Supervisor: Marcia Kirwan **Date:** 25/05/2026

In some cases, it may be appropriate for verification to be given by both the principal supervisor **and** the lead/corresponding author of the work (where the lead/corresponding author of the work is not the candidate or the principal supervisor):

Signature of Lead/Corresponding Author: Anna Connolly **Date:** 25/05/2026

Nature of Current Post/Responsibilities: PhD Candidate

Home institution: Dublin City University

6.2 Abstract

Background

The Fundamentals of Care Framework outlines the core dimensions involved in delivering essential nursing care. Resource shortages and increased care demands compromise fundamental care delivery and contribute to missed nursing care. This impacts quality and safety within healthcare settings but is disproportionately experienced by older patients, therefore both nurse and patient voices must be heard.

Objectives

To individually explore both nurse-reported and patient-reported perceptions of the frequency of missed nursing care. This research also aimed to estimate the factors that contribute to missed nursing care from nurses' perspectives and to identify to what extent the *MISSCARE* instruments can represent the elements within the Fundamentals of Care framework.

Design

A cross-sectional study using the *MISSCARE* instruments to elicit nurse and patient perspectives of missed nursing care.

Setting

A single large university, tertiary hospital in Ireland with over 800 beds.

Participants

Approximately 929 fully qualified nurses working in direct patient care and all patients aged 65 or older in 31 adult inpatient wards were invited to participate.

Methods

The *MISSCARE Survey* and *MISSCARE Survey-Patient* were used to collect data between April and July 2024. Nurses indicated the frequency of and contributing factors to missed nursing care. Communication, timeliness and basic nursing care delivery were measured from the patients' perspectives. The data were analysed using SPSS and mean scores were found for each care item. The items in the *MISSCARE* surveys were mapped to the elements in the Fundamentals of Care Framework.

Results

A total of 151 nurses and 145 patients participated. According to nurses, attending interdisciplinary care conferences, mobilisation and oral care were frequently missed. Patients reported that oral care, communication in relation to who their specific nurse was and mobilisation were frequently missed. The significant reasons for missed care included inadequate numbers of nursing staff and assistive personnel and urgent patient situations. The *MISSCARE Survey-Patient* demonstrated a higher percentage coverage (73.7 %) of the elements outlined within the Fundamentals of Care framework than the *MISSCARE Survey* (42.1 %).

Conclusions

This study reiterates the need to prioritise nurse recruitment and retention strategies and highlights areas which require attention to ensure the delivery of fundamental care. *The MISSCARE* surveys can measure the Fundamentals of Care Framework to a certain extent however, the development of a tool to directly measure all three framework dimensions is required. The development of a succinct tool to measure nurses' and patients' perspectives on missed nursing care is also required.

Keywords

Fundamentals of care; Healthcare quality; MISSCARE Survey; Missed nursing care; Nursing; Older patients; Patient-reported outcomes; Patient safety

Contribution of the paper

What is already known about the topic

- The *MISSCARE Survey* and *MISSCARE Survey-Patient* are validated instruments that are used to elicit nurse and patient-reported data on the frequency of and reasons for missed nursing care.
- Older patients are particularly vulnerable to and disproportionately affected by missed nursing care due to their complex care needs resulting from co-morbidities and emergency admissions.
- Nurse shortages, a lack of resources and increased care demands contribute to missed nursing care and may result in adverse outcome for patients.

What this paper adds

- Including both patient and nurse perspectives of missed nursing care is important in order to promote person-centred care.
- Inadequate staffing is a significant contributor to missed nursing care, therefore nurse recruitment and retention strategies must be prioritised for safe and high-quality fundamental care to be delivered to older patients.
- The *MISSCARE* surveys can measure the Fundamentals of Care Framework to a certain extent however, further research is warranted to develop a tool to directly measure all three framework dimensions.

6.3 Background

Nurses play an integral role in the healthcare system through the organisation and delivery of care and are pivotal in promoting health and preventing illness (World Health Organization, 2024a). Accounting for approximately 59 % of all health professionals (World Health Organization, 2024b), nurses make up the largest occupational group in the healthcare system (World Health Organization, 2020). However, the estimated 4.5 million nurse shortage by 2032 (Boniol *et al.*, 2022) is a challenge for healthcare systems worldwide. Nurse shortages, a lack of material resources, increased care demands and communication issues pose a threat to patient safety, a health priority which nurses contribute to by providing direct patient care (Phillips, Peck Malliaris and Bakerjian, 2021). These factors, coupled with issues relating to how fundamental care is valued within healthcare systems, can cause essential nursing care to be missed (Feo *et al.*, 2019). Missed care is associated with costly health outcomes, compromised dignity, unsatisfactory experiences for patients and families and overall challenges to patient safety and welfare (Feo and Kitson, 2016).

The Fundamentals of Care framework outlines the three core dimensions involved in delivering high-quality and safe fundamental nursing care (Kitson *et al.*, 2013) and provides a theory that can explain, guide and predict person-centred fundamental care (Kitson, 2018). The dimensions include a trusting nurse-patient relationship, the integration of care which ensures that patients' physical, psychosocial and relational care needs are met and finally, the context of care which comprises of contextual factors that act as system and policy level enablers (Kitson *et al.*, 2013).

There are currently no standardised measurement tools for tracking fundamental care (Kitson, 2018). However, identifying measurement tools has been highlighted as a research

priority for challenging the perception of fundamental care as "common sense" (Feo *et al.*, 2019, p. 82) and embedding a perception where the complexity of delivering high-quality fundamental care is recognised. Monitoring a patient's fundamental care requirements and identifying areas where their needs have not been met could act as an early warning system to trigger a follow-up on patients' care plans to ensure that they receive adequate care. Palese et al. (2021) explored the extent to which validated missed nursing care measurement tools can detect the elements within the Integration of Care dimension of the Fundamentals of Care framework. They identified a synergy between the framework and missed nursing care research lines and highlighted the potential of using missed nursing care tools to gather Fundamentals of Care framework metrics.

6.3.1 Missed nursing care model

Missed nursing care or care left undone refers to the regular omission or delay of required nursing care (Kalisch, Landstrom and Hinshaw, 2009). Missed nursing care is underpinned by frequently missed care tasks such as ambulation, feedings, patient education, discharge planning, emotional support, hygiene, intake and output documentation and patient monitoring (Kalisch, 2006). The Missed Nursing Care Model (Kalisch, Landstrom and Hinshaw, 2009) demonstrates how the demand for patient care, labour resources, material resources and communication interact with nursing processes such as assessments, planning, interventions and evaluation and are filtered by nurse's internal processes such as group norms, priority decision making, internal beliefs and values and habits. The model outlines how the relationship between each of these attribute categories contributes to missed nursing care and highlights the impact of missed care on patient outcomes.

Use of the *MISSCARE Survey* has identified that fundamental nursing care activities are frequently missed (Du *et al.*, 2020; Nahasaram, Ramoo and Lee, 2021). Growing reports of poorly executed Fundamentals of Care tasks, such as nutrition, hygiene, toileting and mobilisation (Feo and Kitson, 2016) which mirror the most frequently missed tasks in missed nursing care studies (Bagnasco *et al.*, 2020) demonstrate the interrelation between the Missed Nursing Care Model and the Fundamentals of Care framework.

Although the *MISSCARE Survey* has been used to measure the Fundamentals of Care framework (Palese, Longhini and Danielis, 2021), the patient-reported tool has not been investigated in this context. Therefore, this study aimed to identify if the *MISSCARE Survey* and *MISSCARE Survey-Patient* can represent the elements outlined in the

Fundamentals of Care framework. Furthermore, previous research only sought to measure the Integration of Care dimension of the framework (Palese, Longhini and Danielis, 2021) whereas this study explored the application of the *MISSCARE* measurement tools to all three framework dimensions.

Understanding and identifying missed nursing care in acute hospital settings allows for more targeted interventions to improve nursing care and ensure that fundamental care needs are met (Gallione *et al.*, 2024). Furthermore, considering both nurses' and patients' perspectives is pivotal to providing interventions that promote person-centred care and align with the principles of the Fundamentals of Care framework (Kitson *et al.*, 2013; Kitson, 2018).

6.3.2 Evidence of missed nursing care from nurses' and patients' perspectives

Missed nursing care is commonly explored from the nurse perspective (Chiappinotto *et al.*, 2022) with previous studies reporting care left undone on 45.3 % of shifts in adult acute wards and 46 % of shifts in older people's wards (Senek *et al.*, 2020). Furthermore, the prevalence of missed care across all nursing care elements ranges from 6.8 % to 98.1 % (Gong *et al.*, 2025). Previous applications of the *MISSCARE Survey* (Kalisch and Williams, 2009; Dabney, Kalisch and Clark, 2019) identified turning, bathing, ambulation, emotional support and mouth care as frequently missed care activities (Cho *et al.*, 2020). Additionally, mobilisation, assessing the effectiveness of medication (Gurková, Šinglárová and Žiaková, 2024), attending interdisciplinary conferences and documentation are also frequently missed (Mainz *et al.*, 2024).

Inadequate staffing, patient acuity, heavy admission and discharge activity, and urgent patient situations have previously been identified as significant reasons for missed nursing care (Mainz *et al.*, 2024). Similarly, labour resources have been reported to significantly contribute to missed nursing care (Moreno-Monsiváis, Moreno-Rodríguez and Interial-Guzmán, 2015; Zelenikova, Gurkova and Jarosova, 2019). This demonstrates the association between inadequate labour resources, high demand for complex care and increased levels of missed nursing care (Cartaxo *et al.*, 2024) and therefore highlights nurse staffing interventions as a priority for reducing missed nursing care.

Older patients, aged 65 and older, are vulnerable to missed care given their higher prevalence of co-morbidities and requirement of more complex nursing care (Merten *et al.*, 2013). Older patients have a higher risk of developing complications and are more vulnerable to the consequences of care rationing (Bail and Grealish, 2016). Furthermore, frailty, which is

common in older patients, with prevalence rates ranging from 48.8 % to 80 % (Rezaei-Shahsavarloo *et al.*, 2020) is associated with missed care (Rezaei-Shahsavarloo *et al.*, 2021).

Previous research using the *MISSCARE Survey-Patient* by Kalisch, Xie and Dabney (2014) found that patients reported more missed nursing care in the basic care domain than in the communication or timeliness domains. Frequently reported missed care items include mouth care, ambulation, assistance getting out of bed and into a chair, provision of information about tests and procedures and bathing. Ambulation is the most frequently omitted basic care task with 18.8 % of patients reporting that they never received help with ambulation (Gurková, Šinglárová and Žiaková, 2024). Additionally, Sarpong et al. (2025) identified most missed care in the basic care domain, and highlighted the consideration of patients' opinions as frequently missed. The communication domain has also received high mean subscale score with information regarding the assigned nurse reported as frequently missed (Cohen, Drach-Zahavy and Srulovici, 2024; Gurková, Šinglárová and Žiaková, 2024). Furthermore, the most frequently patient-reported adverse events are IV-related problems, skin breakdowns, hospital-acquired infections and falls (Kalisch, Xie and Dabney, 2014; Gurková, Šinglárová and Žiaková, 2024; Sarpong *et al.*, 2025).

6.3.3 Aim of this study

This is the first study in Ireland to explore both patients' and nurses' perceptions of missed nursing care, to our knowledge. Previous literature has focused on nurse perceptions of missed care with only three other studies investigating both patient and nurse perspectives (Moreno-Monsiváis, Moreno-Rodríguez and Interial-Guzmán, 2015; Cohen, Drach-Zahavy and Srulovici, 2024; Gurková, Šinglárová and Žiaková, 2024). The importance of considering the patient's perspective is evident (Bagnasco *et al.*, 2020; Chiappinotto *et al.*, 2022; Chiappinotto, Coppe and Palese, 2023), therefore this study aims to individually explore and provide a narrative description of both nurse-reported and patient-reported perceptions of the frequency of missed nursing care, and estimate the factors that contribute to missed nursing care from the nurse perspective in an Irish hospital setting.

6.4 Methods

6.4.1 Design, setting and participants

This quantitative research utilised a cross-sectional study design to elicit both patient and nurse perspectives of missed nursing care in an acute hospital setting. The study was conducted in a single large university, tertiary hospital in Ireland with over 800 beds.

All fully qualified nurses employed across 31 adult inpatient surgical, medical and mixed surgical-medical wards were invited to participate. Student nurses, healthcare assistants and nurses employed in outpatient settings or nurses without direct patient care were excluded.

Patients aged 65 or older admitted into the same wards from which the nurses were recruited were eligible for inclusion. In order to capture an informed evaluation of care received, only patients with a minimum length of stay of three days were eligible for participation. Patients were required to be alert, oriented and cognitively capable of communicating, understanding and consenting to participate. This was established with the support of the nurse managers who identified eligible patients. Although the gatekeeping role of the nurse manager may have increased the risk of purposely excluding patients with negative perspectives, cognitive functioning can effect participants' understanding of survey questions and instructions and their ability to provide accurate information (Kutschar, Weichbold and Osterbrink, 2019) therefore, patients with declined cognitive functioning were not eligible for participation.

Nurses and patients were invited to participate via online and paper-based surveys between April 2024 and July 2024. Both the patient and nurse surveys could be accessed via QR codes which were printed on posters and information cards that were distributed across the hospital and within participating wards. Paper-based questionnaires, envelopes and sealed survey-return boxes were distributed to each participating ward.

6.4.2 Survey instruments

The *MISSCARE Survey* (Dabney, Kalisch and Clark, 2019) and *MISSCARE Survey-Patient* (Kalisch, Xie and Dabney, 2014) were used to elicit nurse and patient perceptions of missed nursing care (appendices D and E). The nurse questionnaire included a demographic information section followed by two sections exploring perceptions of missed nursing care. In Part A, nurses were asked to identify, using a five-point Likert scale (1-never missed, 2-rarely missed, 3-occasionally missed, 4-frequently missed, 5-always missed), how often 18 specific nursing care items were left undone on their unit. The *MISSCARE Survey* which was

provided to the researchers by Dr. Beatrice Kalisch included a 'not applicable' option for Part A and was therefore retained as an option in the instrument used in this study. Part B consisted of 19 reasons for missed nursing care which were grouped into three subscales – communication, labour resources and material resources (Dabney, Kalisch and Clark, 2019; Zelenikova, Gurkova and Jarosova, 2019). Nurses were asked to assess the contribution of each reason to missed nursing care using a four-point Likert scale (1 = no contribution, 2 = minor contribution, 3 = moderate contribution, 4 = significant contribution). The survey instrument was also amended to include two additional questions relating to quality and safety. Nurses were asked to rate the overall quality of nursing care and grade the level of patient safety on their units.

The patient questionnaire included three sections. Firstly, patients were asked to identify to what extent various nursing care items were provided to them during their hospitalisation. A five-point Likert scale was used to measure items in the communication and basic care subscales (1 = never provided, 2 = rarely provided, 3 = sometimes provided, 4 = usually provided, and 5 = always provided). These questions were reverse coded, therefore higher scores indicated more missed nursing care. A five-point Likert scale was also used to measure items in the timeliness subscale (1 = <5 min, 2 = 5–10 min, 3 = 11–20 min, 4 = 21–30 min, 5 = >30 min) (Kalisch, Xie and Dabney, 2014). The items were grouped into subscales (basic care, communication and timeliness) based on a 3-factor solution which emerged from an exploratory factor analysis conducted by Kalisch, Xie and Dabney (2014). Five additional questions relating to elements of nursing care were not included in these subscales and have been reported on separately. In the second section, patients were asked to identify whether they had experienced an adverse event, and the final section included demographic questions.

In addition to nurse and patients characteristics, the surveys addressed aspects of care such as eating and drinking, medication management, personal cleaning and dressing, toileting, safety, comfort and mobility. Nurses' and patients' overall rating of nursing care and perceptions of the frequency of missed nursing care were addressed via the surveys in addition to the reasons for missed nursing care according to nurses and patient-reported experiences of adverse events.

6.4.3 Data collection

Nurse recruitment was supported by the nursing executive, directorate nurse managers, clinical nurse managers and a clinical facilitator from the participating hospital. The support of the management in each ward facilitated the patient recruitment process. Permission was granted from the Director of Nursing to distribute recruitment posters and information cards to included wards, break rooms, changing rooms and other pertinent areas within the hospital. Permission was also granted for a researcher to be present on the wards to provide participation information. Furthermore, recruitment information was distributed via email to eligible nurses. Nurses had the option of accessing the survey online or completing a paper survey and returning it via the sealed survey-return boxes.

Permission was granted for patient recruitment posters and information cards to be distributed on the wards and throughout the hospital. Interested patients could access the survey via a QR code or could request a paper-based survey via the contact information on the posters. Paper-based surveys were distributed on the wards to interested patients. Additionally, permission was sought for the researcher to be present on the ward and to ask nurse managers for their support in identifying eligible patients and inviting them to participate. Similar to previous research by Kalisch, Xie and Dabney (2014) using the *MISSCARE Survey-Patient*, patients could fill out the survey themselves or if they had difficulty reading or writing, the researcher could read the questions to them and mark their answers.

6.4.4. Data analysis

After data cleaning, the data were analysed using IBM SPSS Statistics version 29. Descriptive statistics were used for data analysis. Frequencies were used to determine whether patients perceived each nursing care task as missed or not and the arithmetic mean, and standard deviation were used to summarise the data.

In part A of the *MISSCARE Survey*, nurses indicated the frequency of and contributing factors to missed nursing care. The mean missed nursing care score for each item and a mean overall score for missed care was calculated. In part B, an overall mean score for the factors that contribute to missed nursing care was calculated. Higher scores indicated more missed nursing care and more significant reasons for missed care. In line with Kalisch et al. (2021), the non-applicable responses in part A were treated as missing data and were excluded with the mean scores for each missed care task calculated from the nurses who provided responses

ranging from “never missed” to “always missed”. In order to analyse the frequency of missed nursing care and to report percentages of missed nursing care, the items in part A and part B were transformed into dichotomous variables as per the instructions for use of the survey (Kalisch *et al.*, 2011; Kalisch, Xie and Dabney, 2014). In line with previous applications of the *MISSCARE Survey* (Kalisch *et al.*, 2011), items in part A were considered missed if they were reported as occasionally, frequently or always missed and not missed if they were reported as rarely or never missed. Similarly, and as demonstrated by (Gallione *et al.*, 2024), the items in part B were also considered dichotomously. Reasons that were reported to have a significant or moderate contribution to missed nursing care were considered significant and reasons reported to have a minor or no contribution were considered as non-significant reasons.

Communication, timeliness, and basic nursing care delivery were also measured from the patients' perspectives. An overall mean score for missed nursing care for each of these subscales according to the patient perspective was calculated, again with higher scores indicating more missed care. As demonstrated by Kalisch, Xie and Dabney (2014), the items in the *MISSCARE Survey-Patient* were also considered dichotomously in line with part A of the nurse questionnaire. The responses ‘never’, ‘rarely’ and ‘sometimes’ were considered as missed and the responses ‘usually’ and ‘always’ were considered not missed (Sarpong *et al.*, 2025). Patients were also asked to report whether they had experienced specific adverse events using the responses ‘yes’, ‘no’ or ‘unsure’. In line with analysis methods used by Sarpong et al. (2025), the ‘unsure’ responses were excluded during data analysis.

Furthermore, the items measured in the MISSCARE surveys were mapped to the elements in the Fundamentals of Care Framework. In order to understand the extent to which the *MISSCARE* instruments can be applied to the Fundamentals of Care framework, the elements outlined within the framework and the surveys were considered and a comparative analysis was conducted. The elements in the framework were extracted and presented in a tabular format (Table 6.9). The items measured within the *MISSCARE Survey* and *MISSCARE Survey-Patient* were also extracted, analysed and presented within the table to demonstrate their correspondence to the elements in the framework. The elements within the framework were considered in line with the definitions provided by Kitson et al. (2013). This process was conducted by one researcher and reviewed by two senior members of the research team. Consensus was reached in relation to the correspondence of the items and in line with previous research from Palese et al. (2021), a

scoring system was used to conduct a quantitative assessment of coverage to demonstrate the percentage of each of the dimensions of the Fundamentals of Care Framework which is covered by *the MISSCARE Survey* tool and the *MISSCARE Survey-Patient* tool. A score of 0 was given when there was no correspondence and a score of 1 was given for each survey item which corresponded with an element of the Fundamentals of Care Framework.

6.4.5 Ethical considerations

Ethical approval was obtained from the Dublin City University Research Ethics Committee and the participating hospital's Institutional Review Board. The study was conducted in accordance with the Declaration of Helsinki (World Medical Association, 2018). Approval was sought from the Director of Nursing and the nursing executive in the participating hospital to approach nurse managers on the wards and ask their permission to access both nurses and patients and invite them to participate in the surveys. All interested participants were provided with information regarding the study and informed that the surveys were voluntary. Informed consent was implied when the surveys were completed and returned. Nurse managers also granted permission at ward level for nurses to complete the questionnaire whilst on shift.

6.5 Results

6.5.1 Participants

A total of 151 nurses and 145 patients met the inclusion criteria, completed and submitted a questionnaire.

Methodological considerations

Although it is unclear how many nurses were reached via the recruitment advertisements and invited to participate, there were approximately 929 nurses who were eligible to participate. The response rate was 16.3 % with 151 nurses completing and submitting the survey. It was not possible to calculate a response rate for the patient survey as the number of patients who met the inclusion criteria was unclear due to patient level variation across the study period. Also, as recruitment advertisements were placed around the hospital, it is unclear how many potential participants were reached. According to the healthcare pricing office, approximately 6500 patients were admitted to the participating hospital that year however the exact number of inpatients at the time of data collection is unknown. The maximum margin of error recommended in survey research is 10 %, and when considering

a population of 1000 and 10,000, a minimum sample of 88 and 96, respectively, is required (Serdar *et al.*, 2021), therefore a minimum of 100 patient participants was considered appropriate.

The characteristics of the nurse and patient participants are reported in Tables 6.1 and 6.2, respectively.

Table 6.1 Nurse characteristics

Nurse Characteristics	
Gender, *n* (%)	
Male	21 (14.0%)
Female	129 (86.0%)
Age, mean (SD)	37.69 (9.840)
Job title/role, *n* (%)	
Staff nurse (RN)	117 (78.0%)
Nurse Manager/Senior role	33 (22.0%)
Received nursing education in Ireland, *n (%)*	
Yes	45 (30.0%)
No	105 (70.0%)
Baccalaureate (level 8) degree in nursing, *n (%)*	
Yes	130 (87.8%)
No	18 (12.2%)
Unit Worked on, *n (%)*	
Surgical	16 (10.6%)
Medical	64 (42.4%)
Mixed Medical/Surgical	12 (7.9%)
A&E	2 (1.3%)
Critical Care	27 (17.9%)
Other	30 (19.9%)
Experience, *mean (SD)*	
Years worked as a registered nurse in career	13.64 (9.84)
Job satisfaction, *n (%)*	
Very dissatisfied	13 (8.8%)
A little dissatisfied	13 (8.8%)
Moderately satisfied	41 (27.9%)
Very satisfied	80 (54.4%)

Table 6.2 Patient characteristics

Patient Characteristics	
Gender, *n (%)*	
Male	96 (68.1%)
Female	45 (31.9%)
Age, mean (SD)	75.11 (6.822)
Unit, *n (%)*	
Surgical	30 (22.60%)
Medical	66 (49.6%)
Mixed Medical/Surgical	14 (10.5%)
Critical Care	1 (1.5%)
Other	21 (15.8%)
Days in hospital, mean (range)	23.99 (3-300)
Previous hospitalisation, *n (%)*	
Yes	129 (92.1%)
No	11 (7.9%)
Self-reported rating of overall health, *n (%)*	
Poor	15 (10.8%)
Fair	38 (27.3%)
Good	58 (41.7%)
Very Good	18 (12.9%)
Excellent	10 (7.2%)

Furthermore, data pertaining to the number of nurses and healthcare assistants who provided care, the number of patients cared for, the number of admissions and discharges and the number of patient emergencies on the wards within which the nurses who participated in the survey worked are presented in Table 6.3.

Table 6.3 The number of nurses and healthcare assistants who provided care, the number of patients cared for, the number of admissions and discharges and the number of patients emergencies on the wards within which the nurse participants work

	n	Minimum	Maximum	Mean	SD
On your most recent shift how many patients in total were on your ward/unit?	149	4	35	21.19	9.097
Counting yourself, how many registered nurses in total provided direct patient care on your unit/ward during the most recent shift you worked?	123	1	8	4.48	1.479
How many other nursing care staff (Healthcare assistants) in total provided	131	0	3	1.64	0.724

direct patient care on your unit/ ward during the most recent shift you worked?					
How many patient-admissions did you have on your most recent shift (i.e., includes transfers into the unit/ward)?	143	0	8	2.45	1.814
How many patient-discharges did you have on your most recent shift (i.e., includes transfers out of the unit/ward)?	126	0	4	1.65	1.195
How many patient emergencies did you have on your most recent shift (i.e., falls, deteriorating clinical condition of the patient, etc.)	142	0	4	1.10	1.061

6.5.2 Understanding nurse and patient-reported perceptions of missed nursing care

In order to understand both the nurse and patient-reported perceptions of the same items of missed nursing care, and to demonstrate their correspondence with the discrete elements of care outlined in the Fundamentals of Care framework, the results of the surveys are presented in Table 6.4 using the Fundamentals of Care framework headings.

Table 6.4 Nurse and patient perceptions of missed nursing care contextualised within the Fundamentals of Care Framework.

Fundamentals of Care Framework category	**Nurse**	**Missed**	**n**	**Patient**	**Missed**	**n**
Eating and drinking	Patients fed while food is still at the proper temperature*	34 %	144	Timely assistance with feeding **	0 %	22
	Setting up meals for patient who can feed themselves*	28.6 %	140			
Medication Management	Medications administered as scheduled and on time*	16.2 %	148	Correct medication given****	3.9 %	129
	PRN medications requests acted on within 15 min*	18.8 %	149	Medication given on time****	6.2 %	130
				Pain medication received promptly after request***	5.6 %	71

				Nursing staff checked back to see if the medication helped reduced pain**	36.5 %	74
Personal Cleansing and dressing	Bathing/showering*	24.8 %	149	Bathing/showering**	28.1 %	139
	Oral care*	41.5 %	147	Oral care**	64.4 %	135
Safety	IV/central line site care and assessments according to hospital policy*	15.6 %	147	IV or other line (central venous catheter, PICC line, or port) checked by nurses**	7.9 %	127
Toileting	Assist with toileting needs within 5 min of request*	30.4 %	148	Assisted with toileting within 5 min of request*****	22.2 %	54
Comfort	Response to call light is initiated within 5 min*	30.7 %	140	Response to call light within 5 min*****	13.6 %	110
				Help received within 5 min of call light being answered*****	14.8 %	108
Mobility	Mobilisation*	41.7 %	146	Nursing staff monitored/assisted with getting out of bed and into a chair**	26.9 %	130
				Nursing staff monitored/assisted with walking**	38.5 %	109
*The responses 'occasionally missed', 'frequently missed' or 'always missed' were considered missed and the responses 'rarely missed' or 'never missed' were considered not missed.						
**The responses 'never provided', 'rarely provided' and 'sometimes provided' were considered as missed and the responses 'usually provided' and 'always provided' were considered as not missed.						
***The responses '<5 min', '5–10 min' and '11–20 min' were considered as care that was not missed and was delivered promptly whereas the responses '21–30 min', '>30 min' and 'never received the pain medication' were considered as missed.						
****The response 'yes' was considered as not missed and the response 'no' was considered missed.						
*****The response '<5 min' was considered as care that was not missed and was delivered promptly whereas the responses '5–10 min' and '11–20 min', '21–30 min' and '>30 min' were considered as missed or delayed.						

6.5.3 Overall rating of nursing care, staffing and safety

The overall rating of nursing care was considered dichotomously (poor-fair and good-excellent). The nurses were asked to rate the overall nursing care using a four-point Likert

scale (1 = poor, 2 = fair, 3 = good, and 5 = excellent) and the patients were asked to rate their nursing care using a five-point Likert scale (1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent). The majority of both nurses (85.9 %) and patients (97.9 %) reported that overall nursing care was good-excellent. A total of 13.4 % of nurses perceived nurse staffing adequacy 100 % of the time and 29.5 % of nurses rated the patient safety grading on their ward as excellent.

6.5.4 Nurse perceptions of the frequency of missed nursing care

The mean missed nursing care scores for each item is presented in Table 6.5. The overall mean score falls between 'never missed' and 'rarely missed', indicating that nurses reported a low incidence of missed nursing care. Attending interdisciplinary care conferences followed by mobilisation and oral care were most frequently missed.

Table 6.5 Mean scores indicating the frequency of missed nursing care according to nurses' perceptions.

Nurse perceptions of the frequency of missed nursing care		
Items	**Mean**	**SD**
Assessment		
Full documentation of all care provided	2.06	1.05
IV/central line site care and assessments according to hospital policy	1.65	0.87
Monitoring intake/output	1.89	0.93
Assessment of vital signs	1.43	0.68
Glucose monitoring as ordered	1.46	0.72
Adequate surveillance of cognitively impaired patients	1.97	0.98
Interventions – Individual Needs		
PRN medications requests acted on within 15 min	1.82	0.94
Medications administered as scheduled and on time	1.68	0.83
Assist with toileting needs within 5 min of request	2.07	1.06
Response to call light is initiated within 5 min	2.09	1.08
Interventions – Basic Care		
Mobilisation	2.47	2.47
Pressure relieving interventions	2.11	1.04
Oral care	2.29	1.09
Feeding patients while food is still at the proper temperature	2.17	1.04
Setting up meals for patient who can feed themselves	1.99	1.07
Bathing/showering	1.99	0.98
Skin/wound care	1.76	0.83
Planning		
Attend interdisciplinary care conferences when held	2.54	1.33
Mean score	1.97	.74
Note: A five-point Likert scale was used (1-never missed, 2-rarely missed, 3-occasionally missed, 4-frequently missed, 5-always missed).		

6.5.5 Nurse perceptions of the factors that influence missed nursing care

The reasons for missed nursing care are presented in Table 6.6. Overall, labour resources contributed most significantly to missed nursing care. Inadequate numbers of nursing staff and assistive personnel were identified as significant contributors to missed nursing care. A total of 87.2 % and 83.6 % of nurses, respectively, identified these as significant reasons for missed nursing care. Furthermore, 87.2 % of nurses highlighted that urgent patient situations significantly contribute to missed care (Fig. 6.1).

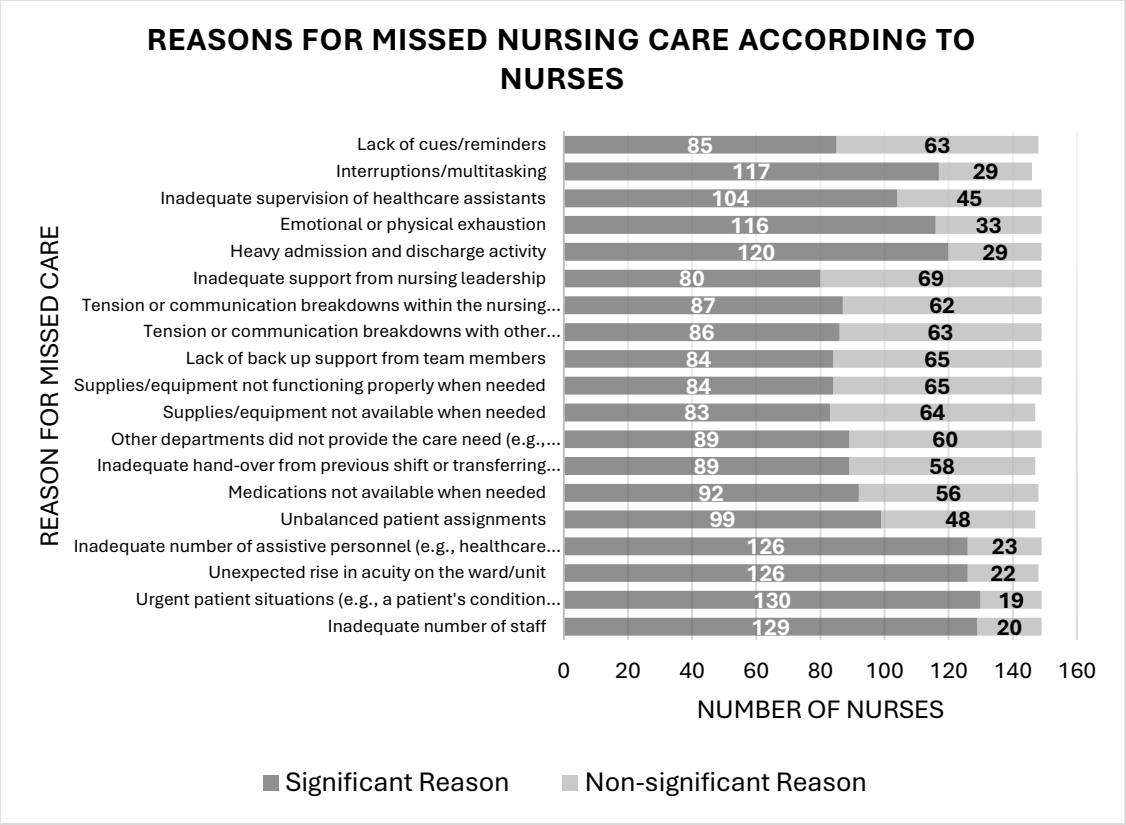


Figure 6.1 Reasons for Missed Care According to Nurses

Table 6.6 Mean score indicating the contribution of each reason to missed nursing care according to nurses' perceptions.

Reasons for missed care		
Items	**Mean**	**SD**
Communication		
Unbalanced patient assignments	2.91	0.97
Inadequate hand-over from previous shift or transferring ward/unit	2.73	0.95
Other departments did Not provide the care need (e.g., physiotherapy, occupational therapy, medical social work)	2.72	0.94
Lack of back up support from team members	2.71	1.01
Tension or communication breakdowns with other staff/departments	2.72	0.95
Tension or communication breakdowns within the nursing team or with the medical staff	2.77	0.98
Inadequate supervision of healthcare assistants	3	1.01
Mean score	2.80	0.78
Material Resources		
Medications Not available when needed	2.81	0.90
Supplies/equipment Not available when needed	2.74	0.92
Supplies/equipment Not functioning properly when needed	2.76	0.89
Mean score	2.77	0.81
Labour Resources		
Inadequate number of staff	3.47	0.79
Urgent patient situations (e.g., a patient's condition worsening, patient fall)	3.36	0.79
Unexpected rise in acuity on the ward/unit	3.30	0.81
Inadequate number of assistive personnel (e.g., healthcare assistants, etc.)	3.40	0.88
Heavy admission and discharge activity	3.25	0.86
Emotional or physical exhaustion	3.27	0.88
Interruptions/multitasking	3.29	0.91
Inadequate support from nursing leadership	2.67	1.07
Mean score	3.25	0.67
Note: A 4-point Likert scale was used. (1-no contribution, 2-minor contribution, 3-moderate contribution, 4-significant contribution).		

6.5.6 Patient perceptions of missed nursing care in the context of communication, timeliness and basic care delivery

The patients' perceptions of missed nursing care are presented in Table 6.7. The basic care subscale had the highest mean subscale score. The most frequently missed item in this domain was mouth care, followed by ambulation. The analysis of the individual items indicated that items within the communication domain were more frequently missed. Patient-reported experiences of adverse events are presented in Table 6.8.

Table 6.7 Mean scores indicating patients' perceptions of the frequency of missed nursing care.

Missed nursing care events from patients' perspective		
Items	**Mean**	**SD**

Communication		
Clear about assignment of specific nurse	2.68	1.71
Nursing staff discussed treatment	2.07	1.32
Nursing staff provided information about tests/procedures	2.17	1.42
Questions or concerns about care or illness listened to by nursing staff	1.43	0.94
Opinions relative to care considered by nursing staff	1.81	1.16
Mean score	2.062	0.92
Timeliness		
Time taken for nursing staff to respond to monitor or other machine beeping	1.45	0.93
Time taken for nursing staff to respond to call light	1.2	0.59
Time taken for nursing staff to provide help in response to the call light	1.19	0.53
Time taken for nursing staff to provide help to go to the bathroom	1.26	0.52
Mean score	1.33	0.71
Basic Care		
Mouth care	3.44	1.73
Bathing/shower care	1.97	1.44
Assistance to get out of bed and sit in a chair	2.03	1.47
Ambulation	2.37	1.62
Mean score	2.43	1.23
Notes: A five-point Likert scale was used to measure items in the communication and basic care subscales (1 = Always, 2 = Usually, 3 = Sometimes, 4 = Rarely, and 5 = Never).		

Table 6.8 Patient-reported experiences of adverse events and overall rating of nursing care.

Prevalence of adverse events			
Adverse events	**Yes *%***	**No *n (%)***	**Unsure *n (%)***
Fall	6.3 %	93 %	0.7 %1`
Pressure Ulcer	7.0 %	92.3 %	0.7 %
Medication error	3.6 %	89.2 %	7.2 %
Hospital-acquired infection	21 %	79 %	-
Problems with IV cannula	20.6 %	77.9 %	1.5 %

Table 6.9 Similarities between the items addressed within the missed nursing care model and the Fundamentals of Care Framework.

		MISSCARE Survey	**MISSCARE Survey-Patient**
Number of items/elements			
	Context of Care		
Policy Level	Financial issues	0	0
	Quality and Safety	3	8
	Governance issues	0	0
	Regulation and accreditation	0	0
	Percentage (%) of the policy level of the Context of Care dimension covered by tools' items	25.0	25.0

System Level	Resources	6	0
	Evaluation and feedback	0	0
	Leadership	1	0
	Culture	5	0
	Percentage (%) of the system level of the Context of Care dimension covered by tools' items	75.0	0.0
	Integration of Care		
Physical care recipient actions	Rest and sleep	0	0
	Personal cleansing and dressing	2	2
	Medication management	3	5
	Toileting needs	1	1
	Eating and drinking	2	1
	Comfort (comfort interventions such as pressure relieving, feeding, pain relief, hygiene, responses to patient requests)	10	12
	Safety	25	8
	Mobility	1	2
	Percentage (%) of the physical aspects of the Integration of Care dimension covered by tools' items	87.5.0	87.5
Psychosocial care recipient actions	Communication	5	6
	Being involved and informed	0	6
	Respect	0	2
	Education and information	0	5
	Having beliefs and values considered and respected	0	2
	Dignity	3	5
	Emotional wellbeing	0	2
	Privacy	0	0
	Percentage (%) of the psychosocial aspects of the Integration of Care dimension covered by tools' items	25.0	87.5
Relational caregiver actions	Being empathetic	0	2
	Helping care recipients to cope	0	7
	Engaging with care recipients	0	6
	Supporting and involving families and carers	0	0
	Working with care recipients to set goals	0	1
	Active listening	0	2
	Helping care recipients to stay calm	0	1
	Being compassionate	0	2
	Being present	0	6
	Percentage (%) of the relational aspects of the Integration of Care dimension covered by tools' items	0.0	88.9
	Relationship		

	Trust (provision of information, responding to patient requests)	3	8
	Focus (surveillance anticipation, detecting changes)	5	11
	Anticipate	6	11
	Know	0	2
	Evaluate	0	5
	Percentage (%) of the relationship dimension covered by tools' items	60.0	100.0
Total	Overall coverage percentage (%) of the three dimensions covered by tools' items	**42.1**	**73.7**

6.5.7 Mapping of the MISSCARE surveys to the elements in the Fundamentals of Care Framework

Based on an evaluation of the correspondence between the elements within the Fundamentals of Care framework and the *MISSCARE* survey instruments using Kitson et al.'s (2013) framework definitions, this research suggests that the *MISSCARE Survey* can almost fully measure the system level elements within the Context of Care dimension and the physical care recipient actions within the Integration of Care dimension. The policy level elements within the Context of Care dimension, the psychosocial care recipient actions within the Integration of Care dimension and the Relationship dimension are partially measured whilst the relational caregiver actions within the Integration of Care dimension are not directly measured. Overall, the *MISSCARE Survey* tool can measure approximately 42 % of the elements outlined within the Fundamentals of Care Framework.

The ability of the *MISSCARE Survey-Patient* to measure the Fundamentals of Care Framework was also evaluated. The physical care recipient actions, psychosocial care recipient actions and the relational caregiver actions within the Integration of Care dimension and the Relationship dimension are almost fully measured. The policy level elements within the Context of Care dimension are partially measured and the system level elements are not directly measured. Overall, the *MISSCARE Survey-Patient* can measure over 73 % of the elements outlined within the Fundamentals of Care Framework.

6.6 Discussion

This is the first study in Ireland to measure missed nursing care from both patients' and nurses' perspective using the *MISSCARE* surveys. Including both nurses' and patients' perspectives ensures that nursing care is person-centred and focused on patients' needs

(Bagnasco *et al.*, 2020). The results of this study suggest that nurses perceive a low incidence of missed nursing care with an overall low missed nursing care mean score. Similar to findings from Nahasaram et al. (2021), these results fall between the 'never' and 'rarely missed' categories. According to patients, basic care tasks were most frequently missed however, some items within the communication subscale received higher mean scores indicating that they are also frequently missed. The results demonstrate that, according to nurses, labour resources contribute significantly to missed nursing care. Additionally, the results demonstrate the extent to which the Fundamentals of Care Framework can be measured by the *MISSCARE* instruments.

6.6.1 Nurse perceptions of the frequency of missed nursing care

Previous research has also reported low mean scores of missed nursing care from the nurse perspective (Kalisch *et al.*, 2013; Cho *et al.*, 2015; Zelenikova, Gurkova and Jarosova, 2019; Gurková, Šinglárová and Žiaková, 2024). Furthermore, missed nursing care research from Turkey, Australia, the United States and Iceland identified an overall low occurrence of missed nursing care with a mean score indicating that care is missed rarely-occasionally, although the highest mean score for missed nursing care was found in Turkey with care being missed occasionally-frequently (Bragadóttir *et al.*, 2020). Although this study identified low rates of missed care, the association between labour resources and missed care demonstrates the importance of focusing on nurse retention strategies to ensure adequate staffing and prevent missed nursing care. The correlation between nurses' intention to leave and missed nursing care further emphasises the need to promote nurse retention. Workload, burnout, managerial support and job satisfaction are key areas which require consideration when developing retention strategies. In order to reduce missed nursing care and improve the sustainability of the nursing profession, targeted interventions that improve nurses' working conditions are required. Retention strategies that address staffing shortages, improve workloads and encourage managerial support are required (Azzellino *et al.*, 2025).

6.6.2 Nurse perceptions of the factors that contribute to missed nursing care

The results of this study reflect previous reports of shortfalls in labour resources significantly contributing to missed nursing care according to nurses (Zelenikova, Gurkova and Jarosova, 2019; Cartaxo *et al.*, 2024). Similarly, Mainz et al. (2024), Moreno-Monsiváis, Moreno-Rodríguez and Interial-Guzmán (2015) and Chiappinotto, Coppe and Palese (2023) found that inadequate staffing was perceived by both nurses and patients to be the most significant

reason for missed care. These results are consistent with previous literature relating to the global shortage of nurses within the healthcare workforce (World Health Organization, 2020). Lower nurse-to-patient ratios is associated with rationed nursing care and poor patient outcomes (Zhu *et al.*, 2019). In particular, the impact of staff shortages on nurses' ability to mobilise older hospitalised patients has been highlighted. This emphasises the need to recognise the harmful effects of poor nurse-to-patient ratios on mobilisation of older hospitalised patients (Lim *et al.*, 2020) and reiterates the need to establish effective nurse workforce planning processes, both in Ireland and globally, that focus on retaining experienced nurses and ensuring that nursing is seen as a valued and attractive profession (Morris, Matthews and Scott, 2019).

6.6.3 Patient perceptions of the frequency of missed nursing care

While nurses reported that care was never or rarely missed, patients reported that basic care and communication subscale items were only usually or sometimes delivered and highlighted frequently missed items such as oral care. This finding is in line with previous reports from both nurses' and patients' perspectives (Kalisch, Xie and Dabney, 2014; Cho *et al.*, 2020; Cohen, Drach-Zahavy and Srulovici, 2024; Gurková, Šinglárová and Žiaková, 2024; Sarpong *et al.*, 2025). Given the relationship between oral care and systemic conditions such as diabetes, cardiovascular disease and dementia (Kapila, 2021), and the generally poor oral health among older patients in Ireland (Sheehan, McGarrigle and O'Connell, 2017) and internationally (Gil-Montoya *et al.*, 2015), oral care must be prioritised in terms of a patient safety agenda. The adoption of oral care education programmes for both patients and nurses and the establishment of formal oral care protocols in addition to nurse managers support of implementing care standards are evidence-based solutions to improving oral care practices in hospital settings (Gallione *et al.*, 2024).

Mobilisation was also identified as a most frequently missed care task. Nurses often perceive mobilisation to be the responsibility of the physiotherapist and can lack confidence in their mobilisation skills and knowledge. However, given their daily provision of direct patient care, their role in promoting mobilisation of older patients is important. Investment from healthcare organisations in mobilisation education and training may empower nurses to take responsibility for mobilisation of older patients and improve patient outcomes (Constantin and Dahlke, 2018). A nurse-driven mobility protocol which proved effective in increasing out-of-bed episodes, improving patient mobility and reducing length of stay has been

developed by Li et al.(2025). Implementing a nurse-driven mobilisation protocol may offer an evidence-based solution to this issue and prevent the functional decline of older patients in acute hospitals. Additional evidence-based solutions to improve mobilisation and reduce missed care in general include ensuring adequate nurse-patient ratios, promoting adherence to guidelines and protocols, engaging nurses in missed nursing care issues by providing education and training and redesigning nursing documentation by developing time-efficient, smart electronic recording with reminder systems to prompt nurses to provide aspects of care such as mobilisation (Longhini *et al.*, 2021).

Similar to previous research, vital signs assessments and glucose monitoring were identified as aspects of patient care that were least frequently missed (Kalisch *et al.*, 2011). These elements of care may be missed less frequently than others given that it is more evident when they are not carried out. Routinely documented aspects of care may be less likely to be missed in comparison to tasks which are not routinely recorded in nursing documentation and therefore may be less likely to be noticed when missed. The routine auditing of aspects of care such as assessments of vital signs and glucose monitoring may also contribute to the lower frequency at which these items are left undone. Furthermore, these care tasks may be placed higher on the priority list and completed more promptly than care tasks such as ambulation, which are more time-consuming and may require additional members of staff (Kalisch *et al.*, 2011). These findings are in line with research relating to the Fundamentals of Care in clinical practice. According to Pene et al. (2025) nurse-patient interactions are often focused on completing tasks within the physical aspects of the Fundamentals of Care framework, with tasks relating to the relational and psychosocial aspects of care missed more frequently.

6.6.4 Using the MISSCARE surveys to measure both patient and nurses perspectives of missed nursing care

Few previous studies have reported on both nurse and patient perceptions of missed nursing care. As mentioned, differences between the items measured in the *MISSCARE Survey* and *MISSCARE Survey-Patient* limits the ability to make direct comparisons between nurse and patient perceptions of missed nursing care (Cohen, Drach-Zahavy and Srulovici, 2024). However, the *MISSCARE Survey* and *MISSCARE Survey-Patient* can be used to measure nurse and patient perspectives of the same phenomena in terms of the frequency of certain items of missed care (Table 6.1). Eliciting patients' and nurses'

perceptions has been identified as an important aspect of reporting missed nursing care (Bagnasco *et al.*, 2020). Therefore, future research should aim to include both viewpoints to respond effectively to nurses' and patients' needs. Again, to allow for a more direct comparison between patient and nurse perceptions of missed nursing care, the development of a tool to measure both perspectives is warranted.

The lack of statistically significant correlations between nurse-reported and patient-reported overall missed nursing care scores (Cohen, Drach-Zahavy and Srulovici, 2024; Gurková, Šinglárová and Žiaková, 2024) suggests that patients and nurses have differing perceptions of missed nursing care and emphasises the need to understand both perspectives (Bagnasco *et al.*, 2020). This lack of correlation may be attributable to the use of different survey instruments, the *MISSCARE Survey* and the *MISSCARE Survey-Patient*, which may measure different phenomena. However, Moreno-Monsiváis, Moreno-Rodríguez and Interial-Guzmán (2015) used the same *MISSCARE Survey* to measure missed nursing care from both patients' and nurses' perspectives and found no significant associations. This suggests that the lack of correlation is more likely to represent true differences between nurses' and patients' perspectives of missed nursing care.

There are several potential reasons for the differences between nurse and patient perspectives of missed nursing care. According to Gustaffson et al. (2020), differences may arise as patients may have difficulty distinguishing between nurses and other healthcare providers and their responsibilities. Also, patients' and nurses' recognition of care needs may not align and therefore may contribute to differences of opinions in relation to the extent to which care is provided. Furthermore, previous research has demonstrated that patients may not recognise all the care tasks for which nurses are responsible, given that they tend to recognise the more medical aspects of care such as medication surveillance (Kalisch, McLaughlin and Dabney, 2012). Differences pertaining to nurse and patient priorities may also contribute to the divergence between their perspectives of missed care. Patients appear to place higher value on the emotional and psychological aspects of care whereas nurses tend to place more emphasis on medical aspects of care (Bagnasco *et al.*, 2020).

6.6.5 Mapping the items measured in the MISSCARE to the elements in the Fundamentals of Care Framework

The results of this study demonstrate that some of the most frequently missed nursing care activities are addressed in the Fundamentals of Care framework. This highlights the overlap

between the Missed Nursing Care Model and the Fundamentals of Care framework and demonstrates the potential for the *MISSCARE* surveys to be used to measure certain elements of the Fundamentals of Care framework.

Similar to research conducted by Palese, Longhini and Danielis (2021), this study has highlighted the similarities and divergencies between the elements of care addressed in the Fundamentals of Care framework and in the *MISSCARE* surveys. As previously identified, the *MISSCARE Survey* directly measures most elements of care within the physical of the integration of care dimension. However, in contrast to previous research, this study sought to explore the application of both the *MISSCARE Survey* and *MISSCARE Survey-Patient* to all three dimensions of the Fundamentals of Care framework. As evident from this research, the *MISSCARE Survey* and the *MISSCARE Survey-Patient* can be used to a certain extent to measure certain elements outlined within the Fundamentals of care Framework. The *MISSCARE Survey-Patient* can be used to elicit patient perspectives on the physical, psychosocial and relational care actions in addition to the relationship between the nurse and patient which is a crucial component in the delivery of fundamental nursing care (Kitson *et al.*, 2013). This research demonstrates that the MISSCARE Survey-Patient provides a more comprehensive measurement of the Fundamentals of Care Framework than the *MISSCARE Survey* and therefore highlights the limitations of the use of the *MISSCARE Survey* to measure the delivery of fundamental care. Although this demonstrates some convergences between the Fundamentals of Care Framework and the Missed Nursing Care model, there are substantial coverage gaps, particularly within the *MISSCARE survey*, that highlight the demand for the development of a tool that can be used to directly measure all elements of the Fundamentals of Care Framework.

6.6.6 Strengths and limitations

The inclusion of only one hospital site is a limitation of this study. Another limitation, similarly noted by Mainz et al. (2024), was the high drop-off rate and the low response rate. Although the response rate was lower in comparison to the average response rates achieved in nursing research (L'Ecuyer *et al.*, 2023), comparable rates have been previously reported (Turunen *et al.*, 2013). Although many nurses accessed the questionnaire online, some did not complete the questionnaire to end. This may have contributed to potential response bias and the over or under-estimation of the frequency of and reasons for missed nursing care. Questionnaire completion fatigue due to frequent research participation invites has been

noted in nursing research with many nurses becoming disinterested in participating (White, 2012). Time limitations and high workloads, which are well-known barriers to recruiting nurses (Weierbach *et al.*, 2010), may also have contributed to the small sample size.

The inability to estimate a response rate due to the patient level variation across the study period is a limitation. Another limitation was the lack of a nested sampling strategy to link the patient and nurse responses such as the sampling method used by Cohen, Drach-Zahavy and Srulovici (2024). Although the nurses and patients were recruited concurrently from the same wards in the same hospital, allowing the same care period to be captured, the lack of a linked patient and nurse sample limited the ability to make direct comparisons between the nurse and patient perspectives of missed nursing care. Furthermore, using different survey tools to measure the nurse and patient perspectives limited the potential comparison of both viewpoints and contributed to the primarily descriptive aims of this research.

Although nurses were asked to identify the number of nurses, healthcare assistants, patients, admissions and discharges and the number of patients emergencies on their ward, analyses on these data were outside the scope of this study. Further exploration of these data would be of interest given the association between patient-nurse ratios and missed nursing care (Nantsupawat *et al.*, 2022) which demonstrates the potential impact that the number of nurses, healthcare assistants and patients in a ward may have on missed nursing care.

Although the Fundamentals of Care Framework is recognised as being representative of core nursing care, it has some limitations. The framework's definition of fundamental care has been perceived as being too general and overly idealistic in terms of nurses' work. Refinement of the framework to include additional clinical elements such as wound care and vital signs is an efficient solution to improve the applicability of the framework to clinical practice (Muntlin *et al.*, 2023). Similarly, this research identified that essential nursing care tasks such as pain management were addressed by the *MISSCARE* survey instruments but not considered directly in the Fundamentals of Care Framework. This reiterates the limitations of the Fundamentals of Care Framework and highlights the potential for its refinement.

Finally, the responses to the questions asked in the *MISSCARE Survey* are based on nurses' perceptions of missed care rather than their specific experience of carrying out nursing tasks, therefore the responses are influenced by nurses' beliefs, norms and habits.

A strength of this study was that the participating hospital was a university teaching hospital with a large population of nurses and patients. Furthermore, another strength was the collection of data from various departments and specialties. As using both virtual invites and face-to-face recruitment appeals is a recommended strategy of maximising nurse participation (Raymond *et al.*, 2018), both online and paper-based surveys were used. This was a strength of this study that helped to increase participation by ensuring that the questionnaires were easily accessible and appropriate for all ages and abilities. Although this research is not without limitations, the overall study confirms trends identified by international studies relating to the frequency of and reasons for missed nursing care.

6.6.7 Implications

These findings demonstrate the need to develop a tool to measure missed nursing care from both nurse and patient perspectives (Cohen, Drach-Zahavy and Srulovici, 2024). This will allow direct comparisons between both perspectives to be drawn and used to identify areas for improving patient safety and healthcare quality. Given the sample size and recruitment challenges, this research highlights the need to consider nurse workload in future measurement tool development. A more sustainable approach to measuring missed nursing care is necessary to elicit adequate response rates. A more succinct and concise measurement tool to consistently measure missed nursing care may be beneficial for identifying areas for improvement and evaluating improvement initiatives. In response to the requirement for a more concise measurement tool, The Situational Nursing Awareness Probe—Missed Nursing Care Edition was developed by Vexler et al. (2025). This tool assesses nurses' situational awareness of missed nursing care, however future research is required to develop a tool to measure and compare both nurse and patient perspectives of missed nursing care.

Finally, this study demonstrates the commonalities between the elements of care in the Fundamentals of Care Framework and the care items investigated through the *MISSCARE* instruments. While the *MISSCARE* instruments can be used to somewhat measure fundamental care delivery, in agreement with Kitson (2018), the development of a specific standardised tool to measure the Fundamentals of Care is warranted.

6.7 Conclusion

This study highlighted the most frequently reported missed nursing care items according to nurses and patients. While nurses are key for delivering high-quality and safe fundamental care, missed nursing care is experienced by patients therefore, including both perspectives

of missed nursing care is essential when developing interventions that promote person-centred care. According to patients and nurses, oral care and mobilisation are priority areas for ensuring that fundamental nursing care is delivered. The investigation of the reasons for missed nursing care echoes previous research and reiterates the need to prioritise nurse recruitment and retention strategies. This study also demonstrates the potential of the *MISSCARE* survey instruments to measure elements of the Fundamentals of Care Framework however, further research is warranted to develop a tool to directly measure all three framework dimensions. Furthermore, this study highlights the potential to use the *MISSCARE* surveys to elicit nurses' and patients' perspectives of the same phenomena. However, a succinct tool to routinely measure and directly compare both perspectives would be beneficial for developing more targeted interventions to improve patient safety.

Chapter 7 : Discussion

7.1 Chapter introduction

This chapter presents a discussion of the results of each of the studies presented in chapters 3,4, 5 and 6 and demonstrates how the research undertaken to complete these studies and the findings they produced have resulted in the aims and objectives of this research being met. A summary and overview of the findings of each of the studies presented in the previous chapters, in addition to a discussion of the results in the context of the aims and objectives and in relation to relevant literature is provided. The findings of these studies will be discussed under a range of topics including the rates of adverse events, the impact of and factors that contribute to adverse events, prevention strategies, the delivery of fundamental care, the inclusion of the patient voice in healthcare quality and patient safety research, staffing and workforce planning, nurse well-being, the accuracy of administrative data, approaches to chart reviewing, co-production in health services research and caring for Ireland's ageing population.

The overall aim of this PhD research was to understand and measure the rates of four specific nursing-sensitive adverse events and levels of missed nursing care in patients aged 65 and over in an acute hospital setting in Ireland.

The objectives of this research were as follows:

1) To determine an appropriate method for validating rates of nursing-sensitive adverse events in administrative healthcare data by understanding the methodological approaches used to conduct chart review validation studies.
2) To conduct a chart review to determine the rates of nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium in older adults in an acute hospital setting in Ireland.
3) To validate the recorded rates of the four nursing-sensitive adverse events in Hospital In-patient Enquiry (HIPE) data by comparing the chart review data and HIPE data.
4) To identify the risk factors associated with the occurrence of the four specific nursing-sensitive adverse events.
5) To measure missed nursing care from both nurses' and patients' perspectives with a focus on identifying the most frequently missed care tasks and the contributing factors.

7.2 Summary of findings

Objective 1 - A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data

The scoping review, which is presented in chapter 3, was conducted to meet the first objective of this overall research project. The work undertaken to complete this review facilitated the determination of an appropriate method for validating rates of nursing-sensitive adverse events in administrative data by providing an understanding of the methodological approaches used by previous researchers to conduct chart review validation studies. Furthermore, by providing an overview of the level of accuracy, as identified through patient chart review, of administrative data for recording rates of adverse events, an additional objective of this research was met as this overview provided an understanding of the extent to which administrative datasets have been considered accurate for identifying rates of adverse events.

The findings of this review demonstrated the potential for administrative data to be used to improve patient safety and healthcare quality and reduce healthcare costs by providing valuable data on rates of adverse events. Although these datasets may provide useful data in relation to adverse events, the findings of this review highlighted that further research is required to ensure that administrative datasets are robust and accurate. This review highlighted the lack of consensus on best practices for conducting chart reviews by providing an overview of the various methodological approaches and sampling strategies that are used to conduct retrospective chart review.

Objectives 2 and 3 - Validating adverse events in administrative healthcare data in Ireland: a retrospective chart review study

The validation study, which is presented in chapter 4, was conducted to meet the second and third objectives of this overall research project. The work undertaken to conduct the chart review component of this study enabled the rates of pneumonia, urinary tract infections, pressure ulcers and delirium in older patients in an acute hospital setting to be determined. Furthermore, the comparison of the chart review findings and the HIPE data met the third objective of the study by allowing the recorded rates of the nursing-sensitive adverse events within the HIPE data to be validated.

The findings of this study identified that of the 1,000 admissions reviewed, 231 (23.1%) contained at least one adverse event. At event level, 373 adverse events were identified including 133 pressure ulcers in 71 admissions, 101 delirium episodes in 100 admissions, 84 pneumonia episodes in 79 admissions and 55 urinary tract infections in 52 admissions.

Of the 302 adverse events identified at admission level, 96 (31.8%) of these were coded in the HIPE data and flagged by the Hospital Acquired Diagnosis indicator. Compared with chart review data, the overall sensitivity of the administrative data was low, and the specificity was high. The positive predictive values varied, and the negative predictive values were generally high. In HIPE data, 42 hospital-acquired adverse events were found that were not identified in the chart review. Overall, the results of this study demonstrated that the HIPE data may not currently represent accurate rates of pneumonia, urinary tract infections, pressure ulcers and delirium when compared to the rates of these nursing-sensitive adverse events as identified through the retrospective chart review.

Objective 4 - Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review

The study presented in chapter 5 was conducted to meet the fourth set of objectives of this research project. The research undertaken to complete this study met objective 4 by identifying an association between various factors and the four studied nursing-sensitive adverse events. Furthermore, the identification of significant associations between the nursing-sensitive adverse events and in-hospital mortality and a patient's discharge destination enabled this fourth set of objectives to be fully met.

The findings of this research highlighted various important risk factors associated with nursing-sensitive adverse events in patients aged 65 and over in an acute Irish hospital. Medical speciality, an increase in age, length of stay, the number of diagnoses and procedures and a patient's admission situation were identified as significant risk factors of the nursing-sensitive adverse events investigated in this research. Furthermore, time from first presentation to admission and number of ward moves were also associated with nursing-sensitive adverse events but yielded some contradictory findings. The results of this study also demonstrated a significant relationship between in-hospital mortality and pressure ulcers. Furthermore, patients who experienced nursing-sensitive adverse events were more likely to be discharged with home care packages or to be discharged to nursing homes, other

hospitals, rehabilitation facilities or destinations within the 'other' category than be discharged home independently.

Overall, the findings of this study demonstrate the requirement for focus to be placed on adverse event prevention strategies that are targeted towards medical patients, older patients, patients with multiple co-morbidities and those with longer lengths of stay. A focus on nursing-modifiable factors such as post-procedural care and care tailored to the specific needs of medical patients and transfer patients may help to reduce nursing-sensitive adverse events. Further exploration of the association between waiting times from presentation to admission, and ward moves and nursing-sensitive adverse events given that the latter two of these factors may also be potentially impacted by key nursing-modifiable interventions. The results of this study also suggest that implementing the use of care bundles comprised of numerous nursing interventions that are aimed at preventing multiple adverse events rather than specific individual events may also yield more positive patient outcomes.

Objective 5 - Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework: A cross-sectional survey

The study presented in chapter 6 was undertaken in order to meet the fifth and final set of objectives of this research. The surveys conducted with both nurses and patients enabled the fifth research objectives to be met by providing an understanding of the frequency of missed nursing care according to nurses and patients and an understanding of the factors that contribute to missed nursing care from the nurse perspective. Furthermore, this study allowed the fifth set of objectives of this research to be met by identifying to what extent the MISSCARE measurement tools can represent the elements outlined within the Fundamentals of Care Framework.

The results of this study suggest that nurses perceive a low incidence of missed nursing care. According to nurses, attending interdisciplinary care conferences, mobilisation and oral care were the most frequently missed care items. Patients reported that oral care, communication in relation to who their specific nurse was and mobilisation were most frequently missed. The most significant reasons for missed care included inadequate numbers of nursing staff and assistive personnel and urgent patient situations. These findings indicate the need to prioritise nurse recruitment and retention strategies and place workforce planning high on the patient safety agenda. The findings of this study suggest that the MISSCARE survey tools can be used to measure the delivery of fundamental care to a certain extent with The

MISSCARE Survey-Patient demonstrating a higher percentage coverage (73.7 %) of the elements outlined within the Fundamentals of Care framework than the MISSCARE Survey (42.1 %).

7.3 Approaches to chart reviewing

This research demonstrated the effectiveness of chart reviewing and its benefits in relation to validating administrative healthcare data and monitoring patient safety. However, the findings of the review presented in chapter 3 demonstrate that there is a lack of consensus on best practices for conducting retrospective chart reviews as various methodological approaches and sampling strategies appear to be used internationally to carry out such studies. Such limitations of chart reviews have previously been identified by Vassar and Holzmann (2013).

Although there is no gold standard method of measuring patient safety or patients harm, structured retrospective chart reviews that encompass primary and secondary review stages have been deemed as valid and reliable methods of conducting research and assessing the quality of care (Siems *et al.*, 2020). Whilst there are various ways to conduct a retrospective chart review, two-stage methodological approaches such as the Harvard Medical Practice Study (HMPS) and the Global Trigger Tool (GTT) are promising methods that can be used to conduct chart reviews (Bachnick *et al.*, 2024). The use of a structured two-stage retrospective chart review tool in this study offers a potentially useful contribution to the field of research exploring best practices for conducting retrospective chart reviews by further demonstrating the effectiveness of two-stage review methodologies.

This research highlights the requirement of more systematic approaches to chart reviewing and demonstrates the benefits of adhering to methodological recommendations such as those outlined by Vassar and Holzmann (2013). The findings presented in the previous chapters offer clear evidence of the enhanced methodological rigor of retrospective chart reviews which follow a standardised protocol with clear guidelines, have clearly defined research objectives, provide explicit inclusion and exclusion criteria and use a standardised data collection instrument. Furthermore, this research has also highlighted the importance of providing training for the personnel involved in the chart review and conducting a pilot study to ensure all necessary variables have been considered for inclusion and to ensure that the chart reviewers are able to locate all relevant information within patients' medical charts.

The effective use of a structured chart review in this study may offer guidance to future researchers who seek to use this methodology to validate rates of adverse events in administrative healthcare data. This research provides the foundations of a framework for conducting retrospective chart reviews to validate rates of adverse events in administrative data and may have positive implications for future researchers.

7.4 Co-production in health services research

A key aspect of the overall process of conducting this research was the co-productive approach that was used to allow the researchers to collaborate with healthcare professionals from the participating hospital. The chart review protocol and data collection instruments were developed using a co-productive process. Therefore, this study also offers a unique contribution to the field of research on the development of chart review methodologies and the validation of administrative healthcare data due to the use of a co-productive research approach. Previous research has demonstrated the benefits of co-production involving healthcare professionals for developing toolkits to improve patient safety culture in hospitals (Ward *et al.*, 2018). Research from Ward et al. (2018) has highlighted the wealth of expertise and experience that the healthcare professionals brought to the co-production process and the depth that their contribution added to the discussions relating to the development of their toolkits. Similarly, the healthcare professionals involved in this project added great depth to the development of the chart review protocol and data collection instrument by sharing their knowledge. The use of co-production in this developmental process provided a framework to bridge the gap between research and practice (Banks *et al.*, 2016). Furthermore, knowledge co-production between the academic researchers and the healthcare professionals allowed the healthcare professionals and researchers to combine their skills in the research process (McCabe *et al.*, 2021). The healthcare professionals were able to guide the researchers in relation to the selection of the relevant variables for collection in the chart review. Additionally, the healthcare professionals provided expertise in relation to locating the relevant information in the patients' medical charts.

The benefits of using a co-productive approach in health research has also been documented by Martin et al. (2022) who demonstrated the importance of combining clinical and research perspectives in health research. This study combined both perspectives as the principal investigator of the overall project had a clinical background and therefore had an understanding of the project from both a clinical and research perspective. Furthermore, a

healthcare professional, with a clinical and research perspective, who was a member of the research team was appointed as coordinator of the research project in the participating hospital. Other members of the research team came from either research or clinical backgrounds, therefore the sharing of knowledge during the co-production meetings provided valuable insights into both perspectives.

In addition to the significant contribution that the co-productive process had to the chart review component of this research, the co-production also aided the development and roll out of the survey component of this research. Although validated survey instruments developed by Kalisch et al. (2014) and Dabney, Kalisch and Clark (2019) were used to gather the survey data, the co-productive process employed in this project facilitated the integration of the research and clinical perspectives as the surveys were required to be amended for the context of the participating hospital. Collaboration between the healthcare professionals and researchers was a vital component of this stage of the research process. Furthermore, the support of the healthcare professionals who were members of the research team was also instrumental in the encouragement of the nurse participation in the surveys.

Although there are various challenges associated with involving healthcare professionals in co-production such as organizational barriers relating to time limitations due to commitment to care provision activities, rigid timeframes to complete projects, workload and staff shortages (Vennik *et al.*, 2016), this research demonstrates that it is feasible to overcome these barriers and successfully implement a co-productive process involving healthcare professionals in health services research.

This use of a co-productive process involving healthcare professionals in this study contributes to the evidence that supports the use of co-production in health services research. This research demonstrates how adhering to the key principles of co-production such as the sharing of power, the inclusion of all perspectives and skills, respecting and valuing the knowledge of all members of the research team, reciprocity and prioritising building and maintaining relationships (National Institute for Health and Care Research, 2024), can result in a successful and meaningful partnership between academic researchers and healthcare professionals. The work completed as part of this project demonstrates to other researchers how these co-production principles can be applied within a health services research context and highlights the feasibility of using co-approaches in future research focused on safety and healthcare quality improvement.

Overall, this research has demonstrated the benefits and effectiveness of employing co-approaches in health services and healthcare research. The contribution of the healthcare professionals was instrumental to the process of conducting this research and the benefits of using a co-productive approach to develop study materials has been highlighted through this research. This research offers guidance to researchers who wish to employ a co-productive approach in health services research.

7.5 Accuracy of administrative data

The scoping review presented in chapter 3 demonstrated that there is significant variation in the accuracy of the recording of adverse events in administrative datasets. The findings presented in chapter 4 offer a significant contribution to the limited information available on the accuracy of the recording of the four specific nursing-sensitive adverse events that indicate functional and cognitive decline of older patients in hospital settings (Bail and Grealish, 2016) in administrative data in Ireland. These findings suggest that Ireland's HIPE data does not currently represent the rates of these adverse events as experienced by older patients given the underutilisation of hospital-acquire diagnoses (HADx) flags.

This research provides evidence to strengthen the argument that there is a lack of visibility of nursing and nursing-sensitive adverse events within administrative data. In order to increase the visibility of nursing in administrative healthcare data, the occurrence of these adverse events must be accurately recorded. As discussed by Twigg et al. (2016), enhanced visibility of nursing-sensitive outcomes in administrative data will provide evidence to inform decision-making related to nurse workforce planning. In order to improve patient outcomes by addressing nurse shortages, it is essential that decision-making in relation to nurse recruitment and retention strategies is guided by accurate evidence of the rates of nursing-sensitive adverse events which again, have been shown to be strongly associated with nurse staffing levels (Griffiths *et al.*, 2016; Dall'Ora *et al.*, 2022).

The research presented in the previous chapters suggests that further work is needed to ensure that nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium are recorded in administrative datasets and are flagged with hospital-acquired indicators such the HADx flags which are used in the HIPE data in Ireland. In order to ensure that these datasets are robust, this research suggests that a focus on providing solutions to the challenges that pose a threat to administrative data accuracy are required.

It is hopeful that the findings of this research will be used to guide the improvement of Irish administrative healthcare data to ensure that is more inclusive of nursing-sensitive adverse events. The improved visibility of nursing and the rates of nursing-sensitive adverse events in acute Irish hospital settings can be used to inform policy related to nurse staffing and the development and implementation of other necessary interventions to improve patient safety.

An extensive list of barriers and facilitators for using administrative data for monitoring patient safety and rates of adverse events such as hospital-acquired infections have been collated by Boulanger, MacLaurin and Quach (2025). They have identified various physician-related, coder-related, motivational, technical, organizational and systemic barriers. The low visibility of nursing-sensitive adverse events in the HIPE data, as identified through the research presented in the previous chapters, may be attributable to the types of barriers identified by Boulanger, MacLaurin and Quach (2025).

Although there are evident challenges associated with the coding of hospital-acquired adverse events in administrative datasets such as variation in terminology used in documentation (Tang, Lucyk and Quan, 2017; Alonso *et al.*, 2020b, 2020a; Doktorchik *et al.*, 2020; Boulanger, MacLaurin and Quach, 2025), Palese, Longhini and Danielis the results of this current research suggest that investment in solutions to these challenges will improve the accuracy of the recording of the rates of adverse events. Similar to the barriers they identified, Boulanger MacLaurin and Quach (2025) have also compiled a list of physician-related, coder-related, motivational, organizational and systemic solutions that may facilitate the improvement of the accuracy of these datasets. They have also identified that the use of electronic tools, educational programmes and resources such as reference materials and improved guidelines for both coders and doctors may also contribute to improved recording of adverse events in administrative healthcare data. The findings of the validation study presented in chapter 4 provide rationale for the uptake of these solutions in an Irish context. Improving the quality of physicians' documentation, their awareness of the importance of clinical coding and its impact on financial reimbursement for hospitals and provided more comprehensive documentation training for doctors in medical school may help to improve the accuracy of administrative data. Furthermore, enhanced communication between coders and physicians and attention to all notes within patients' charts rather than an over-reliance on discharge summaries alone may yield positive results for more accurate recording of hospital-acquired adverse events. Additionally, systematic and organizational solutions may include strengthening documentation practice policies and empowering

coders to make decisions and correct clear documentation errors. Training programmes, coding workshops, the development of standardised forms for documentation such as discharge summaries with clear sections for hospital-acquired adverse events are also plausible solutions to the challenges associated with the coding of adverse events in administrative data (Boulanger, MacLaurin and Quach, 2025).

Progress on improving the accuracy of the recording of nursing-sensitive adverse events in administrative data is already being made as a result of these findings, with additional funding from the Health Research Board (funding number - KTA-2024-001) secured as part of the wider COST2CARE project associated with this research to translate the knowledge obtained via the validation study into real-world solutions to improve the coding of nursing-sensitive adverse events. The further work that is currently being done as a result of this research is promising and suggests that further investment in the aforementioned solutions is of interest to the Irish government who have previously highlighted the importance of maintaining accurate data in relation to the measurement and monitoring of nursing-sensitive adverse events (Department of Health, 2018). The Department of Health in Ireland have a particular interest in the monitoring of missed care and nursing-sensitive patient outcomes associated with missed nursing care given that this data may be useful in determining whether nurse staffing levels and skill mix in Ireland are safe and sufficiently capable of providing adequate care to meet the needs of older patients in acute hospital settings in Ireland. Given their interest in the accurate recording of nursing-sensitive patient outcomes, it appears that the research provided in this report may be useful to the Department of Health in Ireland in relation to informing decisions and policy relating to the allocation of necessary resources, the identification of required changes in practice and the development of an effective performance and quality improvement programme.

7.6 Rates of adverse events

This research has demonstrated the burden of adverse events on the health system by making explicit the rates of hospital-acquired cases of pneumonia, urinary tract infections, pressure ulcers and delirium in patients aged 65 and older in an acute hospital setting in Ireland. As identified in chapter 4, an adverse event was experienced in 23.1% of admissions of older patients. Previous research conducted in Ireland which explored the prevalence of adverse events in the general adult population as opposed to older adults specifically, as explored in this study, identified adverse events in 12.2% of admissions (Rafter *et al.*, 2017). Given that

older patients are more vulnerable to nursing-sensitive adverse events (Alotaibi *et al.*, 2025), it is unsurprising that higher rates of these events were identified in the older population in this study than in studies that focused on the general adult population and included younger patients. The rates of adverse events in older patients have previously been reported to occur in 55% of admissions in a study of 171 admissions of patients aged 60 years and older in an acute care geriatric unit in a hospital in Brazil (Szlejf *et al.*, 2012). Furthermore, 30% of admissions in a study investigating the rates of nursing-sensitive adverse events in older trauma patients were associated with at least one nursing-sensitive adverse event (Järbrink *et al.*, 2025). A more recent study that assessed the frequency of adverse events in hospitalised patients identified that at least one adverse event occurred in 23.6% of admissions of adults aged 18 and older. In the same study, adverse events were reported to occur in 28% of admissions of patients aged 65-84 years old and 29.2% of admissions of patients aged 85 and older (Bates *et al.*, 2023). Evidently, the rates of adverse events identified in this study and in previously published literature highlight the occurrence of adverse events as a patient safety issue that is particularly prevalent in the population of older hospitalised patients.

7.7 Impact of adverse events

The results of this study demonstrate that almost a quarter of patients aged 65 and older experience at least one adverse event during hospitalisation. Given the proportion of patients affected by adverse events, it is important to consider the impact of these events on patients. Furthermore, patient safety incidents also have an effect on both nurses as second victims and the health systems or health organisations as third victims (Lee, Lee and Kim, 2025).

7.7.1 Impact of adverse events on patients

The impact of missed care and adverse events on patients is widely recognised (Schwendimann *et al.*, 2018; Janatolmakan and Khatony, 2022). Patients who experience adverse events may face both short-term and long-term impacts. Long-term effects of adverse events include social/behavioural impacts such as altered healthcare seeking behaviours, psychological impacts such as feelings of anger, grief and a loss of trust in healthcare, physical impacts and associated treatments and financial issues relating to costly long-term care (Ottosen *et al.*, 2021). Such long-term impacts may be more likely to be experienced by patients who suffer serious adverse events. Nonetheless, adverse events have clear consequences for patients with a scoping review study identifying that 53.5% of

patients experienced temporary or minimal harm, 21.2% of patients suffered moderate impairment (Schwendimann *et al.*, 2018). Furthermore, Schwendimann et al. (2018) also reported more serious consequences such as permanent disability in 7.3% of patients and death occurring in 7.3% of patients affected by adverse events.

The adverse events investigated in this research can have significant effects on patients. Hospital-acquired infections such as pneumonia and urinary tract infections can result in prolonged hospital stays, long-term complications and disability, premature death and social and psychological suffering (World Health Organization, 2022). Similarly, older adults who experience delirium in hospital have significantly reduced clinical outcomes in comparison to those without delirium. Tesfaye et al. (2025) reported that, following discharge, patients who develop delirium in hospital demonstrate higher cognitive decline and impairment, greater functional decline, lower quality of life, higher rates of readmission and increased mortality. Furthermore, hospital-acquired pressure ulcers have also been associated with prolonged hospitalisation and further complications such as infection which can complicate a patients recovery and increase their risk of mortality (Williams, 2024). Evidently, nursing sensitive adverse events have a significant impact on patient safety, therefore efforts to reduce and prevent these events must be prioritised.

7.7.2 Impact of adverse events on nurses and healthcare professionals

The impact of adverse events on healthcare professionals has also been extensively researched. Although the occurrence of adverse events can result in reflective learning processes that contribute to improved clinical decision making, professional development and strengthen healthcare professionals' sense of responsibility and encourage them to be more attentive to patient safety, they may often result in negative consequences (Deng *et al.*, 2026). Negative emotional responses, sleep disorders, gastrointestinal issues and feelings of anxiety and depression in healthcare professionals have been associated with adverse event occurrence. Additionally, the experience of an adverse events may contribute a negative impact on clinical decision making and professional performance and result in burnout and increased intention to leave their profession. The impact of adverse events on healthcare professionals may be influenced by the organisational environment within which they work. Open and supportive cultural work environments foster a safe space for second victims which may enable them to recover from the consequences of adverse events however, workplaces with a punitive culture that criticise and punish healthcare professionals involved

in adverse events can result in increased psychological pressure and intent to leave (Deng *et al.*, 2026).

Nurses in particular can be significantly impacted by patient safety incidents such as adverse events. Patient safety incidents which result in death have been associated with an increased intent to leave and an increased likelihood of career change for nurses. Furthermore nurses have also reported an intent to leave their profession when patient safety incidents result in permanent harm (McPeake and Bateson, 2022). Given the serious implications that adverse events can have on healthcare professionals and the nursing workforce, it is imperative that efforts are made to reduce their occurrence. Furthermore, efforts must also be made to ensure that healthcare organisations foster a non-punitive environment which enables nurses to report patient safety incidents and supports them to cope with patient safety incidents.

7.7.3 Impact of adverse events on health care organisations

Patient safety incidents such as adverse events can also have a significant impact on healthcare systems and healthcare organisations. The economic impact of adverse events on health systems is substantial given their association with 15% of hospital expenditure in OECD countries (Slawomirksi, Auraaen and Klazinga, 2017). In addition to direct hospital expenses, adverse events can contribute to prolonged hospital stays, additional treatments and procedures and legal costs which all contribute to the overall economic burden of patient safety incidents on the healthcare system (Kumah, 2025). The global healthcare expenditure associated with unsafe care in OECD countries annually is estimated to be US$ 878 billion (World Health Organisation, 2024a).

Previous research from Ireland has estimated the average daily cost associated with a nursing-sensitive adverse event to be €694. Furthermore, extrapolation of this figure nationally has resulted in the economic cost of nursing sensitive adverse events to the Irish health system being estimated at €91.3 million (Murphy *et al.*, 2021). This highlights the significant economic burden of nursing sensitive adverse events and provides rationale for the rates of adverse events identified through this current research to be used to estimate the financial cost specifically associated with the four nursing-sensitive adverse events investigated in this study.

As this research is part of a wider project exploring the economic cost of hospital-acquired cases of pneumonia, urinary tract infections, pressure ulcers and delirium, the findings from the chart review of the single hospital included in this study will be used to identify the

national rates of these adverse events. The national rates identified within the wider project will then be used to estimate the economic cost of these specific nursing-sensitive adverse events in Ireland. Given that almost a quarter of older patients admitted to Irish hospital experience adverse events, their economic cost to the Irish health system is estimated to be substantial. As identified by Kumah (2025), the development of interventions targeted towards reducing adverse events and mitigating the financial burden on healthcare systems is essential.

In addition to the financial impact of adverse events on healthcare systems, health care organisations may also suffer reputational impacts as a result of adverse events (Mira *et al.*, 2017). Healthcare organisations may lose the trust of their patients following adverse events which may result in reputational damage to the organisation. Additionally, if patients lose trust in their healthcare providers and are left with fears that prohibit them for seeking healthcare, they may experience reduced health outcomes (Ottosen *et al.*, 2021).

Given the impact of adverse events on patients, healthcare professionals such as nurses and on health organisations, it is evident that strategies to reduce and prevent the occurrence of adverse events must be prioritised in terms of a safety and quality agenda.

7.8 Factors leading to adverse events

There are multiple factors that can contribute to adverse events and patient harm in health care settings. According to the World Health Organization (2023), these factors include system and organisational factors such as workflow disruptions and issues relating to care coordination, inadequate staffing, limited resource availability and insufficient processes and procedures. Issues with electronic health records or medical administrative systems are technological factors that can also contribute to patient safety incidents. Human factors and behaviours such as communication breakdowns between healthcare workers and between healthcare workers, patients and their families, ineffective teamwork, fatigue and burnout have also been identified as significant factors that contribute to patient harm. There are also patient related factors such as non-adherence to treatment and limited health literacy and external factors such as inadequate absent policies or regulations and financial pressures that can contribute to patient harm. Many of these factors are interrelated and patient safety incidents such as the occurrence of adverse events are generally attributable to more than one of these factors.

7.9 Prevention strategies

As identified in chapter 5, there are several risk factors associated with the development of adverse events in older patients. The risk factors identified through the study presented in chapter 5 coupled with the contributing factors mentioned above must be considered in terms of the development of prevention strategies that are required to reduce the impact and rates of adverse events. Investment in adverse event prevention strategies may reduce the economic and human cost of patient safety incidents for both healthcare settings and patients (Tessier *et al.*, 2019).

As demonstrated through the findings of the study presented in chapter 5, due to their increased likelihood of developing adverse events in hospital, hospitals should focus efforts on developing prevention strategies targeted towards vulnerable populations such as medical patients, older patients, patients with multiple co-morbidities and those with longer lengths of stay. Previous research has also demonstrated that multidisciplinary staff training has been associated with improved patient safety outcomes (Afolalu, Akpor and Afolalu, 2025). Therefore, a potential strategy for preventing nursing-sensitive adverse events includes multidisciplinary training and education programmes such as a patient safety module, designed, taught to undergraduate medical students and evaluated by McCoy et al. (2020), which has shown to be an effective mechanism for fostering multidisciplinary collaboration skills that may improve patient safety. This intervention has also shown promising findings for replication in other learning environments for a range of healthcare professionals, therefore demonstrating its potential effectiveness for the nursing profession.

The findings presented in chapter 5 which identified key predictors of adverse events suggested that the development, implementation and evaluation of care bundles aimed at preventing multiple adverse events may potentially be useful in mitigating patient safety incidents. The concept of care bundles was developed by the Institute for Healthcare Improvement in 2001 as part of an initiative to improve critical care. These “bundles” which are composed of groups of evidence-based interventions for a defined patient population and care setting have been associated with significant improvements in patient outcomes (Resar *et al.*, 2012). Care bundles have proven to be effective at reducing adverse events when the grouped interventions target one specific adverse event such as pressure ulcers (Demir and Karadag, 2025).

In order to prevent nursing-sensitive adverse events, this research suggests that the guidelines outlined by Resar et al. (2012) for the development of care bundles should be followed and used to design care bundles targeted towards preventing multiple nursing sensitive adverse events in older patients in acute hospital settings. Bail and Grealish (2016) have previously proposed such strategies employing nursing care actions to prevent and mitigate the risks of pneumonia, urinary tract infections, pressure ulcers and delirium in older hospitalised patients. They have demonstrated the potential benefits of combined preventative nursing interventions on patient safety. Furthermore, given the effectiveness of the use of a co-productive approach in this research, it seems appropriate that further research in relation to the development of care bundles targeted towards reducing the burden of nursing-sensitive adverse events should be co-designed, co-developed and co-produced between healthcare professionals and researchers.

This study also identified an association between ward transfers and the occurrence of delirium and pressure ulcers. In contrast to previous research which demonstrated a link between bed and ward transfers and the development of adverse events (Webster *et al.*, 2016; Blay *et al.*, 2017; Toye *et al.*, 2019), the findings presented in chapter 5 suggest that patients with a higher number of ward moves had a reduced risk of delirium and pressure ulcers. As discussed in chapter 5, this reduced risk may reflect the transfer of patients to specialty services that were tailored to their needs and there reduced their risk of developing such adverse events. Nonetheless, as ward transfers have shown to have an impact on nursing-sensitive adverse events, it is imperative that hospitals acknowledge this and make efforts to minimise transfers that are not medically essential. Strategic planning and effective coordination of patient care has the potential to reduce the number of ward transfers a patient experiences, which in turn may mitigate their risk of patient safety incidents such as the development of adverse events (Webster *et al.*, 2016). The lack of formal transfer training for ward nursing staff has been highlighted by Bonnici et al. (2020) who have also reported variable handover processes and inconsistent or incomplete documentation associated with patient transfers. Unified transfer processes and transfer training has been highlighted by Bonnici et al. (2020) as a potentially effective method for reducing the risk of patient deterioration during ward transfers. As the findings of this research suggest that the ward moves that were associated with the reduction of delirium and pressure ulcers were medically necessary, it is possible that lessons can be learnt from this to develop training

programmes and standardised procedures for transferring patients between and within wards when medically necessary.

Overall, the results of the studies presented in the previous chapters demonstrate the requirement for the development of strategies to prevent adverse events given their high prevalence in older patients. As recommended by Mira et al. (2017), hospitals should focus efforts on developing strategies that incorporate safety and organisational policies, patient care, prevention, support for healthcare professionals, open disclosure to patients and families, incident reporting and consideration of measures to protect the reputation of health care professionals the their organisations.

7.9.1 Multidisciplinary care conferences

The findings of this research demonstrated that nurses perceive interdisciplinary care conferences as the most frequently missed nursing care activity. Multidisciplinary care conferences or multidisciplinary team meetings promote co-ordinated patient care and management. They provide an integrated approach to patient care in healthcare settings and bring together the expertise of multiple healthcare professionals who are involved in care delivery. The primary function of a multidisciplinary team meeting is to assess, manage and care for patients by developing treatment and care plans that take all of the patient's needs into consideration (Henriksen *et al.*, 2022). These types of care conferences are multidisciplinary as patients are assessed individually by several healthcare professionals however, they are also interdisciplinary as the members of the team work together towards a specific set of goals and devise joint care plans to treat the patients (Ellis and Sevdalis, 2019; HSE, 2024). Multidisciplinary teamwork is a key feature of the care of older patients with nurse's assuming a multidimensional role as members of the care team of an older patient. Nurse's act as patient advocates, care facilitators, counsellors and primary care givers (Costello, 1994). Given the multifaceted role that nurses assume in relation to the care of older patients, their attendance at interdisciplinary care meetings is of great importance.

A comprehensive geriatric assessment is an assessment approach that is organised and designed to measure an older patient's medical needs, functional ability and social situation. This type of assessment is completed by a team of healthcare professionals who conduct an evaluation of the patient and develop a co-ordinated care plan that aims to lead to better health outcomes (National Clinical Programme for Older People, 2016). Comprehensive geriatric assessment is recognised as the gold standard and given nurse's involvement in

screening and evaluating patients, developing care plans and managing patient care, they play a critical role in comprehensive geriatric assessments (Dimitriadou *et al.*, 2025). The value of the role of the nurse in relation to conducting comprehensive geriatric assessments further emphasises the importance of ensuring that nurses attend multidisciplinary and interdisciplinary team meetings.

Furthermore, given the potential benefits of comprehensive geriatric assessments such as improved accuracy of diagnoses, enhanced functional outcomes and, most relevant to this research, the prevention of hospital acquired adverse events (National Clinical Programme for Older People, 2016), there is clear rationale for conducting comprehensive geriatric assessments. Given the rates of adverse events identified through this research and in light of the potential benefits that comprehensive geriatric assessment may contribute to in relation to the reduction of adverse events, it is essential that nurses and other healthcare professionals work together in multidisciplinary team meetings to implement the components of the comprehensive geriatric assessment and optimise outcomes for older patients in acute hospital settings (Hickman *et al.*, 2015).

Although the value of nurse participation in multidisciplinary care meetings is evident, the findings of this study are in line with previous research that indicates that nurses' attendance at such meetings is frequently missed (Zamanzadeh *et al.*, 2021). According to Zamanzadeh et al. (2021), barriers for nurses in relation to attending multidisciplinary meetings included time limitation, ineffective communication, feeling undervalued by physician team members and structural and organisational issues in relation to the timing of the meetings. Furthermore, Pradelli et al. (2025) identified that organisational factors such as system rigidity, high staff turnover, the absence of sharing knowledge and experiences and high workloads were considered to be barriers to effective multidisciplinary teamwork in acute care settings. The identification of inadequate staffing and patient acuity have also been identified as significant contributors to missed care in this current study. Understaffing and high rates of staff turnover has a negative impact on multidisciplinary teamwork by disrupting cohesion, creating instability, contributing to feeling of inadequacy in new team members and impeding skill development. Similarly, high workloads may lead to communication issues and result in ineffective collaboration between healthcare professionals. These barriers contribute to stressful work environments and reduce the overall performance of multidisciplinary teams (Pradelli *et al.*, 2025). In order to remove these barriers and ensure that nurses and all relevant healthcare professionals can attend

multidisciplinary care meetings, strategies that focus on workforce planning and ensuring a positive and well-resourced work environment are required.

7.10 The delivery of fundamental care

A core aspect of this research sought to investigate the extent to which fundamental care is delivered in acute hospital settings by exploring the concept of missed nursing care from both nurses' and patients' perspectives. The close association between missed nursing care and the development of nursing-sensitive adverse events led to the further exploration of missed nursing care in this research. Adverse events are a significant patient-related consequence of missed nursing care (Chaboyer *et al.*, 2021; Willis and Brady, 2021).

This research sought to build upon the work that has previously established a synergy between the missed nursing care and the Fundamentals of Care Framework research lines (Palese, Longhini and Danielis, 2021). Palese et al. (2021) established the extent to which the MISSCARE Survey can be used to measure the Integration of Care dimensions of the Fundamentals of care Framework however, the study presented in chapter 6 sought to apply the MISSCARE Survey to all three dimensions of the Fundamentals of Care Framework. Furthermore, this research offers a unique contribution to the field of research on the measurement of missed nursing care and fundamental care delivery due to the inclusion of the patient perspective. Consideration of patients' perspectives has previously been highlighted as an important factor in missed nursing care and quality improvement research by enabling nurses and healthcare professionals to respond more effectively to patients' needs (Bagnasco *et al.*, 2020; Chiappinotto, Coppe and Palese, 2023).

Therefore, this research sought to respond to calls for inclusion of the patient voice by eliciting both nurses' and patient perspectives on missed nursing care in Ireland. The unique contribution that this study offers relates to the use of the patient-reported MISSCARE Survey-Patient tool to measure the care items outlined in the dimensions of the Fundamentals of Care Framework.

Since the publication of the study presented in chapter 6, progress has been made in relation to the development of a tool to measure the delivery of fundamental care from the perspective of clinicians. Research conducted by Feo et al. (2025) has led to the development and refining of the Flinders Fundamentals of Care Assessment Tool for Clinical Practice and has demonstrated its effectiveness in measuring and supporting improved fundamental care

delivery. This is a positive move towards the enhanced delivery of fundamental care and the improvement of patient safety and healthcare quality.

Evidently, the importance of listening and responding to patient voice in the context of patient safety and healthcare quality improvement has been further reiterated through this research. As experts based on their first-hand experience of care delivery, and in agreement with Feo et al. (2025), the development of a patient-reported version of the Flinders Fundamentals of Care Assessment Tool for Clinical Practice should be considered. However as also discussed by Feo et al. (2025), there are challenges associated with this as whilst patients may have the experience required to report on the delivery of care in relation to the relationship and integration of care dimensions of the Fundamentals of Care Framework, they may not be able to report on items relating to the Context of Care Dimension.

The findings of chapter 6 indicated that mobilisation and oral care were among the most frequently missed nursing care items according to both nurses and patients. The importance of mobilisation as an intervention for addressing physical impairments, reducing length of stay and improving functionality has been demonstrated in both acute hospital settings and in particular intensive care settings (Daum *et al.*, 2024; Li *et al.*, 2025). The benefits of mobilisation are also recognised by older patients with previous research reporting older patients motivations to mobilise whilst in hospital associated with their goals to restore strength and health and be discharged home

Although the benefits and importance of mobilisation are widely recognised, the findings of this study are in line with previous research that suggest mobilisation is frequently missed (Gurková, Šinglárová and Žiaková, 2024). As demonstrated in chapter 6, inadequate staffing and patient acuity are key factors that contribute to this type of care being missed however, there are additional barriers to mobilisation which must be addressed. Patients have previously reported that the level of pain they experience is a limitation to them in relation to mobilisation. Additionally, patients have reported that they do not want to bother nurses for help with mobilisation (Byrnes, McRae and Mudge, 2023). Although it is important to recognise patient-related factors that contribute to missed mobilisation-related care interventions, due to their role in the daily care of the patient, it is ultimately the responsibility of the nurse to ensure that patients are mobilised. As previously discussed, a lack of clarity in relation to nurses perceptions of mobilisation responsibility, which is often placed on the physiotherapy department, may also contribute to this care being missed.

Therefore, investment in education and training programmes may be beneficial in aiding nurses to recognise their role in the mobilisation of patients and encourage them to feel empowered and confident to take ownership of the responsibility of providing for patients' functional needs (Constantin and Dahlke, 2018). Whilst education, training and implementation of and adherence to nurse-driven mobilisation protocols (Li *et al.*, 2025) may result in a reduction in missed nursing care and improved patient outcomes, this research clearly highlights the need for adequate staffing and improved nurse-patient ratios to enable nurses to manage patient acuity and deliver fundamental care.

In addition to mobilisation, as highlighted in chapter 6, patients and nurses have both identified oral care as a frequently missed fundamental nursing care intervention. Missed oral care is of great concern for older hospitalised patients given its association with hospital-acquired pneumonia, prolonged hospitalisation and increased healthcare costs. Again, the importance of good oral hygiene is recognised by both nurses and patients however, similar to the barriers related to mobilisation, a lack of clarity in relation to nurses' roles and responsibilities and limited time and resources are factors that hinder the provision of oral care. Patient-reported barriers included lack of access to oral care products, difficulty accessing basins and bathrooms and again, not wanting to bother busy nurses. Furthermore, patient care-resistant behaviours must also be recognised as a contributor to missed nursing care (Murray *et al.*, 2024).

In order to increase the provision of oral care in the hospital that participated in this research, ward-level interventions such as oral care education and awareness discussions during nursing huddles, provision of oral care products to every patient on admission and development of oral care delivery checklists for nurses (Murray *et al.*, 2024) should be considered. This current research, in line with recommendations from Murray et al. (2024) highlights the need for policy change to address the failure to deliver oral healthcare to older patients in acute hospital settings.

The findings of chapter 6 have also highlighted the need to improve communication between nurses and older patients in acute hospital settings in Ireland. Effective communication between nurses and older patients has previously been shown to have a positive impact on patient centred outcomes such as satisfaction with healthcare, quality of life, quality of care and patients' physical and mental health (Sharkiya, 2023). The nurse-patient relationship sits at the core of the Fundamentals of Care Framework and is the foundation upon which high-

quality and safe fundamental care is built (Kitson, 2018). Therefore, it is essential that patients are aware of the identity of their assigned nurse. This research highlighted that many patients were not aware of this, therefore efforts should be made to improve communication to ensure that patients have a clear understanding of which nurses are assigned to care for them.

The fundamentals of care framework places emphasis on patients' basic care needs and demonstrates the factors that contribute to these care needs being met. This study offers a contribution to the field of research on quality improvement by clearly demonstrating that certain fundamental, basic but essential nursing care interventions are often missed in acute hospital settings in Ireland. This research therefore highlights the aspects of fundamental care which require prioritisation in order to ensure that older patients receive adequate, good quality and safe care in hospital. In addition to focusing on the identified interventions that appear to be missed most frequently, adequate staffing is a strong theme across this research that requires significant attention in order to improve patient safety and healthcare quality.

7.11 Staffing and workforce planning

It is evident from this research that the level of nurse staffing in acute hospital settings is a prominent and common theme that has emerged across the studies presented in the previous chapters in relation to missed nursing care and the occurrence of adverse events.

The association between nurse staffing levels, the quality of care and the occurrence of adverse events has been well-established. Lower nurse staffing levels have been previously associated with an increase in the risk of in-hospital mortality and the occurrence of hospital-acquired pressure ulcers (Fernández-Sánchez *et al.*, 2025) whereas higher nurse staffing levels have been associated with reduced risk of nursing-sensitive adverse events such as in-hospital mortality, infections, pneumonia, pressure ulcers and medication errors (Driscoll *et al.*, 2018). Safe nurse staffing has also been associated with the reduced risk of the adverse events which act as indicators of the Failure to Maintain framework (Juvé-Udina *et al.*, 2025). This finding is particularly relevant to this research and provides an evidence-based solution to reducing the impact and occurrence of these nursing-sensitive adverse events.

Taking the voice of the patients into perspective and given the findings from previous literature that suggests that patients do not seek the help they require based on not wanting to disturb nurses who are busy with other interventions (Byrnes, McRae and Mudge, 2023;

Murray *et al.*, 2024), it is clear that interventions, strategies and policy is required to ensure adequate nurse staffing in order for patient to receive the fundamental care that they require.

Furthermore, the findings presented in chapter 6 in relation to the nurse-reported factors that contribute to missed nursing care reflect the perceptions of nurses globally with inadequate staffing identified as one of the most frequently reported reasons for missed nursing care in a recently published systematic review (Gong *et al.*, 2025). These findings have important implications and must be considered in relation to the development of nurse recruitment and retention strategies and policies. As the reports of inadequate staffing come from the voices of nurses who have first-hand experience of the challenges associated with delivering patient care in hospital environments, it is vital that their voices are listened to and their valuable contributions are considered and used to develop real-world interventions that will be implemented in hospital settings.

Adequate levels of nurse staffing are also an important consideration in relation to the findings presented in chapter 6. In order to deliver on the provision of additional post-procedure care and care tailored specifically to the needs of medical patients and transfer patients, adequate levels of nurse staffing will be required. Whilst this research has offered a contribution to the field of research on preventing adverse events by identifying nurse-modifiable factors that may contribute to a reduced risk of the studied adverse events, implementing these nursing interventions will require a focus on ensuring adequate staffing.

Whilst this research does not offer a unique contribution in relation to the identification of inadequate nurse staffing, it adds to the abundance of evidence highlighting the shortage of nurses and strengthens the argument for nurse staffing to be prioritised both in an Irish and international context in order to improve patient safety and preserve nurse well-being. This research further supports the progress that is currently being made in an Irish context in relation to safe nurse staffing. The establishment of a Taskforce on Staffing and Skill Mix for Nursing by the Department of Health in Ireland in 2014 was a pivotal development which propelled the momentum of the safe staffing movement in Ireland in relation to nursing care. This taskforce has developed a staffing and skill mix framework and a series of recommendations for implementing the framework on a national, regional and local level. This framework placed emphasis in the on-going need for quality research in an Irish context in relation to nursing care, and more specifically nurse staffing and nurse-sensitive patient outcomes (Department of Health, 2018). Therefore, this research has contributed to the

recommendation of the framework by investing in nursing-sensitive adverse events, the frequency of missed nursing care and the factors, such as inadequate staffing, that contribute to missed care. The findings of this current research also further support the recommendations of the framework by recognising the need to focus on nurse recruitment and retention strategies, the measurement and monitoring of nurse-sensitive patient outcomes, the assessment of missed care events and the overall need to ensure nurse staffing levels in order for safe and effective patient care to be delivered.

7.12 Nurse well-being, missed nursing care and adverse events

The bi-directional relationship between nurse well-being and adverse patient outcomes is a well-recognised phenomenon and an important consideration in relation to the findings of this research. The rates of nursing-sensitive adverse events identified through this research and the previously demonstrated association between nurse burnout and emotional exhaustion and poor patient outcomes such as the development of a range of adverse events (Jun *et al.*, 2021) strengthens the argument for the urgent need to address nurse staffing shortages and improve working conditions for nurses.

The impact of adverse events and missed nursing care on nurse well-being provides further rationale for the prioritisation of the development of strategies to prevent and reduce the occurrence of adverse events. Missed nursing care has been shown to be associated with moral distress and job dissatisfaction. Nurses who have been unable to deliver the required care to their patients reported that they experienced moral distress, turmoil and felt as though they were not performing well in their job (Janatolmakan and Khatony, 2022). This impact of missed care on nurse well-being and job satisfaction further highlights the urgent need to develop policy to ensure safe levels of nurse staffing in order to reduce the frequency of missed nursing care.

A potential solution that may contribute to improved nurse well-being and patient outcomes include the designation of time during huddles for nurses to voice their quality and safety concerns. Encouraging such conversations may allow nurse managers and those in leadership roles to empower frontline nurses to participate in the implementation of changes that will improve their work environments and improve patient safety (Harvey, 2024).

Furthermore, decompression huddles may also offer a solution to missed nursing care and contribute to the prevention of adverse events. According to Harvey et al. (2024) decompression huddles held towards the end of a shift will enable nursing teams to identify

and prioritise remaining care interventions and work together to ensure that all essential care is delivered. This will contribute to positive nurse well-being by enabling nurses to complete their shift feeling confident that they have addressed all necessary care interventions.

Recruitment of new nursing staff alone is an insufficient solution to safe staffing levels as the retention of experienced nurses is essential to the provision of safe and high-quality care. In order to reduce burnout and intent to leave, increase job satisfaction and nurse well-being and retain nursing staff, the development of policies on safe nurse staffing levels and the fostering of supportive work environments for nurses must be prioritised (Drennan, 2025).

7.13 Caring for Ireland's ageing population

Many developed countries, including Ireland, are set to experience population ageing with the proportion of people aged 65 years and older continuing to increase over the next thirty years (Central Statistics Office, 2025a). There are currently approximately 861,000 people aged 65 and older in the Irish population (Central Statistics Office, 2025b), however this is projected to rise to approximately 1.8 million by 2057 (Central Statistics Office, 2024). As previously discussed, older people are particularly vulnerable to missed nursing care and adverse events as a result of their complex care needs (Bail and Grealish, 2016), therefore the rise in the proportion of older people in the population is of concern for the Irish healthcare system.

According to Walsh and Kakoulidou (2025), significant increases are projected for the demand for both short and long stay care and for home services for older people by 2040. Their findings indicate that short stay bed capacity requirements are expected to increase from 3,745 beds in 2022 to between 6,431 and 7,265 beds by 2040. As the findings presented in chapter 5 have demonstrated that older patients who are discharged from hospital often require additional care outside of acute hospital settings on discharge, the projected increased in long stay bed capacity and home care support requirements is an important consideration when planning future healthcare provisions. According to Walsh and Kakoulidou (2025), long stay bed capacity requirements are expected to increase from 29,579 beds in 2022 to between 47,588 beds and 53,266 beds by 2040. Additionally, home support hour requirements are expected to rise from 28.7 million hours annually in 2022 to between 44.9 million and 54.9 million hours by 2040. This projected increase in beds and home care requirements also reflects an increase in the demand for nursing care. However, a challenge for healthcare systems worldwide is the global shortage of nurses which poses a threat to

patient safety and healthcare quality with insufficient nurse staffing levels widely recognised as a factor that contributes to poor patient outcomes (McHugh *et al.*, 2021). Concerningly, Boniol et al. (2022) estimate a projected shortage of 4.5 million nursing personnel in 2030 with a workforce stock of 36.27 million nurses required by 2030. These figures raise concern for the sufficient provision of care for older people in the future both nationally and internationally.

Recent research has indicated that given Ireland's heavy reliance on migrant nurses due to the emigration of Irish nurses in search of better working conditions, there is an urgent need to increase the training of nurses in Ireland. Additionally, there is also a need to improve nurse retention through efficient nurse workforce planning systems to ensure future self-sufficiency of the Irish nursing workforce (Chima, Renjith and Humphries, 2026) in order to meet the care demands of the older population.

As previously discussed, the economic cost of nursing-sensitive adverse events is significant (Bail *et al.*, 2015; Slawomirksi, Auraaen and Klazinga, 2017; Murphy *et al.*, 2021). Given the rates of occurrence of these types of adverse events in older patients, as demonstrated through this research, and due to the ageing nature of the Irish population, the projected economic impact of nursing-sensitive adverse events is concerning with €91.3 million currently being spent annually by the Irish healthcare system due to adverse events (Murphy *et al.*, 2021). Therefore, it is imperative that the Irish Government consider this cost in the context of the projected increase of the proportion of older people in the population and develop a plan to manage the economic burden of care for older people. Also, the use of HIPE data for enabling activity-based funding (HIQA, 2018) highlights the importance of ensuring that the rates of adverse events recorded in administrative datasets are accurate in order to ensure that hospitals are appropriately reimbursed. Inaccurate data has a negative effect on hospital reimbursement (Hughes *et al.*, 2019), therefore accurate recording of the rates of these events must be prioritised in order to facilitate sufficient financial planning to cope with the true cost of adverse events in the older population going forward. Furthermore, the economic burden of adverse events also demonstrates an urgent need to invest time and resources into developing strategies targeted towards reducing missed nursing care and nursing-sensitive adverse events, which will in-turn reduce healthcare expenditure.

Given the rates of adverse events in older patients identified through this research and the projected increase in the proportion of older patients in the population, coupled with the

shortage of nursing and economic impact of adverse events, efforts must be made now to future-proof care provision and plan healthcare capacity in order to ensure that the Irish healthcare system will be capable of providing for the healthcare needs of the older population (Walsh and Kakoulidou, 2025). This research provides important findings and evidence that may be useful in informing the policies and strategies that will be required in order to meet the care demands of the ageing Irish population.

7.14 Chapter conclusion

It is evident from this discussion that research conducted to produce the studies presented in chapter 3, 4, 5 and 6 has enabled the aims and objectives of this research to be met. The best approach to chart reviewing was determined as a result of the scoping review and the rates of the four studied nursing-sensitive adverse events in older patients in an acute hospital setting have been identified and validated within the HIPE data as a result of the validation study. Furthermore, the objectives relating to the identification of factors associated with the nursing-sensitive adverse events and the measurement of missed nursing care from both nurses' and patients' perspectives have been met through the research conducted to complete the studies presented in chapters 5 and 6, respectively. These findings have built upon the previous literature that has been published or has supported the findings of other researchers who have explored similar research topics. Nevertheless, and in light of the limitations that will be discussed in the following section, further research is warranted to provide a more in-depth understanding of some of the results and interpretations presented. The discussion of the findings of this research in relation to previously published literature demonstrates the contribution that this study has made to the field of research on patient safety and healthcare quality in the context of nursing-sensitive adverse events and missed nursing care.

Chapter 8 : Conclusion

The overall contribution of this work has been demonstrated in the previous chapters. This includes an important contribution in relation to the methodological approaches to chart reviewing and validating administrative data, establishing rates of nursing-sensitive adverse events, missed nursing care and the delivery of fundamental care. This chapter provides an overview of the strengths and limitations of this research. Furthermore, the future research implications and the clinical and policy implications of this research have also been highlighted. Although this research offers valuable findings, further research is warranted to further advance the field of knowledge on these topics and develop solutions and strategies to reduce nursing-sensitive adverse events in older patients and enhance the quality of healthcare in acute hospital settings. Nevertheless, this study suggests several potential clinical and policy level implications which also may be useful in reducing the burden of adverse events and missed nursing care on both patients and healthcare systems. This chapter concludes by providing some concluding statements to unify the findings of the research and demonstrate the value of their contribution in the context of patient safety and healthcare quality for older patients.

8.1 Strengths

There are many strengths of this study which lend themselves to the valuable contributions that the findings presented in the previous chapter offer. The strengths associated with each individual study are outlined within chapters 3, 4, 5 and 6 therefore, this chapter will provide an overview of the general strength of the overall research project.

A major strength of this project was the co-productive process that was used to develop the study materials used in this research project. A study-specific structured chart review protocol and data collection instrument, as outlined in chapters 4 and 5, was co-produced by members of the research team, various healthcare professionals from different clinical backgrounds. The wealth of knowledge that healthcare professionals contribute to co-produced research has previously been reported by Ward et al. (2018) as a study strength that ensures that interventions are grounded in real-world experience. Furthermore, the benefits of incorporating the perspectives of healthcare professionals from various clinical backgrounds have previously reported (Martin *et al.*, 2022). The co-production process that facilitated this research has significantly strengthened the overall study by enabling the perspectives of healthcare professionals who have first-hand experience of the clinical

setting involved in the research to inform the development of the study materials and ensure that they were relevant to the context within which they were used.

Another strength associated with the development of the chart-review protocol and data collection instrument was the collaboration with a chart review expert from Dalarna University in Sweden. Dr. Unbeck provided a template for the two-stage review, advised on variable selection and provided training for the chart reviewers. Chart reviewer training is a key methodological consideration when designing chart review studies (Vassar and Holzmann, 2013) which contributed to data quality assurance in this study. Input and expertise from such an expert in chart review methodologies contributed to the strength of the review process and ensured that the chart review was robust.

According to Vassar and Holzmann (2013), a common error associated with conducting retrospective chart reviews is the omission of a set of standardised guidelines to be used to guide the review process. Therefore, in line with recommendations from Vassar and Holzmann (2013), use of a standardised data abstraction form such as the structured chart review protocol and data collection instrument facilitated the standardisation and consistency of data being collected by both the clinical research nurse and the PhD student. Furthermore, the opportunity for both members of the chart review team to work together, discuss the admissions being reviewed and make clinical judgements further strengthened the chart review process.

The model 4 hospital which participated in this research significantly contributes to the strength of this study. Although only one hospital was included, the participating hospital was a university teaching hospital with a large population of both nurses and patients. Such volumes of nurses and patients was a strength of this study as it provided a large population from which both nurse and patient survey participants could be recruited. Furthermore, nurses employed in and patients receiving care in all adult general wards, including surgical and medical wards and intensive care units, were eligible for participation therefore, this provided data from a range of departments and specialties. Similarly, given the large population of both secondary and tertiary care patients, in addition to some national specialty patients, the choice of including this type of model four hospital contributed to a sample that was representative of a broad range of patient complexities.

An additional strength related to the type of hospital which participated in this research was its shared characteristics of healthcare settings with large populations both nationally and

internationally, who are faced with similar challenges such as patient acuity, resource and staff shortages and managing care delivery for both complex and routine patients. This demonstrated the magnitude of which the findings of this research are generalisable and applicable to healthcare settings both nationally and internationally. As demonstrated in previous research with an aim of facilitating benchmarking through the measurement of harm (Mayor *et al.*, 2017), the rates of adverse events identified in this study may be useful as a benchmark to compare adverse event rates across different hospital settings and countries.

Furthermore, a large sample size of 1,000 charts that were selected randomly, with no knowledge of whether an adverse event was present or not, was a strength of this study. The use of a random sample in chart reviews with a primary aim of sampling to discover adverse events is a critical methodological consideration (Griffin and Resar, 2009). The large number of charts that were reviewed contributed to the generalisability of the chart review findings and the random selection of sample of available charts reduced the risk of bias and contributed to internal validity (Kaji, Schriger and Green, 2014) as the reviewers were unaware whether the admission within the chart they selected had an adverse event until review stage one had been completed.

In relation to the survey component of this research, the initial plan for these surveys to be self-administered contributed to their strength as the anonymity of participants is protected in self-administered surveys (Parahoo, 2014). However, many of the patients required assistance with completing the surveys and therefore many responses were researcher-administered which, as outlined within the limitations section, may have compromised the anonymity of the patients. However, no personal identifiable data were collected, therefore the patients identity remained anonymous once the surveys had been placed in the survey collection boxes. Nevertheless, the availability of the researcher to sit with patients and assist them with completing the survey is a strength of the study which contributed to the number of surveys which were completed by patients. Furthermore, the presence of the researcher on the ward ensured that both nurses and patients could easily access information about the project and consider participating in the project.

Furthermore, using validated survey tools was another strength of this study that contributes to the robust nature of the overall methodology used to conduct this research. Validated survey instruments are survey tools that have been extensively tested and measured to ensure

that they accurately capture data relating to the phenomena being studied (Jones, Baxter and Khanduja, 2013). Therefore, using validated survey tools which have been used in many contexts, healthcare settings and countries in this study ensured that the survey instruments were valid and reliable.

The strengths of this research project that have been outlined through this chapter demonstrate the value that this research may contribute to the field of research on nursing-sensitive adverse events, fundamental care delivery and missed nursing care.

8.2 Limitations

The specific limitations associated with each of the studies presented in chapter 3, 4, 5 and 6 have been outlined within the respective chapters. The limitations discussed within this chapter relate to the limitations and challenges faced in relation to the overall study.

The findings of the study overall could be seen to be limited by the inclusion of only one tertiary university hospital in data collection across studies. The inclusion of one model 4 hospital limits the generalisability of the findings to that specific hospital model. The inclusion of multiple hospital sites in this research may have allowed for a more in-depth understanding of missed nursing care and the rates of nursing sensitive adverse events through the comparison of similarities and differences across various hospital settings and models (Heale and Twycross, 2018). As model 4 hospitals have higher bed numbers and provide a broader range of sub-speciality care than model 3 hospitals (Health Service Executive, 2023), higher rates of adverse events may be identified in model 4 settings that deal with more complex patients with acute needs. Therefore, conducting a chart review in additional model hospitals such as model 2 or model 3 hospitals may have allowed the rates of nursing-sensitive adverse events in less acute and high-pressure settings to be understood. Furthermore, conducting surveys measuring missed nursing care at various model hospital sites may have allowed for a comparison between the levels of missed nursing care in the model 4 and the levels of missed nursing care in lower model hospitals that potentially experience less patient acuity and complexity. However, it was not feasible to include more than one hospital site or model in this research due to the time, labour and resource constraints of the project, and although subject to limitations, the focus on one hospital allowed for complete immersion and facilitated an in-depth exploration of this research topic at the participating hospital site. Nevertheless, it would be interesting to explore the

comparison between rates of nursing-sensitive adverse events and levels of missed nursing care across different hospital models in future research.

Although frailty assessments are a standardised component of the nursing documentation reviewed during the chart review, few admissions had frailty scores recorded by nurses. The dearth of data available within the charts reviewed during the retrospective chart review limited the opportunity for the association between frailty and the nursing-sensitive adverse events in this study to be assessed. Given that previous research has demonstrated an association between frailty and an increased risk of nursing-sensitive adverse events such as hospital-acquired infections, delirium and pressure ulcers (Alotaibi *et al.*, 2025), it would have been interesting to be able to explore this association in the context of the participating hospital. Given previous findings suggesting an increased risk of adverse events in frail older patients (Alotaibi *et al.*, 2025; Järbrink *et al.*, 2025), the lack of frailty assessments identified in this research suggests that further emphasis should be placed on ensuring that frailty assessments on admission are completed by nurses. The completion of such documentation ensures that a patient's baseline frailty status is recorded. Capturing a patient's baseline frailty score will allow their risk, on admission, of adverse events to be measured. Additionally, a baseline frailty score is important as it can act as a benchmark which can be used to compare and monitor functional status throughout the course of a patient's stay in hospital and potentially detect functional decline.

The inclusion of healthcare professionals from various backgrounds was an essential component of the co-productive process used to conduct this research however, the lack of patient involvement in the co-production of the study materials is worth acknowledging as a study limitation. Similar potential limitations have been reported by Martin et al. (2022) who also placed more emphasis on the collaboration between researchers and healthcare professionals in their development of a transdisciplinary assessment tool for use in acute stroke units. As this study mainly sought to focus on aspects of the recording of adverse events, expertise from healthcare professionals was considered more beneficial and relevant. Although patients were not directly involved in the series of co-production meetings that guided the development of the chart review protocol and data collection instruments, a patient representative, who was also a co-researcher on this project, was consulted in relation to the development of the project, the study materials and the overall process of conducting this research. Furthermore, a stakeholder group was assembled as part of the overall project associated with this research and meetings were held with the members of the stakeholder

group annually to discuss the development and progress of the research. In addition to the patient representative who acted as an advocate for the patient voice, additional patient representatives from Family Carers Ireland were members of this stakeholder group and advised in relation to the overall development and progress of the project. Nevertheless, additional collaboration with and inclusion of the patient perspective may have enhanced this work and will be considered in the development of future research.

One specific limitation of using a survey methodology to measure participants' perspectives on specific phenomena, such as missed nursing care in this study, is the lack of opportunities for participants to provide context or expand on their responses (Parahoo, 2014). Using surveys, rather than qualitative interviews, to elicit such responses from patients, may have hindered the depth of the information provided by the patients in relation to their experiences and perspectives on missed nursing care. Closed-ended questions, as used in this research, are more efficient in terms of analysis however, they can result in data that lacks depth. Nevertheless, open-ended questions require more complex analysis and present challenges such as difficulties synthesising responses (Albudaiwi, 2017). Although both have limitations, considering that the participants being recruited were healthcare professionals under time-pressure and adults aged 65 and over who may not be in the best of health, closed-ended question were deemed more appropriate as they are more concise and conveniently answerable.

Surveys have additional limitations as they can be difficult for patients who have issues with reading or writing (Parahoo, 2014). However, in an effort to overcome this challenge and minimise the exclusion of patients unable to read or write due to age or socioeconomic related reasons, the surveys could be completed by patients independently, or they could be researcher-administered with the researchers reading the questions to the participants and recording their answers. Self-administered surveys are advantageous as they ensure the anonymity of participants (Parahoo, 2014), however researcher-administered surveys are associated with various challenges such as anonymity limitations and response bias. Although no personal identifiable data were collected during the survey phase of the research, anonymity limitations due to the researcher-administered nature of many of the survey may have contributed to response bias. The researcher sat with and assisted many patients with completing the survey therefore it is possible that this contributed to social desirability bias, the most common form of response bias that occurs due to the interaction between the researcher and participant (Villar, 2008). Social desirability bias refers to the

tendency for participants to give a more positive description of a situation that aligns with a more socially acceptable narrative, rather than a true or accurate account (Kühne, 2018). Given that certain environments, such as hospital wards, have little privacy, the chance of response distortion due to social desirability bias is greater (Bispo, 2022). Therefore, it is possible that the conduction of these, surveys face-to-face in hospital wards may have resulted in response bias. Nevertheless, patients were informed that no personal identifiable data that could link them to their responses would be collected. It was also made clear to them that their responses would not in any way impact their care whilst in hospital.

Another limitation of this overall study was the inability to capture data in relation to care resistant behaviours. Care-resistant behaviours must also be recognised in relation to missed nursing care (Murray *et al.*, 2024). Therefore, the findings presented in this research in relation to both the frequency and reasons for missed nursing care and in relation to the development of nursing-sensitive adverse events, must be interpreted with consideration of care-resistant behaviours that contribute to the challenged nurses face in relation to delivery safe fundamental care.

The challenges presented in relation to each of the studies in chapters 3, 4, 5 and 6 and the challenges discussed in this chapter demonstrate that this overall research project is not without its limitations. Therefore, it is important to recognise these limitations when considering the findings of this research. The limitations discussed highlight potential areas for further research and demonstrate the learning that has been gained through this research process. Furthermore, notwithstanding the outlined limitations, this research offers valuable contributions to the fields of research on chart review methodologies and validation of nursing-sensitive adverse events within administrative datasets, rates of and factors associated with nursing-sensitive adverse events and missed nursing care and the delivery of safe and high-quality fundamental nursing care.

8.3 Future research implications

Further research in relation to identifying rates of adverse events and measuring missed nursing care would benefit from the inclusion of different hospital types to allow for a more in-depth understanding of the impact of the type of hospital on the rates of adverse events experienced and the levels of missed nursing care. Including multiple hospitals in future research would enable the comparison of similarities and differences across different hospital types (Heale and Twycross, 2018). Therefore, conducting chart reviews and surveys

in model 1, 2, 3 and 4 hospitals in future research could provide more in-depth information on the rates of nursing-sensitive adverse events and levels of missed nursing care whilst taking into consideration the variation of patient acuity and complexity, the range of specialty and sub-specialty care provided, resource availability and staffing.

The co-productive processes used to conduct this research were instrumental to this study and added significant value to the overall project. Future research evaluating the co-production element of the research would be beneficial for providing recommendations, based on the lived-experiences of those involved in co-production, to inform improvements in future co-production processes (Pallesen *et al.*, 2020). The evaluation of co-productive processes in healthcare and health services research has previously been demonstrated by Ward et al. (2018). As outlined by Ward et al. (2018), in order to reduce social desirability in the evaluation of the co-productive processes from the perspective of healthcare professionals involves, this further work should be carried out by researchers who are independent of the initial co-productive process. As demonstrated by Pallesen et al. (2020), conducting interviews with co-production participants to measure and evaluate their experiences of the co-production process would be a complementary piece of research to follow-on from this study. Given that there are various challenges associated with co-production, as highlighted in previous chapters, an evaluation of the experiences of those involved in the co-productive process would facilitate further learning and improvement of future research combining clinical and academic perspectives.

The experience of being immersed in the hospital setting through this research and during the data collection phase of the project resulted in many interactions with healthcare professionals who voiced their opinions on missed nursing care. Such interactions and conversations resulted in suggestions from hospital staff which included incorporating the perspectives of additional healthcare workers and hospital staff in future research investigating missed nursing care and nursing-sensitive adverse events. For instance, the inclusion of perspectives from hospital staff working in kitchens preparing, distributing and collecting patient meals was an interesting suggestion which could potentially yield relevant information in relation to the nursing care that patients receive in relation to nutrition and feeding in future research. Due to the time and labour constraints of this project, the addition of a qualitative phase to this research was not feasible. However, based on the interactions with healthcare professionals and staff in the hospital, further research incorporating qualitative interviews with nurse managers and nurses would yield important and relevant

findings in the field of missed nursing care and nursing-sensitive adverse events. Additionally, qualitative focus group interviews with nurses would also be useful to inform further research which is required to develop a more succinct tool to measure missed nursing care in acute hospital settings on a continuous basis.

Furthermore, as a survey methodology does not give respondents the opportunity elaborate, clarify or add additional context to their responses (Parahoo, 2014), the addition of a qualitative interview phase may have yielded a more in-depth understanding of patients' perspectives on missed nursing care. As the patient surveys were often researcher-administered, in that the researcher read the questions to the participants and recorded their answers, a significant amount of time was spent sitting with patients and listening to their verbal responses in relation to the quality of care they received whilst in hospital. These engaging conversations were enlightening and demonstrated the wealth of information that could be gathered through qualitative interviews with patients. Therefore, in relation to further research, consideration should be given to potentially using qualitative interviews to measure patients' perceptions of missed nursing care and the quality of their care and allow them the opportunity to voice their opinions on their care.

Although this research sought to explore the reasons for missed care according to nurses, it would have been interesting to assess patients' perspectives on reasons for missed nursing care. Therefore, future research should focus on understanding patients', in addition to nurses', perceptions of the factors that contribute to missed nursing care. As the recommendations outlined in Chapter 6 highlight the requirement for the development of a succinct tool to measure both nurse and patient perspectives of missed nursing care, it seems appropriate that consideration be given to the inclusion of the patient viewpoint on reasons for missed nursing care in the development of such a tool.

Furthermore, although nurses and patients often perceive missed nursing care in a similar manner and recognise the same care interventions that are missed, previous reports of misalignment between nurses' and patients' perceptions of missed nursing care demonstrates that patients may be able to identify unmet needs that nurses may not consider (Bagnasco *et al.*, 2020). The discrepancies in nurses' and patients' perception reported by Cohen et al. (2024) and Moreno-Monsiváis, Moreno-Rodríguez and Interial-Guzmán (2015) highlights the variation between nurses' and patients' priorities in terms of care delivery, with nurses potentially placing more focus on medical aspects of care and patients expressing more

emphasis on physical and emotional care needs. Given these differences, the continued inclusion of the patient voice in research measuring missed nursing care is important in order to facilitate a patient-centred care culture within hospital settings. Therefore, future research informing the development of a tool to measure both nurses' and patients perspectives of missed nursing care is required.

In relation to oral care, it would have been beneficial to get an insight into the number of patients who were able to clean their teeth independently and the number of patients who could report having the required products and equipment to clean their teeth. Whilst the survey was useful in identifying whether nurses asked patients about or assisted them with their oral care, given the barriers identified by Murray et al (2024), it would be interesting to know whether the patients who participated in this research were either provided with the necessary products or asked if they had sufficient products such as toothbrushes and toothpaste. Further research exploring missed oral care may benefit from the collection of such data in order to provide further clarity in relation to patients' needs. Furthermore, this type of knowledge may also be useful in informing the development of strategies to prevent missed oral care by providing an understanding as to whether patients require more specific nursing interventions or whether focus is needed on ensuring that all patients have the required equipment and products to enable them to maintain their oral health.

Given the somewhat contradictory findings identified among the associations between ward moves and adverse events, future research is required to facilitate a more in-depth understanding of this relationship. Further exploration of additional factors such as communication and handover processes during ward transfers, which have been shown to be influential in terms of patient safety incidents (Bonnici *et al.*, 2020), may contribute to a better understanding of the impact of ward transfers on the increased or decreased likelihood of developing adverse events. Further exploration of the effect of ward moves using hospitals where there is a high prevalence of transfers (Webster *et al.*, 2016) may yield more explanatory findings that can provide further clarity in relation to the association identified through this research.

8.4 Clinical and policy Implications

The development of local and global guidelines for monitoring missed nursing care may enable benchmarking of missed care levels and facilitate a more systematic approach to nursing practices across healthcare settings (Gong *et al.*, 2025). As highlighted by Kalisch

and Williams (2009), the use of the MISSCARE survey tools in acute hospital settings facilitates the collection of important data that represents a true reflection of the nursing environment at the point of delivery from the perspectives of those with first-hand experience. The MISSCARE survey and MISSCARE Survey-Patient offer a channel through which nursing can be evaluated and improved upon by providing nurses and patients with an opportunity to have their voices heard. Although the findings of this research highlight the requirement for the development for a more succinct measurement tool that can be used to measure both patients' and nurses' perspectives, in agreement with Kalisch and Williams (2009), the MISSCARE surveys, or a more succinct adapted version, may offer a progress improvement mechanism whereby these surveys can be administered at regular intervals to continuously assess and monitor levels of missed nursing care and the factors or reasons that contribute to missed nursing care.

As highlighted through the limitations of this research, the lack of recorded frailty scores within the patients' medical charts has significant clinical implications. Therefore, this research has demonstrated that further emphasis be placed on the recording of baseline frailty scores for all patients over the age of 65 years old. The previously demonstrated association between frailty and an increased risk of nursing-sensitive adverse events such as hospital-acquired infections, delirium and pressure ulcers (Alotaibi *et al.*, 2025) further reiterates the importance of gathering a baseline frailty score to understand the extent of older patients' vulnerability to acquiring nursing-sensitive adverse event during their hospitalisations. Knowledge of older patients' frailty scores will allow nurses to make informed decisions in relation to additional care or close monitoring of patients with higher clinical frailty scale scores who are therefore more vulnerable to experiencing nursing-sensitive adverse events. Given the correlation between high clinical frailty scores and length of stay, admission rates, reattendance and mortality (Ellis *et al.*, 2025), the implementation of frailty screening in acute hospital settings must be supported by policy and nursing leadership. Furthermore, a baseline frailty score enables nurses to use this measurement to benchmark a patient's vulnerability and compare and monitor their functional status throughout their stay in hospital. An emphasis on collecting baseline frailty scores on admission may also help to detect functional decline in patients throughout their hospitalisations.

Another clinical implication of this research is the development and evaluation of nursing care bundles which can be used to prevent multiple adverse events. Combining several of the effective nursing interventions outlined by Bail and Grealish (2016) into bundles aimed

at mitigating patients' risks of developing the four studied adverse events that are indicative of the 'Failure to Maintain' conceptual framework has potential benefits for improving patient safety. The effectiveness of care bundles in preventing pressure ulcers (Floyd *et al.*, 2021; Demir and Karadag, 2025), supports the clinical implication that the development of care bundles with a combination of interventions targeted at reducing older patients' vulnerability to multiple nursing-sensitive adverse events may result in more positive patient outcomes.

Furthermore, nurses in leadership roles should promote enhanced communication within nursing teams through safety huddles and systematic handover approaches (Gong *et al.*, 2025). This research implies that a focus on safety huddles in the form of brief team meetings which take place in the ward environment and allow nurses to communicate, collaborate and discuss patient safety concerns (Glymph *et al.*, 2015) may enhance communication. Safety huddles have been shown to foster collaborative safety efforts between nurses and demonstrate the potential to improve patient safety outcomes (Ghoul *et al.*, 2025). Nursing safety huddles should be promoted as safe spaces where nurses are empowered to discuss safety and quality concerns and participate in the identification and implementation of changes to improve nursing work environments and patient safety within acute hospital settings (Harvey, 2024).

Furthermore, the need to incorporate specific care-related topics into nurses' and multidisciplinary safety huddles is another clinical implication of this research. Based on the findings from the study presented in chapter 6, the care interventions which have been identified as most frequently missed should be routinely discussed in order to improve their visibility and ensure that they are being completed on a day-to-day basis. Therefore, oral care, mobilisation and effective communication with patients in relation to ensuring that nurses introduce themselves to their patients and ensure that that patients are aware of who is responsible for their care should be frequently discussed in safety huddles to bring attention to these basic yet fundamental care interventions and to ensure that they do not get missed.

Another clinical implication, which has also been highlighted by Harvey (2024) is the concept of decompression huddles. The results of this research imply that incorporating decompression huddles towards the end of shift may help to reduce missed nursing care by ensuring that all essential care has been delivered by the nursing team in advance of

handover. The effectiveness of huddles at improving team and work processes demonstrates their potential to have a positive impact on clinical outcomes (Pimentel *et al.*, 2021) and further supports the implementation of decompression huddles to enable nurses to work together to identify, prioritise and subsequently complete remaining nursing interventions by the end of their shifts. The concept of decompression huddles is also important in the context of nurse well-being. Designating time towards the end of shift to identify remaining interventions and complete them will empower nurses to feel confident that they have addressed all the care needs of their patients and reduce the stress associated with missed nursing care (Harvey, 2024) which contributes to job dissatisfaction and intention to leave (Algin, Yesilbas and Kantek, 2024; Azzellino *et al.*, 2025).

Given the impact of missed nursing care and the occurrence of nursing-sensitive adverse events on nurses' job satisfaction and intention to leave, it is evident that policy developments are required to support the recruitment and retention of nurses. The results of this study which demonstrate the magnitude of the impact of inadequate nurse staffing on missed care and patient outcomes, imply that urgent attention is required to ensure safe staffing levels in order to meet the care demands of the older population of patients in Ireland. The projected continuation of the global shortage of nurses (Buchan and Catton, 2023) further demonstrates the time-sensitive nature of the additional solutions required to ensure safe staffing levels in both Ireland and internationally. Ongoing evaluation of the impact of nursing-sensitive adverse events is required in order to determine safe staffing levels. The continuous monitoring of missed nursing care and nursing-sensitive adverse events is important as such information may be used to indicate of the adequacy of nurse staffing levels (Department of Health, 2018).

Although the understanding of the prevalence and consequences of missed nursing care, such as nursing-sensitive adverse events, has advanced, there has been little exploration, implementation and evaluation of strategies for reducing the impact of these concerns. The findings of this research imply that policymakers who are responsible for healthcare-related decisions must prioritise the provision of adequate support for nursing teams in terms of both essential resources and staffing. This research supports the recommendations outlined by Gong et al. (2025) which suggest the implementation of policies that delineate minimum staffing level requirements and enforce safe nurse staffing levels. Furthermore, nurse leaders should advocate for flexible nurse staffing models that account for real-time changes in patient acuity and demand (Gong *et al.*, 2025). Progress has been made in Ireland in relation

to safe nurse staffing with the development of the Department of Health's Framework for Safe Nurse Staffing and Skill Mix (Department of Health, 2018). The findings of this research further support the recommendations outlined within this report and highlight the continued need for focus to be placed on implementing strategies and policy to ensure safe nurse staffing levels. Moreover, as outlined within this framework and through the work of Drennan (2025), safe staffing levels are a priority for nurses in terms of improving nurse well-being, however a focus on recruitment alone will not ensure safe staffing levels. Policy changes to improve and foster supportive nurse work environments are required to promote the retention of nursing staff required and reduce intention to leave, burnout and job dissatisfaction among nurses.

8.5 Concluding statements

Overall, this research has provided valuable insights into the rates of nursing sensitive adverse events in older patients and levels of missed nursing care in an acute hospital setting in Ireland. The findings of this research have demonstrated the burden of nursing-sensitive adverse events such as pneumonia, urinary tract infections, pressure ulcers and delirium on both patients and the healthcare system. The validation of the recorded rates of these events within the HIPE data has highlighted the extent to which they are under-reported in hospital administrative data and made explicit the human and economic impact of the inaccurate recording of adverse events. Accurate rates of adverse events within hospital administrative data are vital for benchmarking across hospitals and countries and identifying best practices and opportunities for improving patient safety. Therefore, this research and its effective use of a structured chart review offers methodological guidance to future researchers and provides the foundations of a framework for conducting retrospective chart reviews to validate rates of adverse events in future studies.

In addition to highlighting best practices for recording and monitoring rates of adverse events and levels of missed nursing care, the findings of this study demonstrate the need to invest in strategies that are targeted toward the most vulnerable patients who are at a higher risk of adverse events. Medical patients, older patients, patients with multiple co-morbidities and those with longer lengths of stay should be prioritised in relation to the delivery of nursing care and resource allocation in order to reduce rates of nursing-sensitive adverse events.

The value of the patient voice in the context of measuring missed nursing care has also been highlighted through this research. The inclusion of the patient voice is an important aspect

of health services research which should be routinely incorporated into future research. As experts, given their first-hand experience of receiving nursing care, the patient perspective offers an insight into the lived experience of being admitted to an acute hospital setting where patients may be at their most vulnerable in relation to their health and autonomy. Furthermore, although nurses' and patients' perceptions of missed care may align, as previous research has demonstrated, there may also be discrepancies in their priorities in terms of care delivery. Therefore, the inclusion of patients' perspectives in research measuring missed nursing care may promote a patient-centred care culture in acute hospital settings.

Nevertheless, the nurse voice and perspective is equally important as it provides a valuable point of view from those on the frontlines who are faced each day with the pressures associated with working in acute care environments. Given their first-hand experience of delivering fundamental care, in the face of challenges such as patient acuity and unsafe staffing levels, nurses are the members of the population who are in the best position to provide feedback on their working environments and conditions. They deserve to be empowered to have their voices heard and responded to by healthcare systems and governing bodies.

The need to prioritise nurse recruitment and retention strategies is reiterated by the findings of this research. In order to reduce missed nursing care and nursing-sensitive adverse events, adequate nurse staffing is essential. Ensuring safe nurse staffing levels is imperative to nurse well-being, therefore, to recruit new nursing staff and retain experienced nurses, a focus on fostering a supportive work environment that aims to reduce nurse burnout, intention to leave and job dissatisfaction is essential.

Given the global shortage of nurses, the rapid ageing of the population in both an Irish and Global context, and the projected increase in the demand for nursing care for older patients who are more vulnerable to nursing-sensitive adverse events, the fostering of a culture within acute hospital settings which promotes patient safety and healthcare quality is of great importance. A joint focus on reducing and preventing missed nursing care and nursing-sensitive adverse events and adequately preparing to meet the care needs of the ageing population is required. Both workforce planning policies and additional funding will be required to deliver the necessary and fundamental nursing care associated with this

demographic shift and ensure that the safety of older patients in acute hospital settings is prioritised.

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Appendices

Appendix A - Research Outputs and Impact

Publications

Connolly A., Staines, A., Matthews A., Unbeck, M., Bail, K. and Kirwan M. (2025) 'Risk factors associated with nursing-sensitive adverse events in older hospitalised patients: A retrospective chart review', International Journal of Nursing Studies Advances (Under review)

Connolly, A., Matthews, A., & Kirwan, M. (2025). Nurses' and older patients' perspectives on missed nursing care contextualised within the Fundamentals of Care Framework: A cross-sectional survey. *International journal of nursing studies advances*, *9*, 100452. https://doi.org/10.1016/j.ijnsa.2025.100452

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A., & Kirwan, M. (2025). Validating adverse events in administrative healthcare data in Ireland: a retrospective chart review study. *BMC health services research*, *25*(1), 1113. https://doi.org/10.1186/s12913-025-13201-x

Connolly. A, Kirwan, M. and Matthews, A. (2024) 'A scoping review of the methodological approaches used in retrospective chart reviews to validate adverse event rates in administrative data', *International Journal for Quality in Health Care*, mzae037, doi:10.1093/intqhc/mzae037

Connolly, A., Kirwan, M. and Matthews, A. (2023) 'Validation of the rates of adverse event incidence in administrative healthcare data through patient chart review: A scoping review protocol' [version 1; peer review: 1 approved, 1 approved with reservations]. *HRB Open Research*, 6(21), doi:10.12688/hrbopenres.13706.1.

Oral presentations

Connolly, A., Kirwan, M. and Matthews, A. (2023) 'Validation of the rates of adverse event incidence in administrative healthcare data through patient chart review: A scoping review'. International Society for Quality in Healthcare's 39th International Conference, Seoul, South Korea

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A., & Kirwan, M. (2024). 'Validating rates of nursing-sensitive adverse events in administrative healthcare data in Ireland: A retrospective chart review study'. International Society for Quality in Healthcare's 40th International Conference, Istanbul, Turkey

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A., & Kirwan, M. (2024). 'Validating rates of nursing-sensitive adverse events in administrative healthcare data in Ireland: A retrospective chart review study'. Royal College of Surgeons Ireland 44th Annual International Nursing and Midwifery Research and Education Conference, Dublin , Ireland

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A., & Kirwan, M. (2024). 'COST2CARE: potential for safer care and reduced costs associated with older patients in acute hospitals using hospital discharge data'. Healthcare Systems Ergonomics and Patient Safety Conference 2025, Dublin, Ireland

Connolly, A., Matthews, A. and Kirwan, M. (2025) 'COST2CARE Measuring nurses' and older patients' perspectives on missed nursing care in an acute hospital setting in Ireland'.

International Society for Quality in Healthcare's 41st International Conference, São Paulo, Brazil

McCauley, R., Connolly, A., and Kirwan, M. (2025) 'Co-production to advance patient safety: a joint approach to addressing adverse events in Ireland'. International Society for Quality in Healthcare's 41st International Conference, São Paulo, Brazil

Poster presentations

Connolly, A., Matthews, A., & Kirwan, M. (2023). 'Validation of the rates of adverse event incidence in administrative healthcare data through patient chart review: Results of a scoping review'. National Patient Safety Conference 2023, Dublin, Ireland

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A., & Kirwan, M. (2024). 'Validating rates of nursing-sensitive adverse events in administrative healthcare data in Ireland: A retrospective chart review study'. National Patient Safety Conference 2024, Dublin, Ireland

Connolly, A., Unbeck, M., Bane, F., Bail, K., Craig, M., Matthews, A., Staines, A., & Kirwan, M. (2025). 'COST2CARE: Improving Visibility of Nursing Sensitive Adverse Events in Ireland'. International Council of Nurses Congress 2025, Helsinki, Finland

Connolly, A., Matthews, A., & Kirwan, M. (2025). 'Measuring nurses' and older patients' perspectives on and experiences of missed nursing care in an acute hospital setting'. Healthcare Systems Ergonomics and Patient Safety Conference 2025, Dublin, Ireland

Local oral presentations

Connolly, A. (2023) 'COST2CARE: Addressing the economic and human cost of hospital acquired and nursing-sensitive adverse events in older patients through optimal use of routine discharge data and measurement of missed nursing care', postgraduate research seminar, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2023) 'Validating Rates of Adverse Events in Administrative Data through Retrospective Chart Review', COST2CARE Project Stakeholder Meeting, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2023) 'Validating Rates of Adverse Events in Administrative Data through Retrospective Chart Review', COST2CARE Project Board Meeting, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2023) 'Validating the Rates of Adverse Events in Administrative Healthcare Data Through Chart Review – A Scoping Review', COST2CARE Project Board Meeting, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2023) 'Addressing the economic and human cost of hospital acquired and nursing-sensitive adverse events in older patients through optimal use of routine discharge data and measurement of missed nursing care', Research Exchange Event, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2024) 'A quantitative study of nursing sensitive adverse event rates and levels of missed nursing care in an acute hospital setting', Research Exchange Event, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2024) 'Validating rates of F2M adverse events in HIPE data through retrospective chart review and Investigating levels of missed nursing care in an acute

hospital setting through patient and nurse reported surveys', COST2CARE Project Stakeholder Meeting School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2024) 'Validating rates of nursing-sensitive adverse events in HIPE data through retrospective chart review and Investigating levels of missed nursing care in an acute hospital setting through patient and nurse reported surveys, Postgraduate Research Exchange Event**,** School of Nursing, Psychotherapy and Community Health Research Exchange Event, DCU, Dublin

Connolly, A. (2025) 'Validating adverse events in administrative healthcare data in Ireland: A retrospective chart review study', COST2CARE Project Board Meeting, School of Nursing, Psychotherapy and Community Health, DCU, Dublin (via Zoom)

Connolly, A. (2025) 'COST2CARE Missed Nursing Care: Survey Results', COST2CARE Project Board Meeting, School of Nursing, Psychotherapy and Community, DCU, Dublin

Connolly, A. (2025) 'COST2CARE Missed Nursing Care: Survey Results', COST2CARE Project Stakeholder Meeting, School of Nursing, Psychotherapy and Community, DCU, Dublin

Connolly, A. (2025) 'COST2CARE Project Dissemination: Conferences, Publications and Outputs', COST2CARE Project Board and Stakeholder Meeting, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Connolly, A. (2025) 'A quantitative study of nursing-sensitive adverse events and missed nursing care in an acute hospital setting in Ireland', PhD Student Research Exchange Event, School of Nursing, Psychotherapy and Community Health, DCU, Dublin

Abstract Books

Connolly. A, Kirwan, M. and Matthews, A. (2025) 'Measuring nurses' and older patients' perspectives on and experiences of missed nursing care in an acute hospital setting in Ireland', *International Society for Quality in Healthcare's 41st International Conference: Inclusive Health Systems: Navigating Challenges with Technology and Humanity.* World Trade Centre, São Paulo, Brazil, 12-15th October 2025. pp. 336-338. https://isqua.org/images/2025_Abstract_Book_Final_2.pdf (Accessed 2 November 2025)

Connolly, A., Unbeck, M., Bane, F., Bail, K., Matthews, A., Staines, A. and Kirwan, M. (2024) 'Validating rates of nursing-sensitive adverse events in administrative healthcare data in Ireland: A retrospective chart review study', *International Society for Quality in Healthcare's 41st International Conference*, Istanbul Lutfi Kirdar International Convention and Exhibition Centre, Instanbul. Turkey. Available at: https://isqua.org/media/attachments/2024/10/29/isqua-abstract-book-2024-v1.1-compressed.pdf (Accessed 11 February 2025).

Connolly, A., Kirwan, M. and Matthews, A. (2023) 'Validation of The Rates of Adverse Event Incidence in Administrative Healthcare Data Through Patient Chart Review: A Scoping Review', *International Society for Quality in Healthcare's 39th International Conference: Technology, Culture and Coproduction: Looking to the Horizon of Quality and Safety*. COEX Convention and Exhibition Centre, Seoul, South Korea, 27-30 August 2023. pp. 254-255. Available at: https://isqua.org/images/2024/pdfs/Final-Abstract-Book_compressed.pdf (Accessed 14 March 2024).

Modules and training

Research Integrity Online Training - Comprehensive (Early Stage Researchers)

NS5055: Qualitative Research Summer School

GS602 Postgraduate Tutoring Principles and Practice

PSYC609: Strategies for Getting Published

STAT1005: Quantitative Research Methods

Appendix B - Scoping Review Protocol

Validation of the rates of adverse event incidence in administrative healthcare data through patient chart review: A scoping review protocol

The work presented in this chapter has been published on HRB Open Research:

Connolly A, Kirwan M and Matthews A. (2024) 'Validation of the rates of adverse event incidence in administrative healthcare data through patient chart review: A scoping review protocol' [version 2; peer review: 2 approved, 1 approved with reservations], *HRB Open Research* 2024, **6**:21 (https://doi.org/10.12688/hrbopenres.13706.2)

As per DCU guidelines, due to copyright issues across different publishers, the PDF copies of the published articles in their final journal format cannot be included in the PhD thesis therefore, all published work must appear in manuscript format. The content presented in the thesis is correspondent with the content of the published papers, with the exception of minor variations due to formatting.

Abstract

Background

Patient safety is a key issue for health systems and a growing global public health challenge. Administrative healthcare data provide a coded summary of a patient and their encounter with the healthcare system. These aggregated datasets are often used to inform research and decisions relating to health service planning and therefore it is vital that they are accurate and reliable. Given the reported inaccuracy of these datasets for detecting and recording adverse events, there have been calls for validation studies to explore their reliability and investigate further their potential to inform research and health policy. Researchers have since carried out validation studies on the rates of adverse events in administrative data through chart reviews therefore, it seems appropriate to identify and chart the evidence and results of these studies within a scoping review.

Methods

The scoping review will be conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews. A search of databases such as PubMed, CINAHL, ScienceDirect and Scopus will be conducted in addition to a search of the reference lists of sourced publications and a search for grey literature. Following this, Covidence will be used to screen the sourced publications and subsequently extract data from the included sources. A numerical summary of the literature will be presented in addition to a charting based on the qualitative content analysis of the studies included.

Conclusions

This protocol provides the structure for the conduct of a review to identify and chart the evidence on validation studies on rates of adverse events in administrative healthcare data. This review will aim to identify research gaps, chart the evidence of and highlight any flaws within administrative datasets to improve extraction and coding practices and enable researchers and policy makers to use these data to their full potential.

Keywords

Administrative healthcare data, Patient safety, Adverse events, Validation, Chart review

Introduction

Patient safety is a key issue for health systems and a growing global public health challenge. The human cost of patient safety incidents is high with adverse events causing injury, disability or death and resulting in suffering for patients and family members. The financial and economic burdens of patient safety incidents are also of concern with further healthcare expenditure required for increased length of stays in hospital and additional tests, treatments and healthcare to be provided to patients (WHO, 2021b). The Harvard Medical Practice Study (Brennan et al., 1991) and the Institute of Medicine (2000) identified high rates of adverse events in hospital admissions and marked the beginning of the patient safety movement. This led to rates of adverse events becoming an important quality indicator across health systems. Adverse events have since been reported and measured however, challenges associated with the accuracy of their recording in administrative data has been widely acknowledged (Kim et al., 2022; Rodrigo-Rincon et al., 2015). Evidently, patient safety is a key healthcare quality concern and with adverse events as main contributors to patient harm, their monitoring and measurement is a major priority.

Routinely collected healthcare data are regularly collected for purposes other than research (Welk & Kwong, 2017). These data, frequently called administrative data, capture the patient's characteristics, their diagnoses, treatments and procedures and, essentially provide a coded summary of the patient and their encounter with the healthcare system (Healthcare Pricing Office, 2020).

The key events of a patient's stay in hospital are documented in a discharge summary within their clinical chart or in their electronic health record (EHR). Once a patient has been discharged from hospital, their chart is translated into alphanumerical data by professional coding specialists (Tang et al., 2017). In addition to a patient's discharge summary, clinical coders may also code information in documents such as nursing notes, consultation reports, progress notes, operative reports, pre- and post-operative reports and pathology reports (Healthcare Pricing Office, 2020). Nursing notes have previously been identified as important sources of data for clinical coders (Alonso et al., 2020; Doktorchik et al., 2020; Lucyk et al., 2017) and are particularly insightful in relation to identifying adverse events such as pressure injuries, which are a well-recognised quality indicator (Weller et al., 2022). The data captured by the alphanumerical codes include patient diagnoses, procedures, hospital services used and any complications that arose during a patient's stay.

Various classification systems such as the International Classification of Diseases (ICD) are used to code this data. The ICD translates diagnoses and other health-related issues from words into alphanumerical data, allowing for an efficient method of storing, retrieving, and analysing data (WHO, 2016). Coding systems such as ICD allow for a consistent and standard way of recording, reporting and monitoring diseases. ICD is the is used by all members states of WHO, therefore data can be shared, understood and compared across hospitals, regions and countries (WHO, 2023a). Various derived classifications or extensions of the fundamental ICD classifications have been developed and are used to monitor diagnoses in specific areas or settings (WHO, 2023b). Clinical coders follow clearly defined ICD coding guidelines to assign alphanumeric codes to each diagnosis or event recorded in a patient's chart (O'Malley et al., 2005). As the most widely used classification of diseases, ICD has had 10 iterations since 1900 (O'Malley et al., 2005). The 10th revision of the ICD (ICD-10), which contains more than 155,000 codes (DiSantostefano, 2009), has been widely used since its development about 30 years ago (WHO, 2021a). An 11th revision of the ICD (ICD-11 was adopted by World Health Assembly in 2019 and came into effect in 2022 (WHO, 2023c). Various other coding systems such as the Current Procedural Terminology (CPT), which was developed by the American Medical Association, are used to capture and assign codes to aspects of healthcare data (Dotson, 2013) however, ICD is recognised globally with all WHO member states committed to using this classification system.

Administrative data are often used at national and international levels in health service planning and to inform policy and epidemiological, clinical and biomedical research (Hemkens et al., 2016). They have also been utilised for carrying out audits, developing financial strategies and determining the distribution of health resources (Burns et al., 2012). Their use in the evaluation of the quality of health care delivery has also been well-recognised (Clarke et al., 2019). Given that these datasets are often used for purposes other than those for which they were initially collected, their use in research and evaluation has been labelled as a secondary use (Jorm, 2015). Administrative data can contain rich and valuable information and their use in research has been increasingly recognised. These databases are advantageous for research as they allow research questions that require large sample sizes to be answered (Harron et al., 2017). Their potential to inform research to

enhance the efficiency of health systems and improve population health is well-documented and has led to their increased use in research (Jorm, 2015; Mitchell & Braithwaite, 2021; Moorthie et al., 2022). Patient safety researchers in particular have been increasingly recognising the potential of using administrative data for research purposes and for the monitoring and reporting of patient safety events (Raleigh et al., 2008). Given the association between lower registered nurse staffing levels, increased mortality rates and other adverse outcomes (Griffiths et al., 2016), validating administrative datasets and ensuring their accuracy may also be beneficial in encouraging the potential for these datasets to be linked to nurse staffing data to demonstrate the impact of nurse staffing on patient outcomes and highlight areas for improvement.

Given that these data are used to inform research that may help to improve patients' health and well-being and inform decisions that will impact on the quality of care that patients receive, it is vital that these administrative datasets are of high-quality and that precise and accurate diagnostic codes are used to generate them (Gologorsky et al., 2014; Ibrahim et al., 2021). Accurate measurement of adverse events is central to improving patient safety and healthcare quality by allowing priority areas to be identified, improvement strategies to be designed and implemented interventions to be evaluated (Classen et al., 2011). Accurate data on adverse events may contribute to the development, implementation and evaluation of more targeted and evidence-based patient safety interventions that can prevent adverse events and improve quality of care (Dillner et al., 2023). Although these datasets can provide rich and detailed information, they are subject to limitations. Previous studies indicate that administrative datasets are not always accurate and therefore, may contribute to inaccuracies in research and lead to poorly informed decisions (McGuckin et al., 2022; Nicholls et al., 2017). In particular, the inaccuracy of rates of adverse events in administrative data has been previously identified (Kim et al., 2022). Coding of primary diagnoses and procedures in administrative data is generally accurate however, coding of secondary diagnoses is less complete and therefore, adverse events rates are often underestimated (Raleigh et al., 2008).

Various challenges associated with using administrative data in research have been reported. Such challenges include not all data being abstracted from the patient chart, coded and represented in the database, incomplete data, difficulty determining the number of out-patient visits due to imprecise coding and difficulty capturing all relevant tests due to various diagnostic codes being used for the same test (McGuckin et al., 2022). The inconsistency in the definitions and terminology used in practice have previously been identified by Naessens et al. (2009) as another challenge to the accurate reporting of patient safety issues. Given that these administrative datasets are generated for purposes other than research, their accuracy and appropriateness for detecting adverse events is varied and their poor representation in some coding schemes has also previously been reported (Bates et al., 2003). The limited accuracy and variability of rates of hospital acquired infections in administrative data has also been identified as a challenge associated with using these datasets for research or benchmarking purposes. This has also resulted in calls for validation of these datasets and improvement of the algorithms used to generate them (van Mourik et al., 2015). Although the inaccuracy of administrative data for recording rates of adverse events has been previously reported by researchers such as Walther et al. (2021), who identified poor recording of postpartum haemorrhage within administrative data, the potential of these datasets to provide accurate information is also being recognised. Ackroyd-Stolarz et al. (2014) found a relatively high degree of accuracy in such datasets for identifying adverse events in older patients, therefore demonstrating the potential value of these datasets to inform research and improve patient safety.

Given the lack of consistency in the accuracy of these datasets for recording adverse events, there have been calls for validation studies to explore their reliability and investigate further their potential to inform research and health policy (Ehrenstein et al., 2016; Jorm, 2015; Nicholls et al., 2017). Again, the potential of these datasets to inform research and policy in relation to patient safety and the human and economic cost of adverse events is evident, however specific calls for validating rates of adverse events within these datasets have been made (Raleigh et al., 2008; van Mourik et al., 2015). Many researchers have since carried out validation studies on various administrative datasets therefore, it seems necessary to chart the evidence and results of these studies within this scoping review.

Validating administrative datasets is vital in determining the reliability and credibility of research based on this data and a common way of validating such data by manually comparing the coded data to the data recorded in a patient's healthcare record (Nissen et al., 2019). Patient charts have been referred to as the 'gold standard' reference point in many validation studies (Ehrenstein et al., 2016), therefore this scoping review aims to present an overview of how this method of validating administrative data has been used by previous researchers. Various methodological approaches such as the Harvard Medical Practice Study (HMPS) and the Global Trigger Tool (GTT) can be used to conduct chart reviews. The HMPS method is a two-stage approach involving a nurse review for the triggering of charts, followed by a physician review of triggered charts to confirm rates of patient safety incidents using set definitions (Brennan et al., 1991) The GTT was developed by the Institute for Healthcare Improvement in response to demands for a less labour-intensive approach to chart reviewing. This two-stage approach involves a 20-minute screening phase for a comprehensive list of triggers, followed a physician review of the triggers using broader definitions to confirm the occurrence of an adverse event (Rafter et al., 2015). The HMPS method is a two-stage approach involving a nurse review for the triggering of charts, followed by a physician review of triggered charts to confirm rates of patient safety incidents using set definitions (Brennan et al., 1991) The GTT was developed by the Institute for Healthcare Improvement in response to demands for a less labour-intensive approach to chart reviewing. This two-stage approach involves a 20-minute screening phase for a comprehensive list of triggers, followed a physician review of the triggers using broader definitions to confirm the occurrence of an adverse event (Rafter et al., 2015).

Inclusion criteria

In line with the JBI methodological framework for carrying out scoping reviews (Peters et al., 2020), the inclusion and exclusion criteria for studies that may potentially be included in the review will be defined by the population, concept and context screening criteria (Table 1).

Table 1. Inclusion and exclusion criteria

	Inclusion Criteria	**Exclusion Criteria**
Population	Sources that report on data derived from hospital-based patients.	Sources that report on data relating to any other population than hospital-based patients.

Concept	Sources that report on the validation of rates of adverse events in administrative data through reviews of patient charts.	Sources that do not primarily focus on the validation of rates of adverse events in administrative data through chart reviewing.
Context	Validation studies that have been conducted in hospital-based settings. There will be no limits placed on geographical location of where sources of evidence have been published.	Studies that report on validating data in any other setting than hospital-based settings.
Types of Evidence Sources	Full text peer-reviewed and non-peer reviewed sources (*e.g.,* grey literature).	Duplications and sources of evidence that cannot be made available in full text.
Language	Sources available in English.	Sources published in languages other than English.
Time period	Sources of evidence published between 1991 and 2023.	Sources of evidence published before 1991.

Population

As this is a protocol for a scoping review exploring the use of chart reviews to validate rates of adverse events in administrative data, the population of interest is hospital-based patients. These are Patients who have been discharged from hospital and have had the information within their medical chart extracted, assigned ICD codes, and recorded in administrative data Hospital-based patients' data will have been used to inform the publications that will be included in this scoping review, therefore making them the population of interest in this review. This research will seek to focus on identifying and charting the evidence of reviewing hospital-based patient's charts as a method of carrying out validation studies on rates of adverse events in administrative datasets.

Concept

Validating the accuracy of the coding of administrative data is key for ensuring that the policy, practice and research informed by such datasets is credible and robust (Nicholls et al., 2017). A review of patient charts is a common and effective way of validating the accuracy of administrative data as it allows the coded data recorded in the administrative dataset to be compared to the data maintained within hospital notes or discharge summaries within patient charts (Burns et al., 2012). The chart review methodology is an efficient way of determining whether the administrative data is an accurate reflection of the patient's physical medical chart (Nissen et al., 2019). The concept explored in this scoping review will be the validation of rates of adverse events in administrative data through chart review.

Context

Validation studies that have been conducted in hospital-based settings will be considered for inclusion in this review. Chart reviews that have been conducted as part of a validation of rates of adverse events in administrative datasets that have been carried out in any country will be included in this review. There will be no limitation on the context of the administrative data in order to allow a comprehensive review to be carried out.

Types of evidence sources

The types of sources of evidence to be included in this review will be left open to allow a comprehensive review of all available literature to be carried out. This will allow for the inclusion of various types of publications and therefore, should provide an in-depth presentation of the previous literature published in relation to using chart reviews to validate administrative data.

Methods

This scoping review will be conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping review (Peters et al., 2020). The JBI methodological framework will be used to guide this scoping review and ensure that the review is carried out appropriately.

Search strategy

The sources of evidence that will be included in this scoping review will be identified and collated using a three-step process as outlined by the JBI (Peters et al., 2020). The first step of this process will involve an initial search of two databases. The databases included in this initial search will be PubMed (MEDLINE) and CINAHL. Following this preliminary search, an analysis of the text words in the titles and abstracts of identified papers will be carried out. The indexing terms used to describe the retrieved papers will also be analysed. The second step of this process will involve using the identified keywords and index terms to perform a second search of all included databases. The databases included in this step will include PubMed (MEDLINE), CINAHL, Web of Science and Scopus. The third and final step of this process will involve a search of the reference lists of identified publications for additional sources of materials to be included in this scoping review. The reference lists of all publications selected from full text or those included in the review will be searched in order to ensure a comprehensive and in-depth search for existing literature. A search for grey literature will also be conducted to ensure that the review is as thorough as possible (Arksey & O' Malley, 2005). Grey literature refers to literature that is not commercially published and not usually available within standard databases. Examples of such literature include government reports, conference proceedings, theses and dissertations. A search for this type of literature is beneficial as many researchers publish through other means, such as those mentioned above, and therefore, this allows for the inclusion of a wider scope of material. Also, although such materials may not be included in the final scoping review, they can aid in identifying data sources, research currently being undertaken in the area or complete study reports (Pawliuk et al., 2021).

Sources included in this scoping review will be limited to publications written in English as it will not be feasible for the research team to translate publications published in other languages into English. Literature published over the past 30 years, between 1991 and 2023, will be eligible for inclusion in this study. This time period has been chosen as the patient safety movement was instigated by Brennan et al. (1991) about 30 years ago following their study that investigated the incidence of adverse events and negligence in hospitalised patients through the use of chart reviews.

A librarian from Dublin City University has been consulted and their advice was sought in relation to developing a sample search strategy (Table 2). Advice from the librarian will continue to be sought in relation to the search strategy to ensure that a comprehensive search of the available literature is completed. The research team will continue to work closely with the librarian throughout the data collection phase of the scoping review to make certain that repetitions of the search strategy result in all key and relevant literature being gathered.

Table 2. Sample Search Strategy

Search	Search Terms
S1	“discharge data” OR "hospital discharge data" OR “routinely collected data” OR "routinely collected discharge data" OR “administrative data” OR "administrative health data" OR "healthcare administrative data"
S2	verif* OR valid* OR compar* OR evaluat*
S3	S1 AND S2
S4	"chart review" OR "record review" OR "medical record review" OR "clinical notes" OR "retrospective chart review"
S5	S3 AND S4
S6	"adverse event*" OR "adverse outcome*" OR "healthcare acquired complication*" OR "patient safety incident*"
S7	S5 AND S6

Study selection

After the search for literature to be potentially included in this scoping review, all identified publications will be gathered and their citations will be stored in the bibliographic software Zotero.

The review management tool Covidence will be used to screen the collected publications and subsequently extract data from included sources. The references of the sourced publications will be imported to Covidence from Zotero and any duplicates will be automatically identified and removed. Using Covidence, two members of the research team will independently screen each of the imported studies for inclusion based on title and abstract examination. The researchers will individually assess the eligibility of each publication for inclusion in the review by making reference to the inclusion criteria. The researchers will each have the option of selecting yes, no or maybe at this stage of the selection process. Any conflicts that arise between the two researchers at this initial screening stage will be resolved by discussion and by consulting a third member of the research team to reach a final decision if necessary. Sources of data that received a yes vote from both researchers and are deemed potentially relevant based on the initial assessments made by researchers after examining the titles and abstracts will be retrieved in their full-text version. The full-text versions of potential studies for inclusion will be read and again, be assessed against the inclusion criteria by two researchers independently. The researchers will have the option in Covidence to include or exclude publications at this stage. If the

researchers vote to exclude any publication, they will be prompted to select a reason for exclusion. This decision-making process will be documented and reported in the scoping review and also displayed in a PRISMA flowchart. The researchers will then be guided to the consensus process. The consensus screen in Covidence highlights the number of conflicts between the two researchers and allows a final decision to be reached in relation to the inclusion of publications. In the event that any disagreement between the two members of the research team assessing the studies for inclusion in the scoping review arises, a third member of the research team will be consulted, and their input will be used to resolve such conflicts of opinions. In line with the JBI guidelines (Peters et al., 2020), a PRISMA flowchart of the review process will be developed and included in the review. This flowchart will detail the full flow of the review process from the initial search to the presentation of included sources.

Data extraction

The data extraction method for this scoping review will firstly involve the development of a data extraction template. As previously mentioned, the data will be extracted from the publications selected for inclusion in the scoping review within Covidence. The key information that will be extracted will include the following: name of author(s), year of publication, geographical location of study, aim of the study, methodology and key findings that relate to the research question. The data extraction method will be piloted and trialled on two or three sources to ensure that all relevant data is extracted. After this step, the extraction template will be updated to ensure that it is an appropriate method of collecting all necessary data. The piloting of the template will be carried out by two members of the research team as recommended by Peters et al. (2020). Once these data have been extracted, they will be exported to Microsoft Excel.

Data analysis and presentation

In line with the JBI methodological framework for scoping reviews, the extracted data will be arranged into a charting table in order to provide the reviewers and readers with a clear and descriptive summary of the publications included in the scoping review (Peters et al., 2020). According to Peters et al. (2020), the data charting can be an iterative process and therefore, the charting tool will be piloted, and the table will be continuously updated. The results of this scoping review will be mapped descriptively in order to answer the research question. A narrative account of the included literature will be presented. A numerical summary of the literature will be presented in addition to a qualitative content analysis of the studies included in the scoping review. Both the numerical summary and qualitative content analysis will be of a descriptive nature as the aim of a scoping review is to present an overview of the literature reviewed rather than an assessment of the quality of the included materials (Arksey & O'Malley, 2005; Peters et al., 2020). The descriptive numerical summary will include information such as the overall number of publications that have been included, the years of publication, the geographical location where the studies were conducted, and the types of study designs used. The qualitative content analysis will answer the research question by providing a description of the results of each of the included studies. The data extracted from the included studies will be presented in a tabular and descriptive format.

Considering the implications of the findings produced by a scoping review has been highlighted as an important part of the scoping review methodological framework (Levac et al., 2010). Given that this is viewed as an essential element of conducting a scoping review,

the implications of the results of this scoping review will be considered in relation to the identification of research gaps or calls for further research in the area.

Study status

The scoping review is currently in the preliminary stages of searching the databases. Step 1 of the three-step search strategy, as outlined by Peters et al. (2020) for identifying and collating sources of evidence to inform the scoping review, is currently underway. An initial search of databases for potentially relevant sources of evidence is being performed.

Conclusions

This protocol provides the structure for the conduction of a review to identify and chart the evidence of validation studies of rates of adverse events in administrative data. In line with the JBI guidelines (Peters et al., 2020), any deviations of the scoping review from the protocol will be acknowledged and discussed in the scoping review. It is widely acknowledged that administrative data have the potential to enhance patient safety and be used as a quality indicator however, given that the rates of adverse events in these datasets have been frequently reported as inaccurate, there is a strong rationale to conduct this scoping review. This review will aim to present an overview of the chart review approaches and tools that have been used to validate rates of AEs in administrative datasets and ultimately highlighting the need to develop a systematic approach to measuring rates of AEs in administrative data. This will allow the accuracy of these datasets to be improved, which will enable researchers and policy makers to use them to their full potential to improve patient safety and healthcare quality.

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Appendix C – Chart Review Protocol



Cost2care



COST2CARE: Addressing the economic and human cost of hospital acquired and nursing-sensitive adverse events in older patients through optimal use of routine discharge data and measurement of missed nursing care.

Data Collection Protocol

15th November 2023

Project introduction

Older patients make up the largest proportion of acute hospital inpatient populations across all countries. Common hospital acquired adverse events in this group contribute to higher healthcare costs, lower quality care, and less satisfactory patient experiences overall. Pneumonia, delirium, urinary tract infections and pressure ulcers are four commonly acquired complications that occur in older patients, known collectively as 'Failure to Maintain (F2M)' events. Nursing-Sensitive Adverse Events (NSAE) are outcomes that are affected, provided and/or influenced by processes or structures of nursing care but for which nurses are not solely responsible. The F2M events under examination in this study are nursing-sensitive patient outcomes, predominantly affected by the quality of nursing care provided.

In this study, we will determine how these nursing-sensitive outcomes (NSAEs) are currently represented in routinely available national discharge (HIPE) data in Ireland. A structured chart review will be conducted in one hospital site to validate the rates of NSAEs available in the HIPE data. The cost of these events to the Irish health service will be calculated using ICD10 data, length of stay, and other variables associated with Cost of Illness calculations. Through surveys, the human costs of missed care to both patients and caregivers will be further examined. The overall aim of this study is to demonstrate the potential for safer hospital care and reduced healthcare costs associated with older patients in acute hospitals in Ireland through routine measurement of missed nursing care in hospitals, and sustainable and accurate reporting of nursing-sensitive adverse events using routinely collected hospital discharge data.

Ethical Considerations

Ethical approval has been granted from the DCU Research Ethics Committee and from the Institutional Review Board for the Mater Misericordiae University Hospital. A consent waiver for the chart review element of this study has been granted by the Health Research Consent Declaration Committee based on the public interest associated with carrying out this research.

Nursing-Sensitive Adverse Events

This study will focus on four nursing-sensitive adverse events (NSAEs) otherwise described as Failure to Maintain (F2M) events.

Definition of 'Failure to Maintain': The failure to prevent avoidable hospital-acquired urinary tract infection, pressure ulcers, pneumonia and delirium. 'F2M' provides a framework for understanding that implicit nurse care rationing of basic and essential cares of mobility, communication, skin care, hydration and nutrition leads to functional and cognitive decline in complex older patients, which may lead to these measurable hospital-acquired complications.

Defining the four F2M events: An episode is identified with a complication (urinary tract infection, pneumonia, delirium, pressure ulcers) using a set of secondary ICD10 diagnoses.

Where a complication is matched then further checks are made against an exclusion list of ICD10 codes and Major Diagnostic Groupings (MDC). This is a process of risk adjustment, removing the complications that had a higher risk of co-existing (pre or within-hospital episode) due to comorbidities.

Urinary tract infection - UTI

An episode is identified as having a UTI complication when it has secondary diagnosis of N39.0 or T82.5.

Inclusion ICD Code (Secondary)	Description
N39.0	Urinary tract infection, site not specified
T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system

And it doesn't have a Principal Diagnosis of:

Exclusion ICD Code (Principal)	Description
A40	Streptococcal sepsis
A42	Actinomycosis
A49.9	Bacterial infection, unspecified
N39.0	Urinary tract infection, site not specified
T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system

Or have ANY diagnosis (principal or secondary) of:

Exclusion DiagCode (Any)	Description
O08.8	Other complications following abortion and ectopic and molar pregnancy
O23.4	Unspecified infection of urinary tract in pregnancy
O23.9	Other and unspecified genitourinary tract infection in pregnancy
O86.2	Urinary tract infection following delivery
O86.3	Other genitourinary tract infections following delivery

Or an MDC of the following

Exclusion MDC	Description
11	Diseases & Disorders of the Kidney & Urinary Tract
12	Diseases & Disorders of the Male Reproductive System
13	Diseases & Disorders of the Female Reproductive System
14	Pregnancy, Childbirth & the Puerperium
15	Newborns & Other Neonates

Delirium

An episode is identified as having a delirium complication when it has secondary diagnosis in the following table:

ICD10 Inclusion - Secondary Diagnosis	Description

Exclude – Principal Diagnosis	
F05.0	Delirium not superimposed on dementia, so described*
F05.1	Delirium superimposed on dementia*
F05.8	Other delirium*
F05.9	Delirium, unspecified
R40.1	Stupor
R40.2	Coma, unspecified
*Recommended update (not in original Needleman approach)	

And it doesn't have a principal diagnosis of:

ICD10 Exclusion - Principal Diagnosis	Description
F43.2	Adjustment disorders
F43.9	Reaction to severe stress, unspecified
F44.88	Other specified dissociative [conversion] disorders
F05.9	Delirium, unspecified
R40.1	Stupor
R40.2	Coma, unspecified

And it doesn't have an MDC in the following list:

Exclusion MDC	Description
1	Diseases & Disorders of the Nervous System
19	Mental Diseases & Disorders
20	Alcohol/Drug Use & Alcohol/Drug Induced Organic Mental Disorders

Pressure Ulcer

An episode is identified as having a Pressure Ulcer complication when it has secondary diagnosis in the following table:

ICD10 Inclusion - Secondary Diagnosis Exclude – Principal Diagnosis	Description
L89^	Pressure ulcer
^Includes all subsets of L89, eg L89.0, L89.1, L89.2 etc	

And it doesn't have a principal diagnosis of:

ICD10 Exclusion - Principal Diagnosis	Description
L89	Pressure ulcer

And it doesn't have any diagnosis of

ICD10 Exclusion - Any Diagnosis	Description
G80	Cerebral palsy
G81	Hemiplegia
G82	Paraplegia and tetraplegia
G83	Other paralytic syndromes

And it doesn't have an MDC of 9

Exclusion MDC	Description
9	Diseases & Disorders of the Skin, Subcutaneous Tissue & Breast

Pneumonia

An episode is included as having a pneumonia complication when it has secondary diagnosis in the following table:

ICD10 Inclusion - Secondary Diagnosis Exclude – Principal Diagnosis	Description
J14	Pneumonia due to Haemophilus influenzae
J15	Bacterial pneumonia, not elsewhere classified
J18	Pneumonia, organism unspecified
J69.0	Pneumonitis due to food and vomit
J95.8	Other postprocedural respiratory disorders
J95.9	Postprocedural respiratory disorder, unspecified

And it doesn't have a principle diagnosis of:

ICD10 Exclusion - Principal Diagnosis	Description
DiagCode	Description
J10	Influenza due to other identified influenza virus
J11	Influenza, virus not identified
J12	Viral pneumonia, not elsewhere classified
J13	Pneumonia due to Streptococcus pneumoniae
J14	Pneumonia due to Haemophilus influenzae
J15	Bacterial pneumonia, not elsewhere classified

J17	Pneumonia in bacterial diseases classified elsewhere
J18	Pneumonia, organism unspecified
J69.0	Pneumonitis due to food and vomit
J95.8	Other postprocedural respiratory disorders
J95.9	Postprocedural respiratory disorder, unspecified

And it doesn't have a diagnosis of

ICD10 Exclusion - Any Diagnosis	**Description**
B20	Human immunodeficiency virus [HIV] disease resulting in infectious and parasitic diseases
B21	Human immunodeficiency virus [HIV] disease resulting in malignant neoplasms
B22	Human immunodeficiency virus [HIV] disease resulting in other specified diseases
B23	Human immunodeficiency virus [HIV] disease resulting in other conditions
B24	Unspecified human immunodeficiency virus [HIV] disease
D80	Immunodeficiency with predominantly antibody defects
D81	Combined immunodeficiencies
D82	Immunodeficiency associated with other major defects
D83	Common variable immunodeficiency
D84	Other immunodeficiencies
D86	Sarcoidosis
D89	Other disorders involving the immune mechanism, not elsewhere classified
M35.9	Systemic involvement of connective tissue, unspecified

And it doesn't have an MDC of:

Exclusion MDC	**Description**
4	Diseases & Disorders of the Respiratory System

Inclusion/exclusion criteria for hospital wards/units, patients and events

Only patients aged 65 years and older will be included in this study. Discharges for this group account for the largest proportion of total discharges from acute hospitals and for 55.4% of total inpatient bed days in acute hospitals in Ireland in 2021 (HPO, 2022). Average length of stay for patients in Irish hospitals is 7.1 days, however in this cohort the average length of stay is between 9 and 13 days (HPO, 2022). NSAEs occur more commonly in this group.

Common hospital acquired adverse events, especially for older people, contribute the highest system costs of all adverse events in the health sector (Rowell, Nghiem, Jorm, & Jackson, 2010), placing a high financial burden on the health sector (Slawomirski, Auraaen, & Klazinga, 2017). 'Failure to Maintain (F2M)' events are associated with 25% costs of above-average length of stay for people aged over 65 and are associated with missed or rationed nursing care (Bail et al., 2015).

Chart Review	
Inclusion criteria	**Exclusion criteria**
Charts of patients aged 65 and over	Charts of patients aged below 65
Charts of patients who have been admitted to inpatient adult wards	Chart of patients admitted to wards other than inpatient adult wards
Only patients with a length of stay (LOS) of 72 hours minimum will have their chart reviewed. There will be no cut off for maximum length of stay therefore chart will be reviewed for patient who stayed for 72 hours in hospital up until their discharge	LOS shorter than 72 hours will be excluded
Charts of patients admitted during 2022 will be included	Charts of patients discharged in any year other than 2022 will be excluded

- Exclude adverse events that occurred on earlier admission
- Exclude follow up adverse events (after discharge)
- Include adverse events that occurred and were detected within admission
- Different criteria at patient level and at adverse event level
    - Include pressure ulcers and delirium deemed to have occurred at any time during the episode of care
    - Include deterioration of existing PU or delirium.
    - Only include infection (UTI and Pneumonia) that is deemed to have occurred 48 hours after admission

Nurse Survey	
Inclusion criteria	**Exclusion criteria**
Nurses employed in inpatient adult wards and emergency departments in the same hospital site where the chart review will take place	Nurses employed only on day wards, outpatient departments or in operating theatres.
Being a fully qualified nurse	Nurses that are not fully qualified eg. Student nurses

Patient Survey	
Inclusion criteria	**Exclusion criteria**
Patients aged 65 and over who have been admitted to inpatient adult wards.	Patients aged below 65 and admitted to wards other than inpatient adult wards.
Being capable of completing the survey independently	Patients who are unable to complete the survey independently.
Ability to read and speak English.	Patients who are unable to read and speak English.

Chart Review - F2M adverse events

Data collection for this study will be carried out in the Mater Misericordiae University Hospital (MMUH) in Dublin. A retrospective record review will be carried out in a two-stage procedure. Thorough descriptions of the four predefined NSAEs and a study manual will be used as review support in both the primary and secondary review stages.

In the primary review, all randomized selected admissions i.e., index admissions will be reviewed. The reviewers screen for the presence of one or more of the predefined NSAEs. Only admissions indicating at least one potential NSAEs will be sent forward to secondary review.

In the primary review, each potential NSAE will be assessed separately. To qualify as a NSAE, a score of 3 or higher on a 4-point Likert Scale will be required (1=the potential NSAE was not related to healthcare, 2=the potential NSAE was probably not related to healthcare, 3=the potential NSAE was probably related to healthcare and 4=the potential NSAE was related to healthcare).

Sample size

According to the Healthcare Pricing Office dataset, 6,500 Mater Misericordiae University Hospital (MMUH) patients met the study criteria in the year 2022.The aim of sampling charts and abstracting/ extracting data is to achieve a credible estimate of the overall adverse event rate and allow further analysis on major groups of adverse events. As discussed, the true adverse event rate is not known with any certainty, although the earlier work of Rafter et al (2017) suggest that it may not be very different from that reported in other countries. Based on a simple simulation study (Figs 1,2,3 demonstrate estimated prevalence for a 20%, 10% and 5% adverse event rate) it would seem that a sample size of 400 charts abstracted gives an acceptably precise estimate across a range of plausible F2M adverse effect rates, for the total rate.

Figure 1. Estimated Prevalence of 20% Adverse Event rate

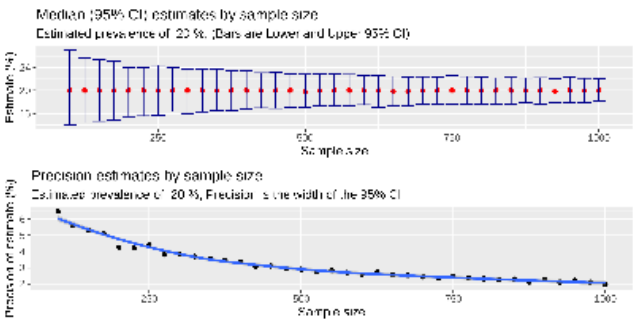


Figure 2. Estimated Prevalence of 10% Adverse Event rate

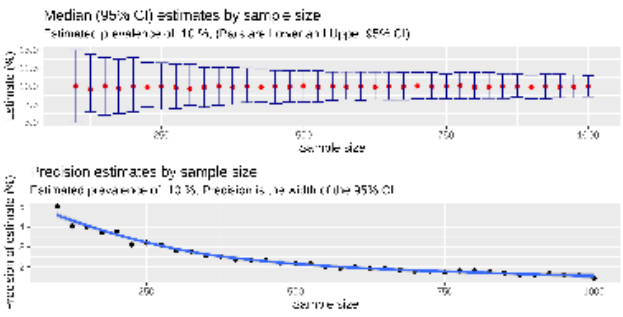
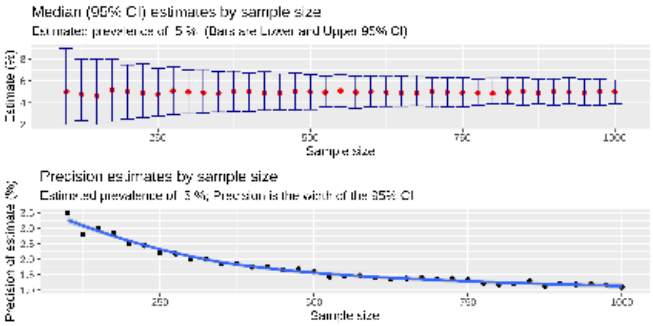
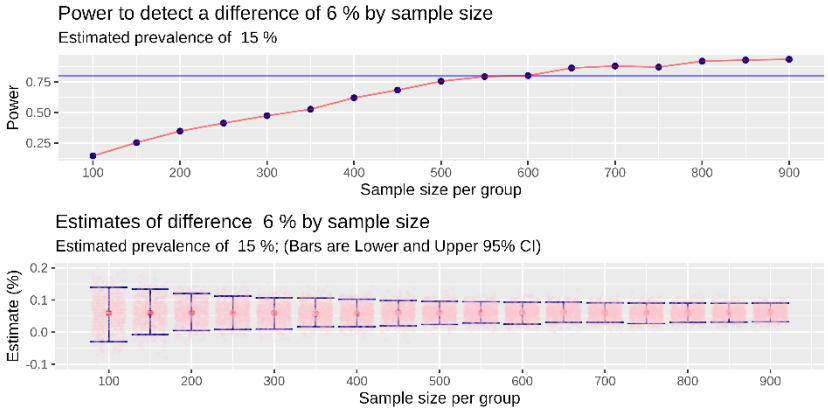


Figure 3. Estimated Prevalence of 5% Adverse Event rate



Nonetheless, to look at subgroups, larger numbers will be needed. We propose to stratify the sample into at least two categories (medical and surgical) but intend to cap the chart review at 1,000 charts. The relative size of the groups, and the expected differences between them in terms of prevalence are not known. Therefore, a sample size, per group, of approx. 500 charts gives reasonable power to detect moderately large differences between groups and will allow us to explore the range of likely outcomes (see Fig 4). It may be possible to stratify the sample of charts by a-priori risk (for example the Charlson index or similar) to improve power further, but this is not yet certain.

Figure 4. Power calculations for group size



Interrater-reliability

The interrater reliability calculations will be based on 10% of the charts. The two primary chart reviewers will both review every 10th chart independently. The data extracted from each reviewer's review of this chart will be inserted in Microsoft Excel and the data will be compared to see what has been identified or missed by either of the reviewers. In relation to monitoring the work of the chart review, the project PI will conduct a second review on 10% of all sampled charts. Where discrepancies are noted in the review findings or where uncertainty arises for any of the review team, selected staff members from MMUH have agreed to provide advice and context.

Review template

The chart review will be conducted in a two-stage process consisting of a primary review stage and a secondary review stage.

Primary review

Each chart included in the chart review sample will be included in the primary review. This stage of the review process will identify the cohort of patients who experienced a NSAE. The charts of patients who were identified as having experienced a NSAE at the primary review stage will then be subject to a secondary review. The instructions below will guide the process of extracting the relevant information from the charts.

Variable	Instruction	Decision
MRN	The MRN as it appears on each chart should be extracted and inserted into the excel sheet in the provided space.	
Encrypted MRN	The encrypted MRN that has been provided by the healthcare pricing office should be noted here.	Discussion with Mr. Fiachra Bane from HPO. Decision to extract encrypted MRN to ensure that data is pseudonymised.
Sex	The sex of the patient should be noted here. Reviewer can select male or female from the drop-down menu.	
Date of first presentation to hospital (DDMMYY)	The date that the patient first presented at the hospital should be noted here.	
Time of first presentation to hospital (24-hour clock)	The time that the patient first presented at the hospital should be noted here.	
Elective/Emergency admission	Note should be taken here as to whether the patient was admitted as an elective admission or an emergency admission. Reviewer can select one option from the dropdown menu.	
Time of triage in ER (24-hour clock)	The time that a patient was seen by a triage nurse in the emergency department should be noted here.	
Date of admission to ward	The date that the patient was admitted to the ward should be noted here (not the date that they presented at the	

	hospital but the date that they were officially admitted to the ward and given a bed).	
Time of admission to ward (24-hour clock)	The time that the patient was admitted to hospital should be noted here.	
Admitted from?	The reviewer must make note of where the patient was admitted from using the drop-down options – home (independent), nursing home, other hospital, home care package, rehab facility, other.	
Other please specify	Free text – specify if admission source is different to those listed in the previous drop-down menu.	
Time from presentation to admission	The time from when the patient presented at hospital and when they were admitted to the ward should be noted here. The reviewer will need to calculate the number of hours between the time that the patient presented at hospital and the time that they were officially admitted.	
Number of ward moves during admission	The reviewer must make note of the number of ward moves that the patient experienced during their admission. Details of the number of ward moves can be found on patient centre	Discussion consultant geriatrician. Decision to record ward moves as they can be associated with onset of delirium.
Number of bed moves during admission	The reviewer must make note of the number of bed moves that the patient experienced during their admission. Details of the number of bed moves can be found on patient centre	Discussion with consultant geriatrician. Decision to record bed moves as they can be associated with onset of delirium.
Age (at discharge)	The age of the patient should be noted here. Their date of birth is not required to be extracted therefore the reviewer may have to calculate the age of the	

	patient by referring to their date of birth without extracting it in full.	
Date of discharge (DD/MM/YY)	The date that the patient was discharged from hospital should be noted here.	
Time of discharge (24-hour clock)	The time that the patient was discharged from hospital should be noted here	
Place of discharge	Reviewers must make note of where the patient was discharged to following their stay in hospital – home, nursing home, other hospital, A&E, home care package, rehab facility, other.	
Discharge situation changed from before admission?	Reviewers will have the option to select yes or no here. Reviewers must make note of whether the patient's discharge situation differed from before their admission. If the patient was discharged to a different location to where they were admitted from or if they required additional care following their discharge that was not required prior to their admission then the reviewer must make a note of this.	
Other?	If notable changes are not related to those listed in the drop-down categories above or other more complex cases	
Was this patient in ITU during this admission?	Note should be made here if the patient was admitted to ITU during their hospital stay. The reviewers will have the option to select yes or no here.	
Frailty Assessment Score	Reviewers should make note of the frailty assessment score for each patient. Frailty scores can be found under comprehensive geriatric assessment or MaterFIT Triage Tool in the	

	patient documents in Patient Centre.	
Pneumonia	Reviewers will have the option to select yes or no here. Reviewer must first check the medication notes within the chart to see if the patient was prescribed any antibiotics. If the patient was prescribed antibiotics for a pneumonia, then the reviewer must check the start date of the antibiotics and compare this with the admission date. If the antibiotics were started 48 hours after admission, then then the reviewers must refer to the predefined criteria to make a judgement as to whether a hospital acquired pneumonia was present or not (Table A). To verify the presence of a pneumonia the reviewer will need to locate information using Patient Centre.	
Assess the extent to which the event was healthcare associated?	Reviewers must make a judgement on the extent to which the event was healthcare associated. Reviewers must select one option from the drop-down menu – NOT healthcare associated, PROBABLY NOT healthcare associated, LIKELY associated, DEFINITELY associated.	Discussion with Maria Unbeck.
UTI	Reviewers will have the option to select yes or no here. Reviewer must first check the medication notes within the chart to see if the patient was prescribed any antibiotics. If the patient was prescribed antibiotics for a UTI, then the reviewer must check the start date of the antibiotics and compare this with the admission date. If	

	the antibiotics were started 48 hours after presentation, then then the Reviewers must refer to the predefined criteria in order to make a judgement as to whether UTI was present or not (Table B)	
Assess the extent to which the event was healthcare associated?	Reviewers must make a judgement on the extent to which the event was healthcare associated. Reviewers must select one option from the drop-down menu – NOT healthcare associated, PROBABLY NOT healthcare associated, LIKELY associated, DEFINITELY associated.	Discussion with Maria Unbeck.
Pressure Ulcer	Reviewers will have the option to select yes or no here. Reviewers must refer to the patient's Waterlow score in order to make a judgement as to whether a pressure ulcer was present or not.	
Assess the extent to which the event was healthcare associated?	Reviewers must make a judgement on the extent to which the event was healthcare associated. Reviewers must select one option from the drop-down menu – NOT healthcare associated, PROBABLY NOT healthcare associated, LIKELY associated, DEFINITELY associated.	Discussion with Maria Unbeck.
Delirium	Reviewers will have the option to select yes or no here. Reviewer must first check the medication notes within the chart to see if the patient was prescribed any antipsychotics (marker for delirium as treatment for behavioural changes). Reviewers must also refer to 4AT scores and nursing notes in order to make a	

	judgement as to whether delirium was present or not.	
Assess the extent to which the event was healthcare associated?	Reviewers must make a judgement on the extent to which the event was healthcare associated. Reviewers must select one option from the drop-down menu – NOT healthcare associated, PROBABLY NOT healthcare associated, LIKELY associated, DEFINITELY associated.	Discussion with Maria Unbeck.
Length of stay	The duration of the patient's stay in hospital should be noted here in days. The reviewer must calculate the number of days that the patient stayed in hospital for by referring to their date of admission and date of discharge.	
Covid-19 Positive during admission?	Reviewers must make note here of whether the patient tested positive for COVID-19 during their stay in hospital. The reviewer will have the option of selecting yes or no here.	Collected for HIPE Manager.
Where in chart?	If an adverse event has been identified, the reviewer must make a note of where the adverse event was documented in the chart.	Collected for HIPE Manager.
Surgical site or wound infection	Reviewers are required to make a note of whether a wound infection was documented in the clinical notes.	Collected for ADON Infection Control
Moisture associated skin damage	Whilst reviewing the chart, the reviewer must make note of any moisture associated skin damage. Reviewer should look for TVN reports to find evidence of moisture associated skin damage. The details of TVN reports may be found in both patient's charts and on patient centre.	Collected for Tissue Viability Nurse

Other wounds or skin breaks	Whilst reviewing the chart, the reviewer must also make note of any other wounds or skin breaks that are not classified as pressure ulcers. Reviewer must review the 'Open Wound Assessment and Management Form' (pink form) to locate this information.	Collected for Tissue Viability Nurse

*Attachment for identifying presence of pneumonia TABLE A

PN: Pneumonia		
Radiology	**Two** or more serial chest X-rays or CT-scans with a suggestive image of pneumonia for patients with underlying cardiac or pulmonary disease	☐
	Without underlying cardiac or pulmonary disease, **one** definitive chest X-ray or CT-scan	☐
	and	
Symptoms	fever >38°C with no other cause	☐
	leukopenia (<4000 WBC/mm3)	☐
	or leucocytosis (⍰ 12,000 WBC/mm3)	☐
	and at least ONE of the following	
	new onset of purulent sputum, or change in character of sputum	☐
	cough or dyspnoea or tachypnoea	☐
	suggestive auscultation (rales or bronchial breath sounds), ronchi, wheezing	☐
	worsening gas exchange (e.g. oxygen desaturation or increased oxygen requirements or increased ventilation demand)	☐
	and according to the used diagnostic method	
Microbiology	**a)** Bacteriologic diagnostic test performed by:	
	Positive quantitative culture from minimally contaminated LRT	☐
	Positive quantitative culture from possibly contaminated LRT specimen	☐
	b) Alternative microbiology methods	
	positive blood culture not related to another source of infection	☐
	Positive growth in culture of pleural fluid;	☐
	pleural or pulmonary abscess with positive needle aspiration	☐
	histologic pulmonary exam shows evidence of pneumonia	☐
	positive exams for pneumonia with virus or particular microorganisms	☐
	c) Others:	
	positive sputum culture or non-quantitative LRT specimen culture	☐

*Attachment for identifying presence of urinary tract infections TABLE B

UTI: Urinary Tract Infection	
UTI-A: microbiologically confirmed symptomatic UTI	
Patient has at least **ONE** of the following signs of symptoms with no other recognised cause:	
fever (>38°C)	☐
urgency	☐
frequency	☐
dysuria	☐
suprapubic tenderness	☐
AND	
positive urine culture	☐
UTI-B: not microbiologically confirmed symptomatic UTI	
Patient has at least **TWO** of the following with no other recognised cause:	
fever (>38°C)	☐
urgency	☐
frequency	☐
dysuria	☐
suprapubic tenderness	☐
AND at least **ONE** of the following	
positive dipstick for leukocyte and or nitrate	☐
Pyuria	☐
clinician diagnosis of a urinary tract infection	☐
clinician institutes appropriate therapy for a urinary infection	☐
UTI-C: asymptomatic bacteriuria: Please Exclude UTI C from the study	
Patient has No: fever (>38°C), urgency, dysuria, suprapubic tenderness	☐
and either of the following criteria:	
Patient has had an indwelling urinary catheter within seven days before urine is cultured	☐
And	
patient has a urine culture, that is ≥10^5 microorganisms per ml of urine with no more than two species of microorganisms	☐
patient has not had an indwelling urinary catheter within seven days before the first positive culture;	☐
And	
patient has had at least two positive urine cultures ≥10^5 microorganisms per mm^3 of urine with repeated isolation of the same microorganism and no more than two species of microorganisms.	☐

Secondary Review

Charts of patients who were identified as having experienced one of the four NSAEs during the primary review stage will be sent forward to the secondary review stage. It is the same reviewer who carry out both review stages per patient. During this stage of the review process further information in relation to each experienced NSAE will be extract from the patients' charts. Each NSAE (if more than one adverse event is experienced by an individual patient) will be investigated separately during the secondary review stage.

Pneumonia

Variable	Instruction	
Date of first detection	The date that the pneumonia was first detected should be noted here.	
Which ward first detected?	The ward where the pneumonia was first detected should be noted here. The name of the ward will not be retained but will be collected initially in order to construct categories associated with where the four "failure to maintain" events were identified (e.g. medical, surgical, general, ICU)	
Confirmed? Radiology	Reviewer will be given the option of selecting yes or no here. (The reviewer should insert yes if they have confirmed the presence of a pneumonia by referring to the predefined criteria and have identified that the patient has a diagnosed case of pneumonia by reviewing their radiology reports).	Discussion ADON Infection Prevention and Control in relation to confirmation of pneumonia – July 2023
Confirmed? Symptoms	Reviewer will be given the option of selecting yes or no here. The reviewer should insert yes if they have confirmed the presence of a pneumonia by referring to the predefined criteria and have identified that the	Discussion with ADON Infection Prevention and Control in relation to confirmation of pneumonia – July 2023

	patient has a diagnosed case of pneumonia their clinical symptoms.	
Confirmed? Microbiology	Reviewer will be given the option of selecting yes or no here. The reviewer should insert yes if they have confirmed the presence of a pneumonia by referring to the predefined criteria and have identified that the patient has a diagnosed case of pneumonia by reviewing their microbiology results.	Discussion ADON Infection Prevention and Control in relation to confirmation of pneumonia – July 2023
Date of commencement of treatment	The date that the patient first started receiving treatment for the pneumonia should be noted here.	
Antibiotic treatment (name)	The details of the antibiotic treatment should be noted here. The reviewer must make note of the name of the antibiotic prescribed.	Discussion with ADON Infection Prevention and Control – July 2023
Antibiotic treatment (route)	The details of the antibiotic treatment should be noted here. The reviewer must select from the drop-down menu the route through which the antibiotic was administered.	Discussion with ADON Infection Prevention and Control – July 2023
Antibiotic (duration)	The details of the antibiotic treatment should be noted here. The reviewer must make note of the duration of time for which the patient has been prescribed to take the antibiotics.	Discussion with ADON Infection Prevention and Control – July 2023
Change to antibiotic (date)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must make note of the date of any changes to the antibiotic treatment.	Discussion with ADON Infection Prevention and Control – July 2023
Change to antibiotic (name)	Any changes to the initially prescribed	Discussion with ADON Infection

	antibiotics should be noted here. Reviewers must make note of any changes to the name of the drug being prescribed.	Prevention and Control – July 2023
Change to antibiotic (route)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must select from drop-down menu any changes to the route through which the drug is being administered.	Discussion with ADON Infection Prevention and Control – July 2023
Change to antibiotic (duration)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must make note of any changes to the duration of time for which the patient has been prescribed to take the antibiotics.	Discussion with ADON Infection Prevention and Control – July 2023
Extra tests	Any additional tests that were required due to the pneumonia should be noted here.	
Extra procedures	Any additional procedures that were required due to the pneumonia should be noted here.	
Changed nursing care	Any changes to the nursing care required by the patient as a result of the pneumonia should be noted here.	
Referral for Consult (specialty)	If the patient was referred for a consult due to the pneumonia, the details of the consult should be noted here. The reviewer must detail what specialty consultation the patient was referred.	
Referral for intervention (physio etc)	If the patient was given a referral for any type of intervention, then the details of the intervention must be noted here. The reviewer must detail what	

	type of intervention that patient was referred (eg. Physiotherapy etc.)	
Date pneumonia resolved	The date that the pneumonia resolved should be noted here, if resolved during admission.	
Treatment on discharge	A note should be made here of any treatment that the patient was prescribed on discharge in relation to their pneumonia.	
Referral on discharge If yes – public health nurse, GP, OPD, other	Reviewer must make a note here of whether the patient was given a referral for pneumonia related treatment on discharge. Review must select yes or no here.	
Referral PHN?	Yes/No	
Referral GP?	Yes/No	
Referral OPD	Yes/No	
Referral (other)	Free text	
Severity (dropdown categories)	The severity of the pneumonia should be noted here. The reviewer must select one option from the dropdown categories relating to the severity of the pneumonia.	Discussion with Maria Unbeck
Discharge plan if unresolved	If the pneumonia was unresolved at the time of discharge, then details of the patient's discharge plan should be noted here.	
Notes: Patient story/contextual details*	Any relevant information relating to the patient and their stay in hospital should be noted here. Reviewers should make note of any information within the patient's chart that provides context in relation to the pneumonia or explains the events of their stay in hospital.	Following meeting with nursing exec at MMUH, it was decided that contextual details would be collected in order to provide context to the occurrence of the adverse event.
Additional event	If patient has suffered any additional pneumonia, the details of this event will be	Discussion with Maria Unbeck following chart

	recorded in a separate sheet on the Excel sheet.	review pilot. Decision to include secondary sheet to capture additional adverse events if patients suffered more than one of any of the included events during the episode of care included in the review November 2023

UTI

Variable	Instruction	
Date of first detection	The date that the UTI was first detected should be noted here.	
Which ward first detected?	The ward where the UTI was first detected should be noted here. The name of the ward will not be retained but will be collected initially in order to construct categories associated with where the four "failure to maintain" events were identified (e.g. medical, surgical, general, ICU)	
Catheter in situ?	Reviewer must make note of whether the patient had a catheter in situ. Reviewer can select yes or no from the drop-down menu.	
Confirmed? (Symptoms)	Reviewer will be given the option of selecting yes or no here. The reviewer should insert yes if they have confirmed the presence of a UTI by referring to the predefined criteria and have identified that the patient has a diagnosed case of UTI by reviewing their clinical symptoms.	Discussion with ADON Infection Prevention and Control – July 2023
Confirmed? (lab confirmation)	Reviewer will be given the option of selecting yes or no	Discussion with ADON Infection

	here. The reviewer should insert yes if they have confirmed the presence of a pneumonia by referring to the predefined criteria and have identified that the patient has a diagnosed case of UTI by reviewing their lab results.	Prevention and Control – July 2023
Date of commencement of treatment	The date that the patient first started receiving treatment for the UTI should be noted here.	Discussion with ADON Infection Prevention and Control – July 2023
Antibiotic treatment (name)	The details of the antibiotic treatment should be noted here. The reviewer must make note of the name of the antibiotic prescribed, the route through which the antibiotic was administered and the duration of time for which the patient has been prescribed to take the antibiotics.	Discussion with ADON Infection Prevention and Control – July 2023
Antibiotic treatment (route)	The details of the antibiotic treatment should be noted here. The reviewer must select from the drop down menu the route through which the antibiotic was administered.	Discussion with ADON Infection Prevention and Control – July 2023
Antibiotic (duration)	The details of the antibiotic treatment should be noted here. The reviewer must make note of the name of the duration of time for which the patient has been prescribed to take the antibiotics.	Discussion with ADON Infection Prevention and Control – July 2023
Change to antibiotic (date)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must make note of the date of any changes to the antibiotic treatment.	Discussion ADON Infection Prevention and Control – July 2023
Change to antibiotic (name)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must make note of any changes to the name of the drug being prescribed.	Discussion with ADON Infection Prevention and Control – July 2023

Change to antibiotic (route)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must select from the drop-down menu any changes to the route through which the drug is being administered.	Discussion ADON Infection Prevention and Control – July 2023
Change to antibiotic (duration)	Any changes to the initially prescribed antibiotics should be noted here. Reviewers must make note of any changes to the duration of time for which the patient has been prescribed to take the antibiotics.	Discussion with ADON Infection Prevention and Control – July 2023
Extra tests	Any additional tests that were required due to the UTI should be noted here.	
Extra procedures	Any additional procedures that were required due to the UTI should be noted here.	
Changed nursing care	Any changes to the nursing care required by the patient as a result of the UTI should be noted here.	
Referral for consult (specialty)	If the patient was referred for a consult due to the UTI, the details of the consult should be noted here. The reviewer must detail what specialty consultation the patient was referred.	
Referral for intervention (physio etc)	If the patient was given a referral for any type of intervention, then the details of the intervention must be noted here. The reviewer must detail was type of intervention that patient was referred (eg. Physiotherapy etc.)	
Date UTI resolved	The date that the UTI resolved should be noted here, if resolved during admission.	
Treatment on discharge	A note should be made here of any treatment that the patient was prescribed on	

	discharge in relation to their UTI.	
Referral on discharge	Reviewer must make a note here of whether the patient was given a referral for UTI related treatment on discharge. Reviewer must select yes or no here.	
Referral PHN	Yes/No	
Referral GP	Yes/No	
Referral OPD	Yes/No	
Referral (other)	Free text	
Severity (dropdown categories)	The severity of the UTI should be noted here. The reviewer must select one option from the dropdown categories relating to the severity of the UTI.	Discussion with Dr. Maria Unbeck.
Discharge plan if unresolved	If the UTI was unresolved at the time of discharge, then details of the patient's discharge plan should be noted here.	
Notes: Patient story/contextual details*	Any relevant information relating to the patient and their stay in hospital should be noted here. Reviewers should make note of any information within the patient's chart that provides context in relation to the UTI or explains the events of their stay in hospital.	Following meeting with nursing exec at MMUH, it was decided that contextual details would be collected in order to provide context to the occurrence of the adverse event.
Additional event	If patient has suffered any additional UTI, the details of this event will be recorded in a separate sheet on the Excel sheet.	Discussion with Maria Unbeck following chart review pilot. Decision to include secondary sheet to capture additional adverse events if patients suffered more than one of any of the included events during the episode of care included in the review – November 2023

Pressure ulcer

If more than one pressure ulcer, each shall be reviewed separately.

Variable	Instruction	Decision
Initial Waterlow score	The initial Waterlow score that the patient received after being reviewed by the nurse within the first six hours of their admission should be noted here.	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Waterlow score on detection	The Waterlow score that the patient received on detection of the pressure ulcer should be noted here. The Waterlow assessment will be repeated every 72 hours throughout the patient's stay in hospital or if their condition worsens during their stay therefore their initial Waterlow score may differ to subsequent score. A score above 10 will result in a skin care plan for 7 days.	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Location of pressure ulcer	Reviewer must make note of the location of the pressure ulcer.	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Grade of pressure ulcer	Reviewer must select one option from the drop-down menu to categorize the pressure ulcer. Drop-down options include stage 1 - Nonblanchable Erythema, stage 2 - Partial Thickness Skin Loss, stage, 3 - Full Thickness Skin Loss or stage 4 - Full Thickness Tissue Loss.	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Date of first detection (onset or confirmed worsening)	The date that the pressure ulcer was first detected should be noted here. The date should reflect either the development of a new pressure ulcer or the confirmed worsening of a pressure ulcer that was	

	present on admission. If a pressure ulcer was initially categorised as a stage two pressure ulcer on admission but progressed into a stage three, then the reviewer must note the date that the worsening of the pressure ulcer was first detected.	
Number of days from presentation to detection	The number of days between the patient's first presentation to the hospital and the detection of their pressure ulcer should be noted here.	
Which ward first detected?	The ward where the pressure ulcer was first detected should be noted here. The name of the ward will not be retained but will be collected initially in order to construct categories associated with where the four "failure to maintain" events were identified (e.g. medical, surgical, general, ICU)	
Validated by TVN?	The reviewer must confirm whether the pressure ulcer was validated by the TVN. Reviewer must check Patient Centre to locate information on the patient's referral to the TVN.	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Date of commencement of treatment	The date that the patient first started receiving treatment for the pressure ulcer should be noted here.	
Treatment type - Antibiotics	Yes/no	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Treatment type – Specialised dressing	Yes/no	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023

Treatment type – Analgesics	Yes/no	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Interventions (mattresses, cushion, TVN, dressings)	Any and all interventions implemented as a result of the pressure ulcer should be noted here. Interventions may include mattresses, cushions, dressings, turning scheme, or consultations with the TVN. Evidence of such interventions documented in the chart should be noted here. Information relating to variances to nursing interventions can be found in the back of the Waterlow Risk and SKIN Assessment Chart.	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023
Extra tests	Any additional tests that were required due to the pressure ulcer should be noted here	
Extra procedures	Any additional procedures that were required due to the pressure ulcer should be noted here	
Changed nursing care	Any changes to the nursing care required by the patient as a result of the pressure ulcer should be noted here.	
Referral for consult (specialty)	If the patient was referred for a consult due to the pressure ulcer, the details of the consult should be noted here. The reviewer must detail what specialty consultation the patient was referred.	
Referral for intervention (physio etc)	If the patient was given a referral for any type of intervention, then the details of the intervention must be noted here. The reviewer must detail was type of intervention that patient was referred (eg. Physiotherapy etc.)	Discussion with ADON Practice Development, CNM and Tissue Viability Nurse – July 2023/ September 2023 Discussion with ADON Nursing Quality – July 2023

Date resolved	The date that the pressure ulcer resolved should be noted here, if resolved during admission.	
Treatment on discharge	A note should be made here of any treatment or interventions that the patient was prescribed on discharge in relation to their pressure ulcer.	
Referral on discharge If yes – public health nurse, GP, OPD, Other	Reviewer must make a note here of whether the patient was given a referral for pressure ulcer related treatment on discharge. Reviewer must select yes or no here.	
Referral PHN?	Yes/No	
Referral GP?	Yes/No	
Referral OPD?	Yes/No	
Referral (other)	Free text	
Severity (dropdown categories)	The severity of the pressure ulcer should be noted here. The reviewer must select one option from the dropdown categories relating to the severity of the pressure ulcer.	Discussion with Dr. Maria Unbeck.
Discharge plan if unresolved	If the pressure ulcer was unresolved at the time of discharge, then details of the patient's discharge plan should be noted here.	
Notes: Patient story/contextual details*	Any relevant information relating to the patient and their stay in hospital should be noted here. Reviewers should make note of any information within the patient's chart that provides context in relation to the UTI or explains the events of their stay in hospital.	Following meeting with nursing exec at MMUH, it was decided that contextual details would be collected in order to provide context to the occurrence of the adverse event.
Additional event	If patient has suffered any additional pressure ulcer, the details of this event will be recorded in a separate sheet on the Excel sheet.	Discussion with Maria Unbeck following chart review pilot. Decision to include secondary sheet to capture additional adverse events if

		patients suffered more than one of any of the included events during the episode of care included in the review November 2023

Delirium

Note: As evident from a study conducted by Chuen et al. (2021) on the frequency and quality of delirium documentation in discharge summaries, the term "delirium" is not always used to document delirium in patients' medical notes. Various other terms such as "confusion" may be deemed as acceptable for identifying delirium through patient chart review. Therefore, in this study, episodes of delirium confirmed through the presence of the term "delirium" will be included in addition to unconfirmed cases of delirium that are captured through the presence of alternative acceptable terms that allow the chart reviewers to document assumed episodes of delirium.

There is a complex and interconnected relationship between delirium and dementia. Patients with dementia are more susceptible to developing delirium than the general population (Fong and Inouye, 2022). Given their vulnerability of developing delirium, patients with dementia must be included in this study.

Previous studies have reported that nurses may have difficulty distinguishing between the declining cognitive impairment of dementia and the acute confusional state of delirium given the complexity of their overlapping symptoms (Steis and Fick, 2012). Due to the similarity of symptoms of both delirium and dementia such as confusion, memory impairment, disorientation and agitation (Voyer et al., 2008), under-capturing and under-reporting of delirium is common as patients with diagnosed dementia often have their delirium symptoms overlooked and therefore attributed to their dementia rather than an episode of delirium (Steis and Fick, 2012).

Variable	**Instruction**	**Decision**
Pre-existing dementia or cognitive decline	Reviewer must make note of whether the patient has a pre-existing dementia or cognitive decline (Yes/No)	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
4AT Baseline Score (first measurement)	The 4AT score that the patient initially received on their first screening should be noted here. This first measurement will be considered as the patient's baseline in terms of their delirium status.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023

Where baseline 4AT carried out	The department/ward where the first 4AT measurement was carried out should be noted here.	
Date of baseline score	The date of the patient's first 4AT measurement should be noted here.	
Changed 4AT Score indicating Delirium if relevant	Reviewers must make note of any 4AT score that indicates delirium after their patient's initial 4AT assessment if relevant. If the patient's initial 4AT scored did not indicate the presence of delirium but a subsequent 4AT assessment did then the review must make note of this.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Changed CAM-ITU Score if relevant	If the patient was admitted to ITU and assessed using the CAM-ITU then their changed CAM-ITU score must be noted here.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
New confusion, agitation, or behavioural changes noted (also be aware of hypoactive delirium)	Yes/No	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Hyperactive or hypoactive delirium?	Drop-down menu to select which	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Date of first detection of delirium	The date on which the patient's diagnosis of delirium was first detected should be noted here.	

Which ward first detected?	The ward where the delirium was first detected should be noted here. The name of the ward will not be retained but will be collected initially in order to construct categories associated with where the four "failure to maintain" events were identified (e.g. medical, surgical, general, ICU)	
Any falls associated with delirium episode?	Any falls that were associated with the patient's delirium episode should be noted here. Select Yes or no.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Is delirium confirmed in chart?	Reviewer must make note here of whether the delirium was confirmed in the patient's chart or not.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Rapid-sedation used?	Yes/no	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Non-rapid sedation used?	Yes/no	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Antipsychotics used?	Reviewers must select from the drop-down menu the antipsychotics used during the patient's episode of delirium.	Discussion with Consultant Geriatrician and Advanced Nurse

		Practitioner in the Medicine for the Elderly Department – October 2023
Haloperidol used?	Reviewers must make note here of whether Haloperidol was used or not.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Changes to nursing care?	Any changes to the nursing care required by the patient as a result of the delirium should be noted here.	
Was this patient specialled 1:1?	Reviewers must make a note of whether the patient was specialled 1:1. A yes or no option can be selected from the drop-down list.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Duration of Specialling (number of days)	If the patient was specialled then note should be made here of the number of days that the patient was specialled for during their stay in hospital.	Discussion with Consultant Geriatrician and Advanced Nurse Practitioner in the Medicine for the Elderly Department – October 2023
Referral for Consult (specialty)	If the patient was referred for a consult due to the delirium, the details of the consult should be noted here. The reviewer must detail what specialty consultation the patient was referred.	
Referral for intervention (physio, OT, Social Worker etc)	If the patient was given a referral for any type of intervention, then the details of the intervention must be noted here. The reviewer must detail was type of intervention	

	that patient was referred (eg. Physiotherapy etc.)	
Date delirium resolved	The date that the delirium resolved should be noted here, if resolved during admission.	
Discharge plan if unresolved	If the delirium was unresolved at the time of discharge, then details of the patient's discharge plan should be noted here.	
Referral on discharge	Reviewer must make a note here of whether the patient was given a referral for delirium related treatment on discharge. The details of the referral should be noted here e.g. PHN, GP, OPD, other.	
Referral PHN?	Yes/No	
Referral GP?	Yes/No	
Referral OPD?	Yes/No	
Referral (other)	Free text	
Severity (dropdown categories)	The severity of the delirium should be noted here. The reviewer must select one option from the dropdown categories relating to the severity of the delirium.	Discussion with Dr. Maria Unbeck.
Notes: Patient story/contextual details****	Any relevant information relating to the patient and their stay in hospital should be noted here. Reviewers should make note of any information within the patient's chart that provides context in relation to the UTI or explains the events of their stay in hospital.	Following meeting with nursing exec at MMUH, it was decided that contextual details would be collected in order to provide context to the occurrence of the adverse event.
Additional event	If patient has suffered any additional delirium, the details of this event will be recorded in a separate sheet on the Excel sheet.	Discussion with Maria Unbeck following chart review pilot. Decision to include secondary sheet to capture additional adverse events if patients suffered more than one of any of the included events during the episode of care included in the review November 2023

Duration of secondary review (Total events)	Reviewer must make note of the time taken to complete the review in minutes.	Discussion with Maria Unbeck – variable included based on review template from Maria. Collected as potentially valuable information for structured chart review publication.

4AT Delirium Assessment Tool

4AT

Assessment test for delirium & cognitive impairment

(label)

Patient name:

Date of birth:

Patient number:

Date: **Time:**

Tester:

CIRCLE

[1] ALERTNESS

This includes patients who may be markedly drowsy (eg. difficult to rouse and/or obviously sleepy during assessment) or agitated/hyperactive. Observe the patient. If asleep, attempt to wake with speech or gentle touch on shoulder. Ask the patient to state their name and address to assist rating.

Normal (fully alert, but not agitated, throughout assessment)	**0**
Mild sleepiness for <10 seconds after waking, then normal	**0**
Clearly abnormal	**4**

[2] AMT4

Age, date of birth, place (name of the hospital or building), current year.

No mistakes	**0**
1 mistake	**1**
2 or more mistakes/untestable	**2**

[3] ATTENTION

Ask the patient: "Please tell me the months of the year in backwards order, starting at December." To assist initial understanding one prompt of "what is the month before December?" is permitted.

Months of the year backwards	Achieves 7 months or more correctly	**0**
	Starts but scores <7 months / refuses to start	**1**
	Untestable (cannot start because unwell, drowsy, inattentive)	**2**

[4] ACUTE CHANGE OR FLUCTUATING COURSE

Evidence of significant change or fluctuation in: alertness, cognition, other mental function (eg. paranoia, hallucinations) arising over the last 2 weeks and still evident in last 24hrs

No	**0**
Yes	**4**

---

4 or above: possible delirium +/- cognitive impairment
1-3: possible cognitive impairment
0: delirium or severe cognitive impairment unlikely (but delirium still possible if [4] information incomplete)

4AT SCORE ☐

GUIDANCE NOTES Version 1.2. Information and download: **www.the4AT.com**

The 4AT is a screening instrument designed for rapid initial assessment of delirium and cognitive impairment. A score of 4 or more *suggests* delirium but is not diagnostic: more detailed assessment of mental status may be required to reach a diagnosis. A score of 1-3 suggests cognitive impairment and more detailed cognitive testing and informant history-taking are required. A score of 0 does not definitively exclude delirium or cognitive impairment: more detailed testing may be required depending on the clinical context. Items 1-3 are rated *solely on observation of the patient at the time of assessment*. Item 4 requires information from one or more source(s), eg. your own knowledge of the patient, other staff who know the patient (eg. ward nurses), GP letter, case notes, carers. The tester should take account of communication difficulties (hearing impairment, dysphasia, lack of common language) when carrying out the test and interpreting the score.

Alertness: Altered level of alertness is very likely to be delirium in general hospital settings. If the patient shows significant altered alertness during the bedside assessment, score 4 for this item. **AMT4 (Abbreviated Mental Test - 4):** This score can be extracted from items in the AMT10 if the latter is done immediately before. **Acute Change or Fluctuating Course:** Fluctuation can occur without delirium in some cases of dementia, but marked fluctuation usually indicates delirium. To help elicit any hallucinations and/or paranoid thoughts ask the patient questions such as, "Are you concerned about anything going on here?"; "Do you feel frightened by anything or anyone?"; "Have you been seeing or hearing anything unusual?"

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CAM-ICU Delirium Assessment Tool

CAM-ICU Worksheet

Feature 1: Acute Onset or Fluctuating Course	Score	Check here if Present
Is the pt different than his/her baseline mental status? OR Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation scale (i.e., RASS), GCS, or previous delirium assessment?	Either question Yes →	☐
Feature 2: Inattention		
Letters Attention Test (See training manual for alternate **Pictures**) Directions: Say to the patient, *"I am going to read you a series of 10 letters. Whenever you hear the letter 'A,' indicate by squeezing my hand."* Read letters from the following letter list in a normal tone 3 seconds apart. **S A V E A H A A R T** **Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."**	Number of Errors >2 →	☐
Feature 3: Altered Level of Consciousness		
Present if the Actual RASS score is anything other than alert and calm (zero)	RASS anything other than zero →	☐
Feature 4:Disorganized Thinking		
Yes/No Questions (See training manual for alternate set of questions) 1. Will a stone float on water? 2. Are there fish in the sea? 3. Does one pound weigh more than two pounds? 4. Can you use a hammer to pound a nail? **Errors are counted when the patient incorrectly answers a question.** **Command** Say to patient: "Hold up this many fingers" (Hold 2 fingers in front of patient) "Now do the same thing with the other hand" (Do not repeat number of fingers) *If pt is unable to move both arms, for 2nd part of command ask patient to "Add one more finger" **An error is counted if patient is unable to complete the entire command.**	Combined number of errors >1→	☐

Overall CAM-ICU		
Feature 1 plus 2 and either 3 or 4 present = CAM-ICU positive	**Criteria Met →**	☐ **CAM-ICU Positive** (Delirium Present)
	Criteria Not Met →	☐ **CAM-ICU Negative** (No Delirium)

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Nurse and Patient Reported Surveys

Primary data on patients' and nurses' experiences of missed nursing care will be collected through surveys.

Separate samples of both nurses and patients will be recruited for participation in the survey component of the research. The MISSCARE Survey instrument developed by Dr. Beatrice Kalisch at the University of Michigan will be used to measure nurse reported missed nursing care. A survey will be distributed to interested nurses and they will be asked to indicate how frequently necessary nursing work is missed in their experience and to estimate the potential reasons for that care being missed.

Missed nursing care impacts on overall quality and safety in an organisation, but ultimately it is experienced by the patient, therefore we will also carry out a patient survey. The MISSCARE Survey – Patient, also developed by Dr. Beatrice Kalisch, is specifically designed to elicit patient reports of the extent to which nursing care was provided. It will be used to measure patient reported missed nursing care. The survey will be distributed to interested patients and using Likert scales, three core areas found to be important to patients – communication, timeliness, and the provision of basic nursing care will be measured.

Research participants will be asked to participate in a paper-based and anonymous survey. The survey will take approximately 10 minutes to complete, and participants will be asked about their experiences of missed nursing care. The data collected through these surveys will be analysed using SPSS, a software platform that is used to perform statistical analysis on datasets.

Prior to participating in the survey, all participants will be provided with a plain language statement detailing all relevant information relation to the study. As no personal data will be collected through the surveys, participation in the survey will imply that the participant has given their consent to be involved in the research project.

Sample size

All patients and nurses who are deemed eligible for participation in this study, based on the inclusion and exclusion criteria that have previously been set by the researchers, will be invited to participated in the study. The researchers aspire to recruit as many participants as possible from those who are eligible to participate. The researchers will aim to recruit at least 300 nurses and 300 patients over the same time period for participation in the survey component of this research. The researchers aim to match the number of patients and nurses in order to capture the same care period.

The MISSCARE Survey

Beatrice J. Kalisch

*Note: An additional section relating to demographics will be included in the survey.

Section A — Missed Care

Direct care staff frequently encounter multiple demands on their time, requiring them to reset priorities. To the best of your knowledge, how frequently are the following care tasks MISSED by direct care staff on your unit? Check only one box for each item.

	Always missed	**Frequently** missed	**Occasionally** missed	**Rarely** missed	**Never** missed	**Not Applicable**
1) Ambulation/ mobilization						
2) Pressure relieving interventions						
3) Feeding residents while food is still at the proper temperature						
4) Setting up meals for residents who can feed themselves						
5) Medications administered as scheduled						
6) Assessment of vital signs						
7) Monitoring intake/output						
8) Full documentation of all care provided						

9) Bathing/Showering						
10) Oral care						
11) Glucose monitoring as ordered						
12) IV/central line site care and assessments according to facility policy						
13) Response to call light is initiated within 5 minutes						
14) PRN medication requests acted on within 15 minutes						
15) Attend interdisciplinary care conferences when held						
16) Assist with toileting needs within 5 minutes of request						
17) Skin/Wound care						

18) Adequate surveillance of confused/impaired residents						

Section B—Reasons for Missed Care

Thinking about the missed care on your unit/shift by direct care staff (as you indicated in Section A above), indicate the significance of the reasons care is MISSED on your unit. Check only one box for each item.

	Significant reason	**Moderate** reason	**Minor** reason	**NOT** a reason for missed care
1) Inadequate number of staff				
2) Urgent patient situations (e.g., a patient's condition worsening, resident fall)				
3) Unexpected rise in acuity on the unit				
4) Inadequate number of assistive personnel (e.g., nursing assistants, medication techs, etc.)				
5) Unbalanced patient assignments				
6) Medications not available when needed				
7) Inadequate hand-off from previous shift or sending unit				
8) Other departments did not provide the care needed (e.g., physical therapy did not ambulate)				
9) Supplies/ equipment not available when needed				
10) Supplies/ equipment not functioning properly when				

needed				
11) Lack of back up support from team members				
12) Tension or communication breakdowns with other ancillary staff/support departments				
13) Tension or communication breakdowns within the nursing team or with the medical staff				
14) Inadequate support from nursing leadership				
15) Heavy admission and discharge activity				
16) Emotional or physical exhaustion				
17) Inadequate supervision of nursing assistants				
18) Interruptions/Multitasking				
19) Lack of cues/reminders				

THANK YOU FOR YOUR PARTICIPATION!

MISSCARE Survey - Patient

To the extent you can remember, please answer the following questions, if you cannot remember, leave the answer blank.

1. How often were you clear about which specific nurse was assigned to take care of you for the shift?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐
2. How often did your nursing staff discuss your treatment with you?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐

3. How often did your nursing staff give you information about tests (e.g. x-ray, MRI, CT scan) and/or procedures you received during this hospitalization (timing, what would be involved, etc.)?

   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐

4. When you had a question or concern about your care or illness, did your nursing staff listen to you?

   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐

5. When you had an opinion about what needed to be done relative to your care, did the nursing staff consider your opinions and ideas?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

6. How often did the nursing staff check with you to make sure your teeth were brushed and mouth rinsed (or provide the care if you could not do it yourself)?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

7. How often did the nursing staff check with you to make sure you had a bath or were kept clean throughout your hospitalization?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

8. If you could not feed yourself at any time during your hospitalization, did your nursing staff help (feed) you within 10 minutes after the arrival of the tray?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

I did not need help to feed myself ☐

I could not eat ☐

9. On average, how often did the nursing staff help you or monitor that you got out of bed and sat in a chair?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

Check here if you were unable to get out of bed ☐

10. On average, how often did the nursing staff help you or monitor that you walked?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

Check here if you could not walk ☐

11. On average, how often did the nursing staff reposition you in bed?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

Check here if you did not need help moving around in bed ☐

12. On average, how often did your nurses check your IV or other line (central venous catheter, PICC line, or port)?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

Check here if you did not have an iv or other line ☐

13. When a monitor or other machine beeped, how long did it usually take the nursing staff to respond?

Less than 5 minutes ☐

5 to 10 minutes ☐

11 to 20 minutes ☐

21 to 30 minutes ☐

More than 30 minutes ☐

No machine beeped ☐

14. When you pushed your call light, how long on average did it take the nursing staff to answer?

Less than 5 minutes ☐

5 to 10 minutes ☐

11 to 20 minutes ☐

21 to 30 minutes ☐

More than 30 minutes ☐

I never pushed my call light ☐

15. Once your call light was answered, how long on average did it take for you to receive the help you requested?

Less than 5 minutes ☐

5 to 10 minutes ☐

11 to 20 minutes ☐

21 to 30 minutes ☐

More than 30 minutes ☐

I never pushed my call light ☐

16. Did you ask for pain medication?

YES (if yes, go to question 17) ☐

NO (if no, go to question 19) ☐

17. If you answered yes to question 16, how long did it take you to get the pain medication?

Less than 5 minutes ☐

5 to 10 minutes ☐

11 to 20 minutes ☐

21 to 30 minutes ☐

More than 30 minutes ☐

I never received the pain medication ☐

18. If you answered yes to question 16, did the nursing staff check back to see if the medication helped reduce your pain?

Never ☐

Rarely ☐

Sometimes ☐

Usually ☐

Always ☐

19. If you needed help to go to the bathroom, how long did it take the nursing staff to get into your room to help you?

Less than 5 minutes ☐

5 to 10 minutes ☐

11 to 20 minutes ☐

21 to 30 minutes ☐

More than 30 minutes ☐

I did not request or need help ☐

20. Overall, how would you rate your nursing care while you were a patient during this hospitalization?

Poor ☐

Fair ☐

Good ☐

Very good ☐

Excellent ☐

21. Did you experience any of the following problems during this hospitalization?

	Yes	No	Unsure
Fall			
Skin breakdown / Pressure ulcer			
Medication Administration Error			
New Infection			
IV running dry			
IV leaking into your skin			
Other problem Explain:___			

*Note: An addition section relating to patient demographics will be included in the survey. Demographics will be gathered based on the RN4CAST patient survey.

THANK YOU FOR YOUR PARTICIPATION!

Determining the cost associated with F2M events and missed nursing care.

Currently the cost of missed nursing care is undetermined. Through calculating the costs of commonly occurring and costly nursing sensitive outcomes we aim to estimate the cost to the Irish health service. This will assist managers and policy makers plan the nurse workforce and care delivery to the largest cohort of patients in the acute hospital system. To this end the support of the healthcare pricing office (HPO) as a member of the advisory group is essential as well as input from a health economist.

The financial burden of adverse events in the Republic of Ireland was estimated to have an annual cost of €194 million, approximately 4% of the Irish acute health care budget (Rafter et al., 2017). Recent work in Ireland estimates the cost to the health service of nursing sensitive adverse events to be in the region of €91.3 million annually (Murphy et al., 2021). It is timely therefore that a surveillance cycle for these most expensive hospital-acquired adverse events be established. Costing of the nurse sensitive adverse events will be achieved using ICD10 data, length of stay, and other variables associated with Cost of Illness calculations.

Based on accurate rates of nursing-sensitive adverse events identified through the chart review, national Diagnosis-Related Groups (DRGs) systems and length of stay, we will calculate national specific cost of illness (COI) using social perspective and bottom-up approach. As the COI is defined as the value of the resources that are expended or forgone as a result of health problems, we will include direct costs (health sector costs – mainly extra length of stay) to provide accurate information on costs of F2M adverse events (and therefore missed nursing care for older patients) on a national level.

Cost2Care Data Protection Considerations

Overview of data and Processing:

In this study, we will determine how these nursing-sensitive outcomes are currently represented in routinely available national discharge (HIPE) data in Ireland. A structured chart review will be conducted in one hospital site to validate the rates of nursing-sensitive events available in the HIPE data. The cost of these events to the Irish health service will be calculated using ICD10 data, length of stay, and other variables associated with Cost of Illness calculations. Through surveys, the human costs of missed care to both patients and caregivers will be further examined.

In order to carry out this work, two main sources of data patient data are required.

Hospital Inpatient Enquiry (HIPE)

The participating Model 4 hospital will generate a random sample of charts for audit in accordance with the criteria set out in the study description, this process will be conducted under the guidance of the Healthcare Pricing Office.

The first data source is the Hospital Inpatient Enquiry (HIPE) national data collection. The HIPE dataset is the only fully audited national data collection on patient admitted to public acute hospitals in Ireland. The HIPE system is managed and administered by the Healthcare Pricing Office (HPO). The HIPE dataset is a pseudonymised dataset which contains demographic, administrative and clinical information on patients. The demographic and administrative information is downloaded directly from hospital patient administration systems to the HIPE system while the clinical information is added by teams of clinical coders in the hospitals based on the documentation in the patient charts. It is intended that the HIPE data, accessed through the participating hospital, the Mater Misericordiae University Hospital, under the guidance of the Healthcare Pricing Office will be used for the following purposes.

1. Generation of a stratified sample of cases from the participating hospital for a retrospective chart review based on the criteria set out in the study protocol.
2. Source of demographic and administrative data on patients whose charts have been selected for the chart review .
3. Comparison of the chart review findings in terms of failure to maintain events with the HIPE record for those patients.
4. Generation of an aggregated stratified national data profile which can be used to generalise the results from the chart review.

Patient Chart:

The patient chart is the primary source of clinical information for patients treated in public acute hospitals in Ireland. The physical chart contains special category, identifiable, personal data on the patients including name, date of birth, medical record number (MRN)

as well as clinical details. The use of patient charts for the identification of F2M events is for a number of reasons:

1. The chart review team need to work with the primary data source in order to be able to fully assess whether an event has occurred. In particular, the nursing notes will be of particular interest in relation to this study.
2. Although the HIPE dataset through the clinical coding guidelines can capture these events, the coded information on diagnoses and procedures is typically not detailed enough to allow for a comprehensive clinical review. Only the chart can provide this.
3. Clinical coding is carried out in accordance with strict coding guidelines as to what can and cannot be coded. In particular, diagnoses can only be coded if there is clear documentation of the diagnosis in the chart. However, for this particular work, the reviewers can potentially use the absence of information in the chart to infer data. This type of assessment is not possible through using HIPE data.
4. Part of the aim of the study is to assess the level of reporting of failure to maintain events on HIPE which is a current area of interest to the HSE.

Detailed Description of Processing

The following section describe the proposed processing steps in detail. In each step the type of data being processed (anonymised, pseudonymized, identifiable) are indicated along with the measures that will be put in place to ensure that the data are handles appropriately in a safe secure manner which will protect the rights of the data subjects.

1. The participating Model 4 hospital will generate a random sample of charts for audit in accordance with the criteria set out in the study description, this process will be conducted under the guidance of the Healthcare Pricing Office. This sampling process will result in a list of hospital stays identifiable by MRN, episode number, admission date and time, discharge date and time which can be used to identify the charts or portions thereof for . In addition to these core variables which will facilitate identification of the correct charts, the following additional information will be provided:

   Patient sex, patient age, length of stay, type of admission (Elective, Emergency, Maternity), admission source, discharge destination, specialty, days spent in ICU, coded clinical diagnoses, coded procedures.

   The demographic and administrative information will be used to stratify the sample to gain understanding on potential factors influencing reporting of F2M events while the clinical information will be used to compare the event rates from the chart review versus those identified through HIPE.

   The final piece of information which will be provided with the chart review sample, will be an encrypted MRN which is generated by the hospital HIPE manager in line with processes used by the HPO as part of their routine data

processes. This encrypted MRN will provide a means for the chart review team to provide data to the wider study team without identifying the patient.

The chart review team will be the only COST2CARE study team members who will have access to the unencrypted MRN.

2. The participating hospital (MMUH) will provide the review sample list directly to the chart review team (for chart retrieval purposes). This transfer will be facilitated via a secure fileshare which will be accessible only to one member of the hospital staff and one member of the chart review team. At this stage, the diagnosis and procedure information will not be included in the sample data so as not to bias the chart reviewers. This information can be supplied to and reattached by the study team based on the encrypted MRN once the chart audit has been completed.

3. The chart review team will agree a protocol with staff in the participating hospital in order to safely and securely access the charts. Although this will be agreed according to existing protocols in the participating hospital it is envisaged that the following items will be explicitly agreed and stated in that protocol.

    - The purpose of the review
    - The duration of the review
    - The staff involved (study chart reviewers and hospital staff)
    - Principle contacts and phone numbers
    - Documentation requirements (paper chart and electronic records)
    - Location of review
    - Access times
    - Chart security
    - Query process

4. While conducting the chart review, the review team will record and store their findings on a password protected excel file on a password protected and preferably encrypted laptop.

5. On completion of the chart review, the reviewers will remove the unencrypted MRN from the excel file along with the admission and discharge dates and times to further ensure anonymity. At this point the data can be considered to be anonymised and can be provided to the wider study team for analysis. The chart review team must confirm in writing that that all instances of MRNs are removed from the study laptop(s) prior to releasing the anonymised data to the wider study team.

6. At this point the chart review team will inform that hospital HIPE manager that the chart review portion of the study is complete and they will then make the diagnoses and procedures as recorded on HIPE available to the study team. These will be provided via secure fileshare.

7. Once initial analysis of the study sample has been carried out, the HPO will provide the study team with a national summary data aggregated by the stratification factors used in the sampling methodology to generalise the results to the national hospital population. Given that the review sample will be taken from a single hospital, careful consideration will be given to the appropriateness of this step by experts in this field.

Legal Basis:

As detailed in the study protocol, the proposed study design contains a retrospective chart review. As per the 2021 amendments to Health Research Regulations 2018 (S.I. No. 314 of 2018) a retrospective chart review carried out for research purposes can be done without the consent of participants, subject to mandatory safeguards and specified governance mechanisms. These include:

1. The proposed research must be low risk
2. The research must be approved by a REC
3. Appropriate transparency requirement must be met
4. Only certain categories of individuals can carry out a chart review without obtaining explicit informed consent
5. The personal data accessed cannot be used for other purposes and cannot be shared with others without being fully anonymised.
6. If the retrospective chart review is not ow risk then the either explicit informed consent must be obtained or a decision must be sought from the HRCDC

The study team assessment is that the research is low risk and as such has been approved by the DCU REC and the IRB for MMUH. A consent waiver has been granted by the HRCDC for the chart review process. The HPO in the data protection statement explicitly mentions that HIPE data may be used for research purposes.

Data Controller:

The data controller of the data generated for the purposes of this research project will be Dr. Marcia Kirwan.

Data Processors:

No data processors will be employed for the purpose of this study.

Data Minimization:

In respect of the concept of data minimization, only the data fields required for the proposed analysis as listed in the “Detailed Description of Processing” will be made available.

Data Supporting Assets:

The main data supporting assets for the national HIPE file as held by the HPO are HSE servers, networks, encrypted laptops etc. All of the HSE infrastructure is password protected and access is restricted to named individuals. All laptops are hardware encrypted by default, however no identifiable personal data is held on these devices.

The data supporting assets for the local HIPE file in each hospital are the servers hosting the local HIPE instance and the local hospital network. Note that in the case of Statutory hospitals, and some voluntary hospitals the local HIPE instance is also hosted on central HSE infrastructure.

In the case of the study team, the data supporting assets will comprise a number of laptops which are password protected and accessible only to named individuals on the study team.

Retention Period:

The patient chart will only be accessible by the chart review team for the duration of the review portion of the study. The charts themselves will be retained by the participating hospital according to their retention policies. The identifiable review results including the MRN will only be available to the chart reviewers and will be retained in that identifiable format (i.e. including MRN) for the duration of the chart review. The anonymised chart review results, including only the encrypted MRN will be retained for the duration of the overall study and will then be destroyed.

How are data subjects informed of the processing:

The HSE data protection policy and service users privacy notice (https://www.hse.ie/eng/gdpr/hse-data-protection-policy/) inform patients that their data may be provided for research purposes. These documents only extend to the provision of anonymised data for research purposes therefore additional notification should be put in place by the participating hospital to inform patients that their charts may be made available for the retrospective chart review.

Is personal data being shared:

The chart review team will have temporary access to patient charts in order to carry out the review. However, the results of the review will only be made available to the wider study team in a fully anonymised fashion. Individual patient level data will not be shared by the study team. Only aggregated data and summaries will be published.

Transfer to third country:

There will be no transfer of personal data, either identifiable or pseudonymised, to third parties

Data protection law training:

All members of the research team from Dublin City University have completed an online data protection training course with Dublin City University.

Anonymization processes:

As part of the normal monthly processing of the national HIPE file, the HPO generate an anonymised MRN for inclusion on the file. MRN encryption in this study is carried out by the hospital HIPE manager in line with processes used by the HPO as part of their routine

data processes. The anonymised MRN is generated such that multiple discharges relating to the same patient are identified using the same encrypted MRN, however the recipients of the data cannot identify the original MRN from the encrypted one.

Technical and Organisational Measures:

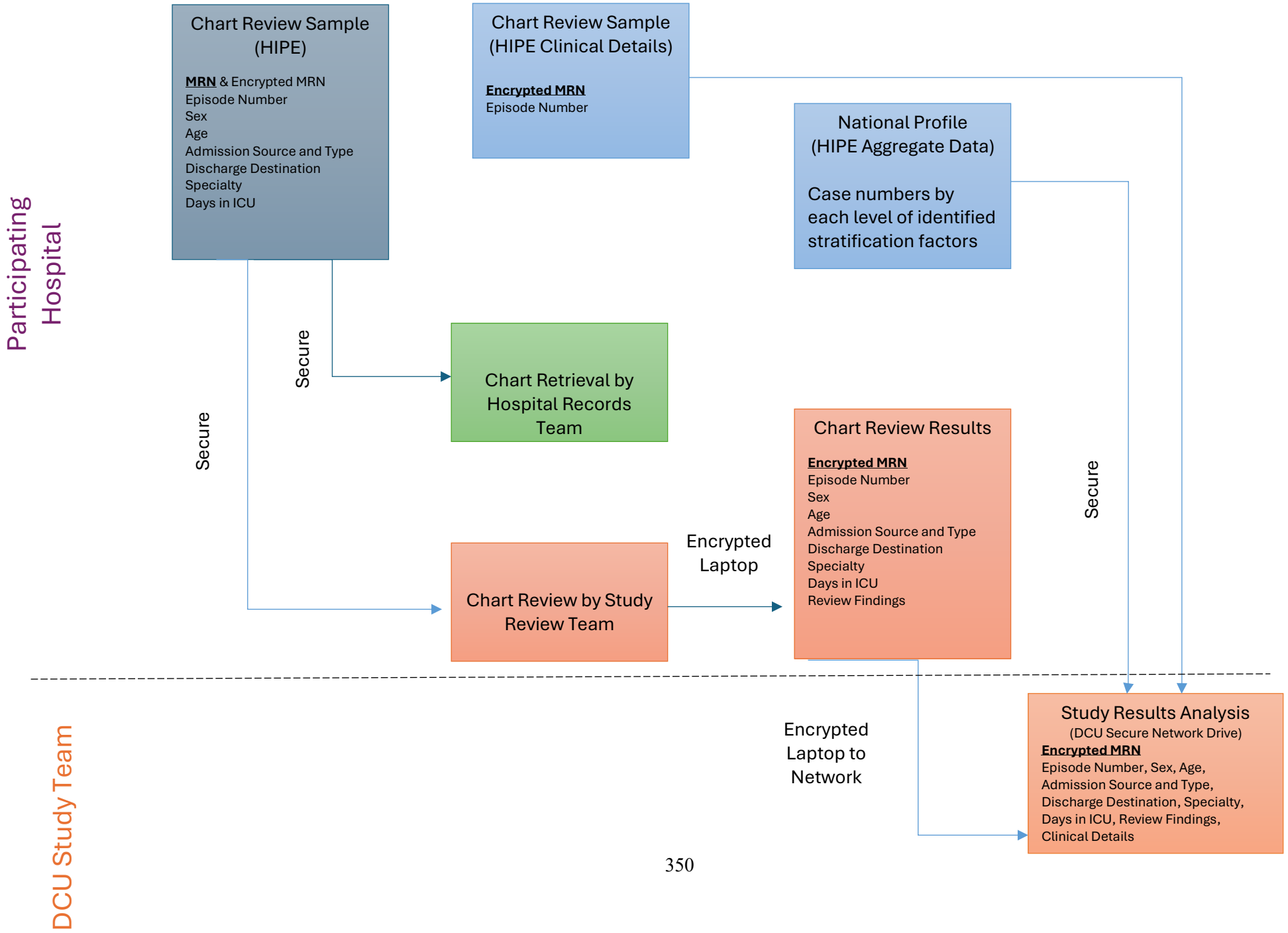
Technical Measures:

MRN encryption is carried out by the hospital HIPE manager in line with processes used by the HPO as part of their routine data processes

All DCU laptops are hardware encrypted and password protected.

Organisational Measures:

All members of the research team from DCU have completed an online course in data protection.


Participating Hospital
Chart Review Sample (HIPE)
MRN & Encrypted MRN
Episode Number
Sex
Age
Admission Source and Type
Discharge Destination
Specialty
Days in ICU
Chart Review Sample (HIPE Clinical Details)
Encrypted MRN
Episode Number
National Profile (HIPE Aggregate Data)
Case numbers by each level of identified stratification factors
Secure
Secure
Chart Retrieval by Hospital Records Team
Chart Review Results
Encrypted MRN
Episode Number
Sex
Age
Admission Source and Type
Discharge Destination
Specialty
Days in ICU
Review Findings
Secure
Chart Review by Study Review Team
Encrypted Laptop
DCU Study Team
Encrypted Laptop to Network
Study Results Analysis
(DCU Secure Network Drive)
Encrypted MRN
Episode Number, Sex, Age, Admission Source and Type, Discharge Destination, Specialty, Days in ICU, Review Findings, Clinical Details

Appendix D – Nurse Survey



If you are a Staff Nurse or Clinical Nurse Manager working in an adult in-patient ward in the Mater Hospital you are eligible to participate in this survey.

Please Note: Nurses and student nurses working in day wards, outpatient departments, emergency departments or in operating theatres are **NOT** eligible for inclusion in this study.

Dear Nurse,

This questionnaire relates to a study which is currently underway in the Mater Hospital. The study is called COST2CARE and it recognises that the quality and safety of nursing care is an important determinant of patient outcome following hospitalisation. As part of the COST2CARE project researchers are eager to examine a phenomenon which is described as Missed Nursing Care. This phenomenon was first described by Professor Beatrice Kalisch in 2006 and refers to any aspect of necessary nursing care that is delayed, missed, or left undone at the end of a shift (often due to a lack of staff, time or other resources). Other researchers describe the concept as Care Left Undone and it is often examined as a patient safety indicator in nursing and healthcare literature. In order to explore this concept of care left undone and understand how it is experienced by nurses, it is important that the nursing voice is heard. The COST2CARE researchers want to know if care is delayed or left undone in your ward/unit and if so which aspects of care are more likely to be delayed or incomplete. They also wish to hear nurses' views and experiences on why this might be the case. This project is intended to enhance patient safety in Irish hospitals by identifying the factors which prevent nurses from delivering care to patients as they would wish to deliver it. We would be very grateful if you choose to help us by completing the attached questionnaire.

This study has been approved by your hospital. The survey is voluntary and strictly confidential. Do not write your name on the questionnaire. Your name is not required and not known to us and therefore can never be associated with your responses. The information you provide will go directly to the researchers. Your participation will not affect your employment status in any way. By completing the online questionnaire and submitting the questionnaire, you are giving your consent to participate.

More information on the overall COST2CARE study can be found on the study website at www.cost2care.eu. If you have any further questions or concerns regarding this study, please contact marcia.kirwan@dcu.ie.

COST2CARE Nurse Survey

ABOUT YOU

1. What is your gender?
   ☐Female ☐Male ☐Other ☐Prefer not to say

2. What is your age? Years: _____

3. What is your job title/role?
   Staff Nurse (RN) ☐

   Nurse Manager (e.g., Clinical Nurse Manager) ☐

   Other [Please specify: _____] ☐

4. A) Did you receive your basic nursing education in Ireland? _____

   B) If no, in what country did you receive your basic nursing education? Country : _____

5. Do you have a baccalaureate (level 8) degree in nursing?
   ☐Yes ☐No

6. How satisfied are you with your choice of nursing as a career?
   ☐Very dissatisfied ☐A little dissatisfied ☐Moderately satisfied ☐Very satisfied

7. How many years have you worked as a registered nurse...
   A) in your career Years:_____ Months: _____
   B) in this hospital Years:_____ Months: _____

8. For how many years have you worked as a registered nurse...
   A) in the specialty in which you currently work Years:_____ Months: _____
   B) Did in this ward/unit? Years:_____ Months: _____

ABOUT YOUR MOST RECENT SHIFT AT WORK IN THIS HOSPITAL

1. Please indicate the type of unit you work on:
   Surgical (any surgical specialty) ☐

   Medical (any medical specialty) ☐

   Mixed Medical/Surgical ☐

   Intensive Care Unit (ICU) ☐

   High Dependency Unit (HDU) ☐

Other [Please specify: _____

2. On your most recent shift how many patients in total were on your unit/ward? _____

3. Counting yourself, how many registered nurses in total provided direct patient care on your unit/ward during the most recent shift you worked?
   Number of registered nurses: _____

4. How many other nursing care staff (Healthcare assistants) in total provided direct patient care on your unit/ward during the most recent shift you worked?
   Other nursing care staff: _____

5. A) How many patient-admissions did you have on your most recent shift (i.e., includes transfers into the unit/ward)? _____

5. B) How many patient-discharges did you have on your most recent shift (i.e., includes transfers out of the unit/ward)? _____

5. C) How many patient emergencies did you have on your most recent shift (i.e., falls, deteriorating clinical condition of patient, etc.) _____

Section A

Nursing staff frequently encounter multiple demands on their time, requiring them to reset priorities. To the best of your knowledge, how frequently are the following nursing care tasks left undone by nursing staff at the end of a shift due to these multiple demand on your unit/ward? Check only one box for each item.

	Always Missed	Frequently Missed	Occasionally Missed	Rarely Missed	Never Missed	Not Applicable
1) Mobilization						
2) Pressure relieving interventions						
3) Feeding patients while food is still at the proper temperature						
4) Setting up meals for patients who can feed themselves						
5) Medications administered as scheduled and on time						
6) Assessment of vital signs						

7) Monitoring intake/output						
8) Full documentation of all care provided						
9) Bathing/Showering						
10) Oral care						
11) Glucose monitoring as ordered						
12) IV/central line site care and assessments according to hospital policy						
13) Response to call light is initiated within 5 minutes						
14) PRN medication requests acted on within 15 minutes						
15) Attend interdisciplinary care conferences when held						
16) Assist with toileting needs within 5 minutes of request						
17) Skin/Wound care						
18) Adequate surveillance of cognitively impaired patients						

Section B—Reasons

Thinking about the care left undone on your unit/ward/shift by nursing staff (as you indicated the section above), please assess the contribution of each of the statements below. Check only one box for each item.

	Significant Contribution	Moderate Contribution	Minor Contribution	No Contribution

1) Inadequate number of staff				
2) Urgent patient situations (e.g., a patient's condition worsening, patient fall)				
3) Unexpected rise in acuity on the unit				
4) Inadequate number of assistive personnel (e.g., healthcare assistants, etc.)				
5) Unbalanced patient assignments				
6) Medications not available when needed				
7) Inadequate hand-over from previous shift or transferring ward/unit				
8) Other departments did not provide the care needed (e.g., physical therapy (physiotherapy), occupational therapy, medical social work)				
9) Supplies/ equipment not available when needed				
10) Supplies/ equipment not functioning properly when needed				
11) Lack of back up support from team members				
12) Tension or communication breakdowns with other staff/departments				
13) Tension or communication breakdowns within the nursing team or with the medical staff				
14) Inadequate support from nursing leadership				
15) Heavy admission and discharge activity				
16) Emotional or physical exhaustion				

17) Inadequate supervision of healthcare assistants				
18) Interruptions/Multitasking				
19) Lack of cues/reminders				

QUALITY AND SAFETY

1. In general, how would you describe the quality of nursing care delivered to patients on your unit/ward?

   ☐Poor ☐ Fair ☐ Good ☐ Excellent

2. Please give your unit/ward an over grade on patient safety.

   ☐Poor ☐ Fair ☐ Good ☐ Excellent

3. How often do you feel the unit staffing is adequate?

   100% of the time ☐

   75% of the time ☐

   50% of the time ☐

   25% of the time ☐

   0% of the time ☐

THANK YOU FOR YOUR PARTICIPATION!

Appendix E – Patient Survey



PATIENT SURVEY INSTRUCTIONS

Please complete this questionnaire **ONLY** if you are a patient aged **over 65** and have been **admitted for more than three days** are eligible for participation in this study.

This survey is part of a study to improve the quality of care in hospitals. Your participation is voluntary. Your care will not be affected in any way by your decision to participate or not. Your answers are anonymous.

Do not write your name or any personal details on the form

Place your completed questionnaire in the envelope provided. The sealed envelopes will be collected directly by COST2CARE researchers. By filling out the questionnaire you are giving your permission to participate.

- Please tell us about your experience in this hospital. You may ask for help in filling out the questionnaire, but the answers should be your own. Do not fill out this questionnaire if you are not the patient unless you are assisting the patient, and then record the patient's responses not your own.
- After completing the questionnaire, please insert it in the attached envelope, seal the envelope, and the sealed envelope will be collected by the researchers.
- Answer all the questions by checking the box next to your answer.
- You are sometimes told to skip over some questions in this questionnaire. When this happens you will see an arrow with a note that tells you what question to answer next, like this:

  Yes

  No → If No, Go to Question 1

If you have any questions, the DCU researcher is available in the hospital to answer your questions.

COST2CARE Patient Survey

To the extent you can remember, please answer the following questions, if you cannot remember, leave the answer blank.

1. Please select one option in response to each question.

	Never	Rarely	Sometimes	Usually	Always
How often were you clear about which specific nurse was assigned to take care of you for the shift?					
How often did your nursing staff discuss your treatment with you?					
How often did your nursing staff give you information about tests (e.g. x-ray, MRI, CT scan) and/or procedures you received during this hospitalization (timing, what would be involved, etc.)?					
When you had a question or concern about your care or illness, did your nursing staff listen to you?					
When you had an opinion about what needed to be done relative to your care, did the nursing staff consider your opinions and ideas?					
How often did the nursing staff check with you to make sure your teeth were brushed/cleaned and mouth rinsed (or provide the care if you could not do it yourself)?					
How often did the nursing staff check with you to make sure you had a shower/wash throughout your hospitalization?					

2. If you could not feed yourself at any time during your hospitalization, did the nursing staff help to feed you within 10 minutes after the arrival of the tray?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐

Always ☐
Check here if you did not need help to feed yourself ☐
Check here if you could not eat ☐

3. On average, how often did the nursing staff help you or monitor that you got out of bed and sat in a chair?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐
   - Check here if you were unable to get out of bed ☐

4. On average, how often did the nursing staff help you or monitor that you walked?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐
   - Check here if you could not walk ☐

5. On average, how often did the nursing staff reposition you in bed?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐
   - Check here if you did not need help moving around in bed ☐

6. On average, how often did your nurses check your IV or other line (central venous catheter, PICC line, or port)?
   - Never ☐
   - Rarely ☐
   - Sometimes ☐
   - Usually ☐
   - Always ☐
   - Check here if you did not have an iv or other line ☐

7. When a monitor or other machine beeped, how long did it usually take the nursing staff to respond?
   - Less than 5 minutes ☐
   - 5 to 10 minutes ☐
   - 11 to 20 minutes ☐
   - 21 to 30 minutes ☐
   - More than 30 minutes ☐

No machine beeped ☐

8. When you pressed your call light, how long on average did it take the nursing staff to answer?
   - Less than 5 minutes ☐
   - 5 to 10 minutes ☐
   - 11 to 20 minutes ☐
   - 21 to 30 minutes ☐
   - More than 30 minutes ☐
   - I never pressed my call light ☐

9. Once your call light was answered, how long on average did it take for you to receive the help you requested?
   - Less than 5 minutes ☐
   - 5 to 10 minutes ☐
   - 11 to 20 minutes ☐
   - 21 to 30 minutes ☐
   - More than 30 minutes ☐
   - I never pressed my call light ☐

10. Did you ask for pain medication?
    - YES (if yes, go to question 11) ☐
    - NO (if no, go to question 13) ☐

11. If you answered yes to question 10, how long did it take you to get the pain medication?
    - Less than 5 minutes ☐
    - 5 to 10 minutes ☐
    - 11 to 20 minutes ☐
    - 21 to 30 minutes ☐
    - More than 30 minutes ☐
    - I never received the pain medication ☐

12. If you answered yes to question 10, did the nursing staff check back to see if the medication helped reduce your pain?
    - Never ☐
    - Rarely ☐
    - Sometimes ☐
    - Usually ☐
    - Always ☐

13. If you needed help to go to the bathroom, how long did it take the nursing staff to get into your room to help you?
    - Less than 5 minutes ☐

5 to 10 minutes ☐
11 to 20 minutes ☐
21 to 30 minutes ☐
More than 30 minutes ☐
I did not request or need help ☐

14. Overall, how would you rate your nursing care while you were a patient during this hospitalization?

Poor ☐
Fair ☐
Good ☐
Very good ☐
Excellent ☐

15. Please select one option in response to each question.

	Yes	No	Unsure
Did you experience a fall during this hospitalisation?			
Did you experience a pressure ulcer during this hospitalisation?			
Was your medication always correct?			
Was your medication always on time?			
Did you get any infection during this hospitalisation?			
Did you experience any problems with your IV cannula during this hospitalisation?			
Did your cannula have to be replaced during this hospitalisation?			

General Information

1. Type of ward

Surgical (any surgical specialty) ☐
Medical (any medical specialty) ☐
Mixed Medical/Surgical ☐
Intensive Care Unit (ICU) ☐
High Dependency Unit (HDU) ☐
Other [Please specify: _____

2. How many days have you been in the hospital this time? ____ days ☐Unsure

3. Have you been hospitalized before? Yes☐ No☐

4. How many times in the last 5 years?_____ ☐Unsure

5. Age: _____ years old

6. Gender: ☐ Male ☐ Female ☐ Other ☐ Prefer not to say

7. In general, how would you rate your overall health?
   ☐ Poor ☐ Fair ☐ Good ☐ Very good ☐ Excellent

THANK YOU FOR YOUR PARTICIPATION!

Appendix F – Dublin City University Research Ethics Committee Ethics Approval

Ollscoil Chathair Bhaile Átha Cliath
Dublin City University

Dr Marcia Kirwan
School of Nursing, Psychotherapy and Community Health

23rd February 2023

REC Reference: DCUREC/2022/253

Proposal Title: COST2CARE: Addressing the economic and human cost of hospital acquired and nurse-sensitive adverse events in older patients through optimal use of routine discharge data and measurement of missed nursing care

Applicant(s): Dr Marcia Kirwan, Ms Anna Connolly, Prof Anthony Staines, Prof Anne Matthews, Prof Amanda Phelan, Prof Walter Sermeus, Mr Fiachra Bane, Ms Mairead Hayes

Dear Colleagues,

Thank you for your application to DCU Research Ethics Committee (REC). Further to full committee review, DCU REC is pleased to issue approval for this research proposal.

DCU REC's consideration of all ethics applications is dependent upon the information supplied by the researcher. This information is expected to be truthful and accurate. Researchers are responsible for ensuring that their research is carried out in accordance with the information provided in their ethics application.

Materials used to recruit participants should note that ethical approval for this project has been obtained from the Dublin City University Research Ethics Committee. As part of DCU REC's ongoing monitoring process, during your research you may be asked to provide DCU REC with a progress report. Should substantial modifications to the research protocol be required at a later stage, a further amendment submission should be made to the REC.

Yours sincerely,

Dr. Melrona Kirrane

Dr. Melrona Kirrane
Chairperson
DCU Research Ethics Committee

DCU
Research & Innovation

Taighde & Nuálaíocht Tacaíocht
Ollscoil Chathair Bhaile Átha Cliath,
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Appendix G – Participating Hospital Site Ethics Approval

Mater Misericordiae University Hospital
Sisters of Mercy
Eccles Street, Dublin D07 R2WY, Ireland

Ospidéal Ollscoile Mater Misericordiae
Siúracha na Trócaire
Sráid Eccles, Baile Átha Cliath D07 R2WY, Éire

Tel: +353 1 8032000 Web: www.mater.ie

Not for prescription purposes

Ms. Mary Raftery
Director of Nursing
Mater Misericordiae University Hospital
Dublin 7

01st June 2023 Institutional Review Board Reference: 1/378/2356

RE: COST2CARE: Addressing he economic and human cost of Hospital acquired and nursing-sensitive adverse events in older patients through optimal use of routine discharge data and measurement of missed nursing
Standard Application Form (Version 2, 10th May 2023)
Study Protocol
Draft Variables for Chart Review Data Extraction
Missed Nursing Care (The MISSCARE Survey)
MISSCARE Survey – Patient
DCU Data Protection Impact Assessment
MMUH DPO Email (31st March 2023)
DCU Insurance Certificate (16th September 2022)
Nurse Recruitment Poster
Patients +65 Recruitment Poster
Plain Language Statement for Survey
Participant Information Leaflet – Nurses
Participant Information Leaflet – Patients

Dear Ms. Raftery,

I acknowledge receipt of your correspondence dated 10th and 22nd May 2023 enclosing points of clarification, Standard Application Form (Version 2, 10th May 2023), MMUH DPO email, Participant Information Leaflet – Nurses, Participant Information Leaflet – Patients and budget breakdown for the above research study to be carried out at the Mater Misericordiae University Hospital (MMUH).

This correspondence has been noted and approval for this research study to proceed at MMUH is granted on the **condition that data being shared with DCU is completely anonymous and that a NDA should be submitted for Research Governance review and CEO signature.**

It is your responsibility to adhere to the approved research protocol and ensure the following:
1. Only Investigators named on the approved IRB application form are involved in the research;
2. All investigators involved with the research only use the approved documents without deviation (unless they have been approved by the IRB);
3. To submit annual reports setting out the progress of the research;
4. To notify the IRB when the research is concluded.

It is your responsibility to comply with your legal obligations under Data Protection Law and the Health Research Regulations. You should consult with the research study site Data Protection Officer on any data protection issues in particular in relation to the sharing of any personal data outside of the MMUH. Detailed GDPR Guidance for research is available on the HRB website: https://www.hrb.ie/funding/gdpr-guidance-for-researchers/.

Yours sincerely

Pp Hannah King

Dr. Aoife Cotter
Vice-Chairperson
Institutional Review Board

Cc: Dr. Marcia Kirwan, Associate Professor in the School of Nursing, Psychotherapy and Community Health, DCU

'Commitment to Excellence'
Chairman: Mr David Begg Vice Chair: Mr David O'Kelly CEO: Mr Alan Sharp
Directors: Mr Rod Ensor, Prof Cecily Kelleher, Dr Mary McMenamin,
Dr. Brian Marsh, Ms Ellis O'Brien, Ms Brid Cosgrove, Ms Suzanne Dempsey, Prof Jim Egan, Ms Anne Vaughan, Mr Pat O'Doherty

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F0006-Dec-22
«FOOTTEXT5»

Appendix H – Health Research Consent Declaration Committee Approval

HRCDC
Health Research Consent Declaration Committee

Teach Grattan
67-72 Sráid an Mhóta Íochtarach
Baile Átha Cliath 2
D02 H638
Éire

Grattan House
67-72 Lower Mount Street
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PRIVATE AND CONFIDENTIAL

Dr. Marcia Kirwan
School of Nursing, Psychotherapy and Community Health,
Dublin City University,
Glasnevin Campus,
By email only: marcia.kirwan@dcu.ie
Cc by email only: Anna Connolly, anna.connolly82@mail.dcu.ie

23rd October 2023

Dear Marcia,

RE:	**Application:**	"COST2CARE: Addressing the economic and human cost of hospital acquired and nursing-sensitive adverse events in older patients through optimal use of routine discharge data and measurement of missed nursing care"
	Reference ID:	23-006-AF1
	Data Controller(s):	Dublin City University
	Subject:	Responses to attached conditions

Thank you for correspondence of 25th September 2023, providing responses to the conditions attached to the consent declaration. In addition, thank you for your updated replies/informaiton submitted on 13th October and 23rd October. The Secretariat have reviewed updated your responses; please find the following UPDATED points below for your records attention:

- **UPDATED: Condition 1.** The Secretariat nots the response regarding updates that will be made to the poster and the study website, and the placement of the poster in the hospital. It is also noted the Mater Hospital will be named on the study website, that is currently under development. This condition is noted as **'underway'** and remains valid for the duration of the study.

- **Condition 2**. The response in your correspondence, including the information that will be on the study website is noted. This condition is noted as **'underway'** and remains valid for the duration of the study i.e., the process for withdrawing from the study and deleting data must remain in place.

- **Condition 3**. The REC letter dated 1st June 2023 is noted. This condition is noted as **'met'.**

- **UPDATED: Condition 4.** The Applicant/data controller confirms the legal agreement is adequate to cover the DCU chart review and to protect/govern the participant's data. In addition, the Applicant confirms that data will not be transferred/provided from the HPO to DCU for this study; accordingly, a data sharing agreement with the HPO should not be necessary. It is further noted that data that was to be provided from the HPO will now be generated/provided from the Mater Hospital. It was previously outlined that the Mater Hospital is involved in this study, providing the DCU team with access to the patient records for the chart review. In this context an amendment request form should not be necessary with regards the removal of the HPO.
  Condition 4 is noted as **'met'.**

- **Condition 5.** The response provided is noted and this condition **remains valid for the duration of the declaration.**

HRCDC
Health Research Consent Declaration Committee

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www.hrcdc.ie

- **Condition 6.** The response to this condition is noted. This condition is noted as **underway** and **remains valid for the duration of the declaration.**

- **Condition 7.** The response to this condition is noted. This condition is noted as **underway** and **remains valid for the duration of the declaration.**

On behalf of the HRCDC we wish you success with your research study.

Kind regards,



Jonny Barrett
Programme Officer, Secretariat
Health Research Consent Declaration Committee

Appendix I – Participant Information Leaflet - Patients



Participant Information Leaflet – Patients

Project Name: Cost2Care

University Department: School of Nursing, Psychotherapy and Community Health
Study Site: Mater Misericordiae University Hospital

Principal Investigator:
Dr. Marcia Kirwan Email: marcia.kirwan@dcu.ie

Co-Principal Investigator for data collection at MMUH:
Ms. Mary Raftery Email: mraftery@mater.ie

Other Investigators:
Prof. Anne Matthews Email: anne.matthews@dcu.ie
Ms. Anna Connolly Email: anna.connolly82@mail.dcu.ie

Data Controllers:
Dublin City University (for research data)

Data Protection Officers:
Data Protection Officer of Dublin City University Email: data.protection@dcu.ie
Data Protection Officer of Mater Misericordiae University Hospital Email: DPO@mater.ie

Introduction
This research is being conducted as part of a funded project. The project is being funded by the Health Research Board. You are invited to participate in this study. Please read the following information before deciding to participate.

Background
The largest group of patients in acute hospitals in Ireland are older people aged 65 and over. While these patients require nursing care for their acute presenting condition, they often simultaneously require fundamental nursing care to address other needs related to advancing age, or the presence of co-morbidities. If this care is missed, patients are at high risk of experiencing complications, which are associated with extended lengths of stay or reduced function on discharge. Ultimately, these complications are high-cost events, both financially, to the health service, and in human costs to the patient and caregiver.

Aims of this research

The main aim of this study is to demonstrate the potential for safer hospital care and reduced healthcare costs associated with older patients in acute hospitals in Ireland through routine measurement of missed nursing care in hospitals, and sustainable and accurate reporting of nursing sensitive adverse events using routinely collected hospital discharge data.

Why have I been invited to take part?
The perspective of the patient is integral to this study and the researchers are committed to ensuring the patient voice is heard and responded to. When nursing care is missed it impacts on overall quality and safety in an organisation, but ultimately it is experienced by the patient. It seems important therefore that as experts in their own experience patients should be included in this study. All patients aged 65 and older in any adult in-patient ward in MMUH for over three days will be invited to participate in this study. Inclusion criteria for participation in this research also includes being capable of completing the survey independently and being able to read and speak English.

How will the study be carried out?
The data collection will begin in October 2023 and last for a duration of six months. Patients will be invited to participate during this period and interested participants will be distributed surveys which they may return at any stage whilst the data collection period is underway. The data will be collected through surveys that will be distributed to patients being treated in any adult in-patient wards in MMUH. The data will be collected on site at MMUH, taken to DCU and analysed by researchers at the university.

How many patients will be taking part in the study?
It is anticipated that approximately 300 patients will take part in the survey component of this study.

What does participation in this research involve?
Participation in this research project will involve completing a paper-based or online survey. The survey will take approximately 10 minutes to complete. As there will be no personal data collected through this survey, consent will be obtained from participants in the form of their participation in the study. Participation in the survey will imply that the participant has given their consent to being involved in the study.

Potential risks in participating in this research
This project is low-risk, therefore it is unlikely that there will be any risk posed to participants. In the event that participants become upset or distressed due to any topics addressed in the surveys, support will be organised. Participants' confidentiality will be carefully managed therefore, it is unlikely that any risks will arise relating to this.

What will happen to my data?
The survey data will be collected on site at MMUH via anonymous, paper-based and online surveys. The survey data will then be transferred to DCU to be analysed by the researchers. The data collected through the surveys will be stored securely on a DCU encrypted laptop which will be stored in a locked room in DCU. Only the researchers involved in the data analysis processes will have access to the data. Statistical analysis will be carried out on the data and the results will be used to further explore the human cost of missed nursing care and nursing sensitive adverse events. The data will be used to inform reports related to this study and once these reports have been published, the data will be permanently deleted.

Benefits to taking part in this study
Participants will have the opportunity to share and voice their opinions on their experiences of giving and receiving nursing care. Their participation may also have positive implications for patient safety in the future.

How participants will be informed about the progress of the project

Participants may contact the investigators using the contact details listed above for information on the progress of the project. A project webpage will be set up and updated with information regarding the progress of the project. Participants will be directed towards this webpage if they wish to stay updated and informed about development and progress of the project. The results of the study will be reported in medical/scientific journals and disclosed at medical/scientific conferences. No information which reveals your identity will be disclosed.

Privacy Notice
The data controller is Dublin City University and the data processor who will be solely responsible for the collection, control and processing of the data collected is the Principal Investigator. All efforts will be made to protect the privacy of participants however, individuals have the right to lodge a complaint to the Irish Data Protection Commission if they feel that their privacy has not been respected. If participants require further information in relation to data protection, they may contact the principal investigator or the DCU data protection unit through the DCU data protection officer, Mr. Martin Ward (Email: data.protection@dcu.ie Phone: 7005118 / 7008257).

When will the data be disposed of?
Data collected during this project will be stored safely for three years after the completion of the project, at which point it is anticipated that all reports and publications using this data will be completed. All Files containing data collected throughout the course of this project will be permanently deleted three years after the project has been completed.

Confidentiality
All efforts will be made to ensure that the data collected will be confidential in order to protect the privacy of the participants. Participant names will not be collected at any stage of the survey and therefore, the participants will remain anonymous. A risk assessment of the data protection implications of this research and it was determined that this is a low-risk study as no identifiable personal data will be collected. All researchers have undertaken training in data protection laws and will ensure that the privacy of participants is protected by not collecting any identifiable personal data. Despite these efforts, the confidentiality of information can only be protected within the limitations of the law - i.e., it is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

What are your rights?
You are entitled to:

- The right to access to your data and receive a copy of it
- The right to restrict or object to processing of your data
- The right to object to any further processing of the information we hold about you (except where it is de-identified)
- The right to have inaccurate information about you corrected or deleted
- The right to receive your data in a portable format and to have it transferred to another data controller
- The right to request deletion of your data

By law you can exercise the following rights in relation to your personal data, unless the request would make it impossible or very difficult to conduct the research. You can exercise these rights by contacting the principal investigator at marcia.kirwan@dcu.ie or the DCU Data Protection Officer at data.protection@dcu.ie. Further information on data protection is available on the study website.

Has this study been approved by a research ethics committee?
Yes, this study has been approved by Dublin City University Research Ethics Committee. Approval was granted on the 23rd of February 2023. This study has also been approved by (insert MMUH when approval granted)

Participation in this study is voluntary
Participation is voluntary and participants may withdraw from the study at any point prior to submitting the survey as once it has been submitted, it will not be possible for researchers to identify their data and remove it. If participants withdraw from the study prior to submitting the survey, no data will be collected however again, as this is an anonymous survey, participants cannot withdraw their data after their survey has been submitted as it will not be possible to identify their survey answers and link the participant to the answers they have submitted. Withdrawal will not in any way affect the care that participants receive whilst they are an in-patient at MMUH.

Who is organising and funding this study? Will the results be used for commercial purposes?
This study is being funded by the Health Research Board. The researchers at Dublin City University have received a grant from the HRB to conduct this research. This study is also being undertaken as part of an academic qualification. A PhD student has been recruited to work on this project and will utilise the results of the student to inform their research. The results of this study will not be disclosed for commercial purposes.

Is there any payment for taking part? Will it cost me anything if I agree to take part?
No, patients will not be paid for participation in this study. Agreeing to participate will also not results in any costs to the participant.

Who should I contact for information or complaints?
If you any questions or concerns about this study, please contact the principal investigator or data protection officers at the contact details listed on this information leaflet.

Under GDPR, if you are not satisfied with how your data is being processed, you have the right to lodge a complaint with the Office of the Data Protection Commission, 21 Fitzwilliam Square South, Dublin 2, Ireland. Website: www.dataprotection.ie.

If participants have concerns about this study and wish to contact an independent person, please contact:
The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000, email: rec@dcu.ie

Appendix J – Participant Information Leaflet – Nurses







Participant Information Leaflet – Nurses

Project Name: Cost2care

University Department: School of Nursing, Psychotherapy and Community Health
Study Site: Mater Misericordiae University Hospital

Principal Investigator:
Dr. Marcia Kirwan Email: marcia.kirwan@dcu.ie

Co-Principal Investigator for data collection at MMUH:
Ms. Mary Raftery Email: mraftery@mater.ie

Other Investigators:
Prof. Anne Matthews Email: anne.matthews@dcu.ie
Ms. Anna Connolly Email: anna.connolly82@mail.dcu.ie

Data Controllers:
Dublin City University (for research data)

Data Protection Officers:
Data Protection Officer of Dublin City University Email: data.protection@dcu.ie
Data Protection Officer of Mater Misericordiae University Hospital Email: DPO@mater.ie

Introduction
This research is being conducted as part of a funded project. The project is being funded by the Health Research Board. You are invited to participate in this study. Please read the following information before deciding to participate.

Background
The largest group of patients in acute hospitals in Ireland are older people aged 65 and over. While these patients require nursing care for their acute presenting condition, they often simultaneously require fundamental nursing care to address other needs related to advancing age, or the presence of co-morbidities. If this care is missed, patients are at high risk of experiencing complications, which are associated with extended lengths of stay or reduced function on discharge. Ultimately, these complications are high-cost events, both financially, to the health service, and in human costs to the patient and caregiver.

Aims of this research
The main aim of this study is to demonstrate the potential for safer hospital care and reduced healthcare costs associated with older patients in acute hospitals in Ireland through routine measurement of missed nursing care in hospitals, and sustainable and accurate reporting of nursing sensitive adverse events using routinely collected hospital discharge data.

Why have I been invited to take part?
The perspective of the nurse is integral to this study and the researchers are committed to ensuring the nurse voice is heard and responded to. When nursing care is missed it impacts on overall quality and safety in an organisation, but ultimately it is nurses who have first-hand experience of the factors, such as lack of time and other resources , that contribute to missed nursing care and increase the pressure placed on nurses to deliver essential care to all patients. It seems important therefore that as experts in their own experience nurses should be included in this study. All nurses employed at the MMUH in any adult in-patient ward will be invited to participate in this study. Inclusion criteria for group 1 will include being a fully qualified nurse, therefore student nurses will be excluded from this study.

How will the study be carried out?
The data collection will begin in October 2023 and last for a duration of six months. Nurses will be invited to participate during this period and interested participants will be distributed surveys which they may return at any stage whilst the data collection period is underway. The data will be collected through surveys that will be distributed to nurses employed in any adult in-patient wards in MMUH. The data will be collected on site at MMUH, taken to DCU and analysed by researchers at the university.

How many nurses will be taking part in the study?
It is anticipated that approximately 300 nurses will take part in the survey component of this study.

What does participation in this research involve?
Participation in this research project will involve completing an online or paper survey. The survey will take approximately 10 minutes to complete. As there will be no personal data collected through this survey, consent will be obtained from participants in the form of their participation in the study. Participation in the survey will imply that the participant has given their consent to being involved in the study.

Potential risks in participating in this research
This project is low-risk, therefore it is unlikely that there will be any risk posed to participants. In the event that participants become upset or distressed due to any topics addressed in the surveys, support will be organised. Participants' confidentiality will be carefully managed therefore, it is unlikely that any risks will arise relating to this.

What will happen to my data?
The survey data will be collected on site at MMUH via anonymous, paper-based and online surveys. The survey data will then be transferred to DCU to be analysed by the researchers. The data collected through the surveys stored securely on a DCU encrypted laptop which will be stored in a locked room in DCU. Only the researchers involved in the data analysis processes will have access to the data. Statistical analysis will be carried out on the data and the results will be used to further explore the human cost of missed nursing care and nursing sensitive adverse events. The data will be used to inform reports related to this study and once these reports have been published, the data will be permanently deleted.

Benefits to taking part in this study
Participants will have the opportunity to share and voice their opinions on their experiences of giving and receiving nursing care. Their participation may also have positive implications for patient safety in the future.

How participants will be informed about the progress of the project
Participants may contact the investigators using the contact details listed above for information on the progress of the project. A project webpage will be set up and updated with information regarding the progress of the project. Participants will be directed towards this webpage if they wish to stay updated and informed about development and progress of the project. The results of the study will be reported in medical/scientific journals and disclosed at medical/scientific conferences. No information which reveals your identity will be disclosed.

Privacy Notice
The data controller is Dublin City University and the data processor who will be solely responsible for the collection, control and processing of the data collected is the Principal Investigator. All efforts will be made to protect the privacy of participants however, individuals have the right to lodge a complaint to the Irish Data Protection Commission if they feel that their privacy has not been respected. If participants require further information in relation to data protection, they may contact the principal investigator or the DCU data protection unit through the DCU data protection officer, Mr. Martin Ward (Email: data.protection@dcu.ie Phone: 7005118 / 7008257).

When will the data be disposed of?
Data collected during this project will be stored safely for three years after the completion of the project, at which point it is anticipated that all reports and publications using this data will be completed. All Files containing data collected throughout the course of this project will be permanently deleted three years after the project has been completed.

Confidentiality
All efforts will be made to ensure that the data collected will be confidential in order to protect the privacy of the participants. Participant names will not be collected at any stage of the survey and therefore, the participants will remain anonymous. A risk assessment of the data protection implications of this research and it was determined that this is a low-risk study as no identifiable personal data will be collected. All researchers have undertaken training in data protection laws and will ensure that the privacy of participants is protected by not collecting any identifiable personal data. Despite these efforts, the confidentiality of information can only be protected within the limitations of the law - i.e., it is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

What are your rights?
You are entitled to:

- The right to access to your data and receive a copy of it
- The right to restrict or object to processing of your data
- The right to object to any further processing of the information we hold about you (except where it is de-identified)
- The right to have inaccurate information about you corrected or deleted
- The right to receive your data in a portable format and to have it transferred to another data controller
- The right to request deletion of your data

By law you can exercise the following rights in relation to your personal data, unless the request would make it impossible or very difficult to conduct the research. You can exercise these rights by contacting the principal investigator at marcia.kirwan@dcu.ie or the DCU Data Protection Officer at data.protection@dcu.ie. Further information on data protection is available on the study website.

Has this study been approved by a research ethics committee?

Yes, this study has been approved by Dublin City University Research Ethics Committee. Approval was granted on the 23rd of February 2023. This study has also been approved by MMUH Institutional Review Board.

Participation in this study is voluntary
Participation is voluntary and participants may withdraw from the study at any point prior to submitting the survey as once it has been submitted, it will not be possible for researchers to identify their data and remove it. If participants withdraw from the study prior to submitting the survey, no data will be collected however again, as this is an anonymous survey, participants cannot withdraw their data after their survey has been submitted as it will not be possible to identify their survey answers and link the participant to the answers they have submitted.

Who is organising and funding this study? Will the results be used for commercial purposes?
This study is being funded by the Health Research Board. The researchers at Dublin City University have received a grant from the HRB to conduct this research. This study is also being undertaken as part of an academic qualification. A PhD student has been recruited to work on this project and will utilise the results of the student to inform their research. The results of this study will not be disclosed for commercial purposes.

Is there any payment for taking part? Will it cost me anything if I agree to take part?
No, nurses will not be paid for participation in this study. Agreeing to participate will also not results in any costs to the participant.

Who should I contact for information or complaints?
If you have any questions or concerns about this study, please contact the principal investigator or data protection officers at the contact details listed on this information leaflet.

Under GDPR, if you are not satisfied with how your data is being processed, you have the right to lodge a complaint with the Office of the Data Protection Commission, 21 Fitzwilliam Square South, Dublin 2, Ireland. Website: www.dataprotection.ie.

If participants have concerns about this study and wish to contact an independent person, please contact:
The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000, email: rec@dcu.ie

Appendix K - Patient Recruitment Poster

PATIENTS Needed for DCU Research

THE MATER HOSPITAL

Cost2care

DCU researcare currently looking for **PATIENTS OVER 65 YEARS OLD** to participate in a survey



What is the project?

This Cost2Care project is currently underway in the Mater Hospital.
Researchers are asking patients to tell us about the care they have received in hospital

What are the researchers interested in?

The COST2CARE researchers want to know about your experience of nursing care in this hospital

Over 65s

Eligibility to Participate

If you are a **patient over 65 years** of age on any adult inpatient ward for more than 3 days, you may participate in this research

What does participation in this research involve?

Participation in this research project will take approximately 10 minutes and involves filling out a paper or online survey or you can access the survey online using the QR code



To access the survey please scan here

or contact the researchers for a printed survey

Interested?

If you wish to participate in this research, please scan the QR code or contact the principal investigators at the contact details listed below

Dr. Marcia Kirwan
Email: marcia.kirwan@dcu.ie

For more information please visit:
www.cost2care.eu

HRB Health Research Board

DCU Ollscoil Chathair Bhaile Átha Cliath Dublin City University

Appendix L – Nurse Recruitment Poster

NURSES Needed for DCU Research

THE MATER HOSPITAL

Cost2care

DCU researchers are currently looking for **NURSES** to participate in a survey

What is the project?

This Cost2Care project is currently underway in the Mater Hospital and it recognises that the quality and safety of nursing care is an important determinant of patient outcome following hospitalisation.



What are the researchers interested in?

The COST2CARE researchers want to know if care is delayed or left undone in your ward/unit and if so which aspects of care are more likely to be delayed or incomplete. They also wish to hear nurses' views and experiences on why this might be the case.

Eligibility to Participate

Nurses working on any inpatient ward

Nurses in OT, OPD, Day Wards and ED are **not** included in the study.

What does participation in this research involve?

Participation in this research project will take approximately 10 minutes and involves filling out a paper or online survey or you can access the survey online using the QR code



To access the survey please scan here

Interested?

If you wish to participate in this research, please scan the QR code or contact the principal investigators at the contact details listed below

Dr. Marcia Kirwan
Email: marcia.kirwan@dcu.ie

For more information please visit:
www.cost2care.eu

HRB Health Research Board

DCU Ollscoil Chathair Bhaile Átha Cliath Dublin City University