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Practitioners' practice when evaluating venous thromboembolism risk due to lower limb injuries within the emergency setting.

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Declaration

I declare that the work in this thesis, which I now submit for assessment as final part of completion towards the award of the degree of Doctor of Nursing, is entirely my own work. I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others except where otherwise stated.

Signed: 

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Date: 13th October 2023

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Dedication

This thesis is dedicated to my daughter Sophie, who is my best friend and the greatest daughter anyone could wish for. I hope that over the years she has seen my dedication and ambition and that she will continue to follow her own dreams and ambitions throughout her life.

Acknowledgements

First of all my number one thank you has to go to my husband who has always supported my career and dreams and given me the time and space to complete this doctorate.

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Finally, thanks to all frontline workers who over the past four years have continued to leave their families daily and dedicated their lives to their patients to overcome the COVID-19 pandemic.

Abstract

Aim:

This study aimed to understand patient care by exploring nurse practitioners' knowledge and current practice regarding Venous Thromboembolism (VTE) risk assessment and treatment of patients with lower limb injuries within the Emergency setting.

Background:

The primary motivation for this study was fuelled by my interest in advanced nursing practice and the management of patients presenting with injuries to the emergency department (ED). Healthcare prevention is seen as a key element to improving overall health and to try to curtail the continuously rising healthcare costs. The assessment and prophylaxis of VTE in hospital patients have shown to be both medically and financially beneficial. The action of conducting a VTE risk assessment for patients sustaining a lower leg injury is evidence that an assessment has taken place and therefore justifies the clinical decision for the Registered Advanced Nurse Practitioners (ANP) to prescribe prophylaxis or not for the patient.

Method:

A parallel results convergent mixed-methods research design was conducted. Quantitative and qualitative data were collected in parallel, analysed independently then merged. An online survey instrument was used to investigate the ANPs' current practice and knowledge concerning VTE risk assessment in lower limb injuries requiring immobilisation. Data was analysed with SPSS and NVivo.

Results:

The response rate was 85.8% (73/85) from a sample size of 85 ANP in the ED setting. The majority of the respondents 61.7% (n=45) in this study rated their overall knowledge in relation to VTE as poor or fair. 75.3% (n= 55) ANP stated that they are dissatisfied or very dissatisfied with their clinical practice. 86.3% (n= 53) of ANPs were not familiar with internationally recognised risk assessment tools.

Conclusion:

The need for education and standardisation of VTE guidelines in practice to aid ANPs in their current practice when evaluating VTE risk is paramount.

Relevance to clinical practice:

Guidelines and risk assessment tools exist in clinical practice but the knowledge surrounding these and the adherence to applying these to patients with lower limb immobilization is very low.

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Chapter One: Introduction

There have been no previous published research studies focusing on risk assessment adherence in ambulatory patients who are discharged from the emergency department (ED) or local injury units (LIU) with a lower limb injury which resulted in a lower leg immobilisation.
This chapter will focus on the aim of the study and then discuss the context of this study and how it has emerged as a result of my own clinical practice. It will also discuss the role of the nurse practitioner both nationally and internationally. It will also give an overview of Venous Thromboembolism (VTE) and how it is relevant in fractures. This will lead to the discussion concerning VTE clinical guidelines and risk assessments and also the adherence in relation to these and if knowledge and education can improve adherence.

This study aimed to understand patient care by exploring the nurse practitioners' knowledge and current practice regarding VTE risk assessment and the planned management of patients with lower limb injuries within the emergency setting.
Therefore to meet the aim of this mixed-method study, the following research questions were formulated:

The overall question is:

1. How do emergency advanced nurse practitioners evaluate VTE risk in patients with lower limb injuries in their clinical practice?

Specific approach-related research questions were devised as:

Quantitative Questions:

2. What is the current knowledge that emergency advanced nurse practitioners have regarding VTE risk assessment and prophylaxis in patients with lower limb immobilisation?

3. How do emergency advanced nurse practitioners currently practice identifying patients who are most at risk of developing a VTE as a result of lower limb immobilisation?

Qualitative Question;

4. What barriers and facilitators exist to optimal emergency management for the prevention of VTE in patients with lower limb immobilisation?

Hybrid Question (Mixed-Method);

5. Do the qualitative findings help explain the results from the quantitative phase of the study?

The 'Null' Hypothesis;

That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation.

The 'Alternative' Hypothesis;

That within the emergency setting the knowledge and execution of VTE risk assessment for patients with lower leg injuries resulting in immobilisation is poor.

1.1 Context and Emergence of this Research

The primary motivation for this study was fuelled by my interest in advanced nursing practice and the management of patients presenting with injuries to the emergency department. I have written many peer-reviewed articles and case studies regarding the management of certain injuries within the emergency setting. I have also been working in the ED for 23 years and as a Registered Advanced Nurse Practitioner (ANP) for 14 years. I became interested in the issue of patients developing VTE as a result of being placed in a walking boot or cast due to sustaining a lower leg injury. The development of local injury units (LIU) with the appointment of Advanced Nurse Practitioners (ANP) in emergency nursing was a significant initiative towards improving patient care (Department of Health and Children 2001). Within the ED setting the ANP plays a role in the management of patients who attend with predominantly non-life, non-limb threatening musculoskeletal conditions often referred to as 'minor injuries'. The NCNM (2008a) reported that injuries account for 30% to 60% of all attendances in Irish emergency departments. This figure has altered a bit in recent years with the development of LIU and private LIU openings throughout the country. The Department Of Health (DOH) in their report, stated that injuries account for at least 8.5% of hospital admissions and are the third leading cause of death in the country (DOH 2018). The Major Trauma Audit National

Report for 2014-2015 reported that almost one in two patients sustained an injury in their own home and that the most frequent cause of major trauma was as a result of falls from less than two metres (NOCA 2016). The National Council for the Professional Development of Nursing and Midwifery (NCNM) in Ireland claims that the function of the ANP in the ED is to assess, diagnose, manage and discharge a range of minor injuries within the agreed local protocols (NCNM 2008b). The ANP utilises advanced clinical nursing knowledge and critical thinking skills to independently provide optimum patient care through caseload management of acute injuries and illness within the ED setting. Therefore the ANP in the ED is faced with clinical decision-making challenges daily. Good patient care is dependent on high-quality, accurate and efficient decision making within the unpredictable ED.

In a study by the National Clinical Programme for Emergency Medicine (EMP) in 2013 ANPs were described as 'being cost effective in terms of added value to the patient experience with less recalls for missed fractures, as well as improving provision of patient information resulting in less unplanned re-attendances' (pg.28). People attending the ED setting believe that they have an 'injury or illness that could place their health in jeopardy or lead to an impairment of their quality of life and that emergency medicine care will remove or reduce this risk' (EMP 2012 pg. 30). Emergency Medicine (EM) is defined by timely and accurate decision-making regarding the saving of life and limb (Wiswell *et al* 2013, March 1994). Meaney *et al* (2012) found that 45% of all presentations to Irish EDs were as a result of an injury. With this in mind and media coverage of people dying as a result of developing a clot from their broken leg having attended the ED is disturbing for any member of the ED team and therefore needs review as to why this is occurring to our patients who have put their trust in us to make them better (Figure 1.1).

Figure 1.1 Newspaper Headlines

Healthcare organisations are changing from curative medicine to preventative medicine with the main aim of preventing the appearance of a disease or illness within the growing population. Healthcare prevention is seen as a key element to improving the overall health of the Irish population and to try to curtail continuously rising healthcare costs (DOH 2013). Investment in healthcare prevention is mentioned continuously in newspapers, Government statements and within the healthcare organisation itself as a cost-saving intervention. However, the generalised statements regarding the cost-effectiveness of healthcare prevention is sometimes an unrealistic expectation. Russell (2007) stated that several studies have shown that preventing illness can save money. The assessment and prophylaxis of VTE in hospital patients have shown to be both medically and financially beneficial. The National Institute for Health and Clinical Excellence (NICE) guidelines state that all patients should be assessed for risk of VTE and commenced on VTE prophylaxis if required (NICE 2015). The original VTE guideline published by NICE was CG92 but after a comprehensive review of the literature and evidence-based research by the technical committee, they revamped an updated guideline NG89 which concentrates more on reducing the risk of developing a hospital-acquired VTE (NICE 2018). With the availability of evidence-based NICE guidelines, nurse practitioners can utilize these guidelines and convert evidence-based knowledge into evidence-based practice which allows for a consistent safe approach to improving the care of our patients within the emergency setting. This goal of improving the quality of healthcare that we provide in our hospitals is the

responsibility of the practitioners to implement a quality improvement initiative. Quality improvement initiatives usually begin with recognizing that a problem exists within the healthcare setting (Bauer *et al* 2015). The DOH in 2016 in the *Framework for Improving Quality* stated that Quality Improvement (QI) is the combination of better patient outcomes, better experience of care and continued support of staff in the delivery of quality care (DOH 2016). The action of conducting a VTE risk assessment for patients who have sustained a lower leg injury, is evidence that an assessment has taken place and therefore justifies the clinical decision for the ANP to either prescribe prophylaxis or not for the patient depending on the level of risk. It also highlights if patients are predisposed to other conditions that inhibit them from having lower molecular weight heparin (LMWH) as it could result in an increased risk of bleeding (Hunt 2009).

1.2 Registered Advanced Nurse Practitioners

The ANP utilises 'advanced clinical nursing knowledge and critical thinking skills to independently provide optimum patient care through caseload management of acute injuries and illness within the ED' (Gibbons & Stoddart 2018 pg.7). ANPs should be visionary, identify areas for improvement and implement positive initiatives at all levels of the health system. All ANPs are required to involve themselves in clinical audit and research and to use evidence-based practice within the clinical setting (NCNM 2008a). Therefore the ANP within the ED setting is faced with challenging decision making within a highly pressurised environment daily. At the time of this research, there were 85 ANP in ED and LIU across Ireland who are providing caseload management for minor injuries / ambulatory care (Appendix 1, email from NMBI).

1.2.1 Development of Advanced Nurse Practitioner Role

Since the Report of the Commission of Nursing in Ireland by the Government of Ireland in 1998, nursing has embarked on a journey of radical change and development. The Commission on Nursing recognised that promotional opportunities should be open to nurses and midwives wishing to remain in clinical practice and accordingly recommended a clinical career pathway leading from registration to clinical specialisation and to advanced practice (Government of Ireland, 1998). One recommendation that came from the report was the establishment of clinical career pathways, which would allow nurses with extensive experience and advanced expertise, as well as having undertaken the appropriate educational requirements, to become an advanced nurse practitioner (ANP) or advanced midwife practitioner (AMP), (2003). All of

these advances have pushed nursing away from the traditional "doctor's handmaid" to a profession that leads healthcare services, develops healthcare policy at the national level and one that is rapidly changing within today's health service. In the Health Strategy 'Shaping a Healthier Future' (Department of Health 1994), Themes were highlighted which include equity, quality of service and accountability; all principles that support the establishment of the ANP role. When I reviewed the literature (Chapter 2) several common themes were mentioned by different authors suggesting that ANPs could reduce waiting times, lead to improved patient education and increased patient satisfaction through a holistic approach to care (Sakr *et al*., 1999; Byrne *et al*., 2000; Conlon, 2002; Horrocks *et al*., 2002; Carter and Chochinov, 2007 Conlon *et al* 2009). Nurse Practitioners (NP) is the term used in the United States of America (USA), where they introduced the NP to meet the 'healthcare delivery needs and to provide a cost-effective manner to maintain quality of care' (Mc Mullen *et al.,* 2001).

1.2.2 Advanced Nurse Practitioner Roles Globally

The NP role originated in the United States of America (USA) in the mid-1960s (Ruel and Motykca 2009). The concept of NP has spread worldwide and is now well-established in several countries worldwide (Fagerstrom 2009; Schober and Affra 2006). It has been estimated that up to 40 countries have an established NP programme or are working towards establishing this role (NSW Health 2010). Unfortunately, the role definition varies between countries such as Australia, Belgium, Canada, Cyprus, Denmark, Finland, France, Ireland, Norway, Scotland, Spain, Singapore, Switzerland, Japan, New Zealand, the United Kingdom and the United States. The United States, United Kingdom and Canada have been the pillars in implementing advanced practice roles.

The titles associated with this advanced nursing role vary across the different countries and can cause a degree of confusion. Carney (2016) states that there are 13 different titles worldwide. Ireland and many other countries have adopted the designated title of 'Advanced Nurse Practitioner' (ANP). This title will be used as an umbrella term that incorporates several advanced practice roles such as nurse practitioner (NP) and advanced practice nurse (APN).

Advanced Nurse Practitioner in Ireland:

There is consistency in the literature that the use of the umbrella term advanced nurse practitioner is confusing and ambiguous (Hutchinson *et al.,* 2014; Jokiniemi *et al.,* 2012). As of 2010, the responsibility of the ANP qualification no longer lies with the NCNM, it is now governed by Nursing and Midwifery Board of Ireland (NMBI). Registration as an ANP in

Ireland is tightly controlled and they are called Registered Advanced Nurse Practitioners (ANP). ANP are nurses who have gained the protected title from the Nursing and Midwifery Board of Ireland (NMBI) by being educated to at least a Master's degree, being a registered prescriber and demonstrating competencies relevant to their context of practice. Competencies of the ANP form the nucleus of the role. The competencies consist of professional values, clinical decision making, knowledge, communication, management, leadership and professional scholarship (NMBI 2019). As a result, the ANP role requires the nurse to be an autonomous independent practitioner in their decision making, prescribing, diagnosing and discharging of patients (Gibbons & Stoddart 2018). Autonomy in clinical practice insists that the ANP is accountable and responsible for advanced levels of decision-making required by their position. As expert practitioners, ANPs are required to demonstrate exemplary practical, theoretical and critical thinking skills. ANPs should be visionary, identify areas for improvement and implement positive initiatives at all levels of the health system.

1.2.3 Advanced Nurse Practitioner within Emergency Department

The ANP in the ED setting faces clinical decision-making challenges daily. The ED setting can present challenges to decision-making behaviour and thinking processes of ANP in assessing, diagnosing and providing appropriate treatment for their patients due to a variety of multiple stressors, fast pace and the unpredictable nature of the department (Smyth & Mc Cabe 2016). Due to the large volume of patients that attend the ED setting every day, this puts pressure on the ANP to see as many patients as possible in an expedited fashion with sometimes little background patient information to hand (Davis & Jacques 2008) while attempting to deliver the highest possible quality of care. Several key components such as cognitive aspects of human judgement and contextual issues that influence the human thought processes have been identified in the literature (Helman 2015, Kahneman 2011). While years of education and practice generally guide the ANP within the ED setting in decision-making regarding their patients, clinical guidelines and protocols also play a useful role in the management of patient care (Munasque 2009). However, it has been well documented in the literature that the challenges of over-crowding and poor patient throughput lead to poor compliance and adherence to guidelines, resulting in poor clinical decision making and a lack of evidence-based practice (Kirk & Nilsen 2016, Person *et al* 2013, Bigham *et al* 2010).

1.3 Venous Thromboembolism (VTE)

Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE), come under the umbrella term of VTE, which is the development of a blood clot (Sobieraj 2008). These blood clots, if they form in a vein, are known as a thrombus but if it dislodges and travels in the blood then it is known as an embolism. If the thrombus is in the deep veins of the leg then this is referred to as a DVT (Watts & Grant 2013). If the thrombus travels to the lungs this is called a PE (Sobieraj 2008). The pathogenesis of VTE includes three main elements hypercoagulability, reduced blood flow, and vessel damage due to disease or injury (Bagot & Arya 2010).

VTE is a significant global health burden, with incident events alone costing NHS Scotland an estimated £14.9 million in 2017/2018 and the USA an estimated $7–10 billion each year (Thrombosis UK 2021, Grosse *et al* 2016a, Grosse *et al* 2016b). It was reported by Thrombosis UK (2022) that 'every 37 seconds someone in the western world dies from a VTE'. Resolution NHS documented that around 25,000 patients in the UK die each year from hospital-contracted VTE (NHS 2020). This is a similar picture in the US where it is estimated that VTE occurs every year in approximately 900,000 people in the US, resulting in a death toll of 300,000 (Raskob *et al* 2010) and it is the third highest cause of death in the US (Lim *et al* 2012). Data in relation to VTE is limited in Ireland but a retrospective study looking at VTE incidence in one hospital group over 22 months suggested that at least 47% of diagnosed VTE are hospital-acquired events (Kevane *et al* 2019).

Within the last decade, VTE has resulted in more deaths than prostate cancer, breast cancer, road traffic accidents and AIDS combined (Raskob *et al* 2014). A UK survey found that 71% of medical inpatients who were regarded as a medium or high risk of developing a DVT did not receive any form of VTE prophylaxis (Rashid *et al* 2005). A survey looking at eight different Asian countries found that over half the physicians did not practice VTE prophylaxis and 48.6% of their healthcare institutions did not have any VTE guidelines in place (Lee *et al* 2012). In the UK the All-Party Parliamentary Thrombosis Group in 2012 reported that a failure of the trusts to prevent VTE has resulted in a cost of £110 million in negligence payments since 2005 (Catterick & Hunt 2014). Duffy *et al* (2013) in a study comparing costs and clinical outcomes pre and post-VTE prophylaxis calculated an overall cost savings of $245,439 over a 12-month period. As a result, since 2013 the NHS in the UK has provided a financial incentive to drive this initiative, the trust needs to have assessed 95% of their patients for risk of developing a VTE to avail of a financial award (NHS Commissioning Board 2013). The NHS

since implementing this financial award has seen a marked improvement with 96% of NHS acute care providers assessing for VTE risk as reported during the first quarter of 2019/2020 (NHS 2019) compared to a UK study in 2012 showed that 18% of the hospitals involved in the study failed to meet the 90% target for assessing patients at risk of VTE (DoH 2013).

It is concerning that VTE prophylaxis assessment is still not routinely practiced throughout all healthcare settings. Watts and Grant (2013) stated that 'orthopaedic patients have a particularly high risk of developing a DVT and without prophylaxis 45-51% of orthopaedic patients will develop a DVT' (pg.1). However, it appears in the literature that current practice and treatment of VTE within hospitals worldwide is inconsistent (Cohen *et al* 2008). Most of the previously published studies investigated the risk of VTE in lower limb immobilization in patients, who had either been admitted into hospital or who had required surgery. There is minimal literature surrounding the cohort of non-surgical and ambulatory patients (Riou *et al* 2007) who are at risk of VTE following a lower limb injury resulting in immobilization. Patients that are diagnosed in the ED with a lower limb fracture are generally discharged from the ED with future follow-up in the orthopaedic outpatient department, there would only be a small percentage of this cohort of patients requiring hospital admission (Somersalo *et al* 2014).

Batra *et al* (2006), Iqbal *et al* (2012) and Kocialkowski *et al* (2016) are all studies that looked at VTE from a clinical practice viewpoint and investigated the thromboprophylactic practice of doctors within an orthopaedic outpatient setting. Kocialkowski *et al* (2016) also looked at the VTE risk assessment compliance in clinical practice of both doctors and specialist nurses within the orthopaedic outpatient as well as the ED. This is the only paper in the literature that investigates the clinical practice of the ED clinicians caring for these non-surgical, ambulatory patients who are discharged with lower limb immobilization. Kocialkowski *et al'*s research demonstrates that patients can be safely assessed for risk as categorised as either high or low risk for VTE and that thromboprophylaxis can be safely administered for patients deemed to be at increased risk (pg. 4).

Aitken *et al* (2012) found in one year that out of the 7,762 patients that were referred from ED to the orthopaedic outpatient ward that 3.2% (n=251) either cancelled their appointment or failed to attend. This highlights the need for the VTE risk assessment to be completed in the ED rather than the orthopaedic outpatient. The NICE guidelines enable us as clinicians within the ED to convert evidence-based knowledge into evidence-based practice allowing for a more consistent, safe approach for improving the quality of care that our patients receive within the

ED setting.

As emergency medicine is a broad speciality, Smith and his colleagues in 2017 on behalf of the James Lind Alliance Priority Setting Partnership in UK, highlighted that VTE prophylaxis in patients with lower limb injury and temporary immobilisation, was a research priority and needed further research (Smith *et al* 2017, JLA 2020).

1.4 VTE and Fractures

Immobility is considered a major risk factor for VTE in all populations (Nokes & Keenan 2009). As early as 1944, the risk for VTE associated with lower limb fractures requiring immobilisation was established (Batra *et al* 2006). The association between injury and VTE is well recognized, and the reported incidence of VTE after trauma varies from 7% to 58% depending on patient demographics, kind of injury, method of detection, and type of VTE prophylaxis used (Knudson *et al* 2004).

In a study by Adam *et al* 2018, where the researchers performed ultrasound on patients post lower limb fractures, an incidence rate of 27.6% of patients developed a DVT associated with fractures of the lower extremities including tibia and fibula fractures. A traumatic injury resulting in a fracture can be a stressful and unexpected event, which can lead to many physical, psychological and social issues (Wiseman *et al* 2013). With this in mind, we as ANP, nurses and doctors must provide a seamless safe journey for our patients.

The Royal College of Emergency Medicine (RCEM) in 2015 carried out an audit throughout the UK examining data about patients (9916) who presented to an ED or LIU (167 centers) and required treatment consisting of either a backslab or splint to immobilize their lower limb injury (Morris *et al* 2015). Over 90% of these patients were diagnosed with a fracture. However, it turned out that 25.9% of patients discharged from the ED had no VTE risk assessment carried out prior to discharge. This practice is mirrored in my own emergency setting where patients are being discharged from the ED to be followed up at a fracture clinic without any VTE risk assessment preformed or documented in the patient's ED clinical notes. Since COVID 19 my local fracture clinic preform a virtual fracture clinic resulting in some patients never having been physically assessed by a member of the orthopaedic team.

It is important that this practice ceases and that changes are implemented in accordance with both national guidelines such as NICE or SIGN, as well as local hospital guidelines. ANP's are

in a prime position to lead clinical practice initiatives. They are clinical experts within their own area of specialist practice, they keep abreast of up-to-date research and evidence-based knowledge. Elliott *et al* (2013) agree by saying the ANP 'demonstrate clinical leadership by identifying educational needs within their own area of specialties' (Elliott *et al* 2013 pg. 1041).

1.5 VTE Clinical Guidelines

Clinical practice guidelines are evidence-based recommendations that systematically aid clinicians complex clinical decision-making process in relation to caring for patients with specific clinical condition. The Institute of Medicine (IOM) defines clinical practice guidelines as "statements that include recommendations, intended to optimize patient care, that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options" (Graham *et al* 2011 pg. 15). Clinical practice guidelines have the potential to improve both clinicians' and patients' healthcare decisions by enhancing quality of service and patients healthcare outcomes. Guidelines help to standardize the healthcare provided by reducing variations in clinical practice from clinician to clinician. They also help to improve the quality and consistency of care provided by clinicians. Clinical guidelines increase the efficiency in healthcare services by evaluating the risks and benefits to guide treatment decisions and by promoting patient engagement in their own care management (Woolf *et al* 1999, Eddy *et al* 2011, Peterson & Rumsfeld 2011).

Numerous clinical practice guidelines exist globally that address VTE in hospitalised patients as a result of a variety of different predisposing conditions. A number of these evidence-based guidelines outline the appropriate prophylaxis required to prevent VTE in these hospitalized patients (SIGN 2014, Kahn *et al* 2012, NICE 2015, NICE 2019). The literature supports the use of clinical practice guidelines and promotes their use stating that they beneficially impact on patients outcome in relation to prevention of developing a VTE (Geerts *et al* 2008, NICE 2007a). However, despite the existence of these clinical practice guidelines, patients still develop VTE and VTE-related deaths still occur globally. As previously mentioned VTE is a global issue and measures have been implemented to try to overcome VTE events occurring in patients. The Australian Commission on Safety and Quality in Health Care in 2020 have implemented a VTE prevention program while the National Institute for Clinical Excellence (NICE) have introduced a quality standard [NG89] that covers reducing the risk of venous thromboembolism for use in all UK hospitals. In spite of these initiatives, the incidence of VTE as well as death cases from VTE in hospitalized patients is still occurring (Tsai *et al* 2013,

Mehta *et al* 2016) globally. Despite the wealth of evidence supporting the use of VTE guidelines, they are not universally followed (Schiro *et al* 2011, Abboud *et al* 2020) and therefore it appears that there is an obvious gap between evidence-based literature, clinical guidance and clinical practice.

1.6 Risk Assessment of VTE

Many risk factors may lead to VTE events. Virchow's triad of venous stasis, vascular injury, and hypercoagulability are well-documented predisposing factors for VTE (Bagot & Arya 2008). Other acquired risk factors can comprise of surgery, active cancer, prolonged bed rest, reduced mobility, acute respiratory failure, severe sepsis, being elderly and obesity (Giordano *et al* 2017). It is noted, that the majority of hospitalized patients have at least one factor that may put them at risk for a hospital-acquired VTE (Almoosawy *et al* 2023, Anderson *et al* 1992). There are established guidelines describing evidence-supported best practices for preventing, diagnosing, treating, and managing VTE, such as those published by the NICE. As a result of the risk to hospitalised patients, the National Health Service (NHS) NICE guidelines in the UK, have become world leaders in developing an improvement initiative since June 2010 where all adult patients admitted into hospital were to have a VTE risk assessment completed. Each trust needs to ensure that their hospital admissions comply with the 95% benchmark set by the NHS Improvement initiative. At the beginning of 2011 the proportion of adult patients that had VTE risk assessment completed was 53%, this has gradually been increasing year on year. By 2016/17, the proportion of patients risk assessed for VTE was 96% (3.6 million) out of the 3.7 million patients admitted to NHS-funded acute care hospitals. As a result of this initiative hospital-acquired VTE events in England reduced by 8% (Thrombosis UK 2021). This positive outcome was mirrored in a study by Maynard and colleagues where mandatory risk assessment at admission to determine the need for VTE prophylaxis was found to be successful (Maynard *et al* 2010). However, this initiative by the NHS in England has not been replicated in Ireland and thousands of patients each year are at risk of developing a VTE due to no VTE risk assessments being documented. In 2018, the Irish Health Service Executive (HSE) stated that approximately 11,000 people may be affected each year by VTE. Many studies have shown that thromboprophylaxis to medical inpatients can reduce the incidence of VTE by one-half to two-thirds (Cohen *et al* 2006, Samama *et al* 1999). It is worth noting that over prevention with the over prescribing of anticoagulant drugs in patients that are deemed low VTE risk may lead to severe consequences including bleeding, high healthcare costs, and even death. Therefore it is of utmost importance that a precise VTE risk assessment is carried

out to determine, the risk-to-benefit ratio of thromboprophylaxis, in guiding clinical prevention in patients and therefore ensuring a better outcome overall for patients (Wang *et al* 2020).

There are many VTE risk assessment criteria tools available for clinicians to avail of within their clinical environments. Within the NICE clinical guideline NG 89 there is a risk assessment protocol which is for admission-related patients either medical or surgical (NICE 2019). There is also the Padua Risk Assessment Model which is recommended by the American College of Chest Physicians to stratify the risks and guide disease prevention. The Padua model is a linear model built on VTE-related risk factors reported in the literature and consists of 11 risk factors where the clinician scores the patient depending on the importance of these existing risk factors. A score greater than four points suggests high-risk stratification, as such these patients are then recommended to receive prophylaxis (Wang *et al* 2020, Qaseem *et al* 2011).

It is well documented in the literature that trauma increases the risk of VTE considerably. A national USA study showed that 1.5% of admitted trauma patients experienced VTE during hospitalization and that 1.2% were readmitted for VTE within 1 year (Rattan *et al* 2018). Rattan and his colleagues discovered over 5 million patients who had been admitted due to a trauma, 1.2% (n = 61,800) had been readmitted within 1 year due to developing a VTE and resulting in an economic burden of $256.9 million (Rattan *et al* 2018). Two million of these involved lower limb fractures, none of which had previously been risk assessed or treated with prophylaxis.

As many as 32% of trauma patients admitted to the intensive care unit experience VTE despite appropriate prophylaxis (Yumoto *et al* 2017). A Cochrane Review found that prophylaxis significantly reduces DVT risk, pharmacotherapeutic prophylaxis is more effective than mechanical prophylaxis, lower molecular weight heparin (LMWH) is more effective than low dose unfractionated heparin (LDUH) and that all major trauma patients should receive prophylaxis with LMWH (Barrera *et al* 2013).

These studies document VTE risk assessment factors but their focus was on admitted medical, surgical and orthopaedic patients. As my study focussed on ambulatory lower limb injury it was the intention to investigate the non-admitted patient, as these patients did not fall under the remit of the NHS improvement initiative and therefore remain a vulnerable cohort of patients. NICE guideline NG89 currently defines lower limb immobilisation as ‘any clinical

decision taken to manage the affected limb in a way that would prevent normal weight-bearing status, or use of that limb or both' (NICE 2019 p.35). Many patients who are managed with crutches and a splint would meet this definition and therefore justify risk assessment (Horner *et al* 2019). This does not necessarily mean that these patients should receive prophylaxis but recommends that a thorough risk assessment is completed. Cochrane reviews have suggested that without thromboprophylaxis, approximately 1 in every 50 patients will suffer a symptomatic VTE event following temporary immobilisation after an injury (Kahn *et al* 2018, Zee *et al* 2017). Horner *et al* 2019, conducted a systematic review identifying risk assessment tools suitable for this cohort of patients. They identified seven risk assessment models all with a variety of variables (Horner *et al* 2019). From these seven, only three (The Guidelines in Emergency Medicine Network (GEMNet), Plymouth rule, L-TRiP(cast)), had been validated and these were included in the research reported in this thesis (Horner *et al* 2019).

1.7 Adherence

Even when evidence-based practice guidelines are implemented, their application may be inconsistent in the clinical setting (Schiro *et al* 2011). There are a number of potential factors which could affect the adherence to VTE prevention. VTE guidelines awareness, the clinician's own views that VTE is not a problem, clinician reluctance to use pharmaceutical prophylaxis as well as the lack of knowledge can affect adherence outcomes (Cohn 2009, Maynard & Stein 2010, Caprini *et al* 2005, Caprini 2011). Lack of adherence to clinical guidelines within the emergency setting is well documented in the literature (Ebben *et al* 2013). Adherence to clinical guidelines is deemed important in an attempt to reduce variations within clinical practice and to ensure that patients receive the recommended treatment therefore improving the quality of care and health outcomes (Janssen *et al* 2011). Ebben *et al* (2013) suggest that 'further research should focus on identifying factors influencing adherence' (Ebben *et al* 2013 pg. 14). This study aims to identify what factors exist if any, in preventing practitioners from adhering to the recommended evidence-based guidelines and risk assessment tools.

1.8 VTE Knowledge and Education

The importance of integrating clinical guidelines into clinical practice to improve patient safety and reduce VTE burden has been established (Wang *et al* 2020). ANP, nurses and doctors are on the frontline in the health service delivery and therefore play a central role in translating the clinical guidelines into practice (Collins *et al* 2010). Improving the quality of patient care is

necessary for bridging the gap between VTE and clinical guidelines (Lockwood *et al* 2018). A key aspect of the risk assessment process is the sharing of information with patients, clinicians must inform patients that there is an increased risk of VTE with temporary immobilisation and what the common presenting features are, even if the absolute risk is low (Horner *et al* 2019, Davis *et al* 2019). However, clinicians and ED staff are unable to share this information, if they don't comprehend this information themselves. What knowledge exists in relation to VTE risk and VTE clinical guidelines within the staff in the ED and LIU needs to be established. Tang *et al* 2015, investigated the knowledge of VTE among physicians and nurses in an ICU setting and discovered that the knowledge of the relevant clinical guidelines were insufficient and subsequently very few assessed the risk of thrombosis. A study carried by Oh *et al* 2017 in two university-accredited regional cancer hospitals in South Korea, also found that the majority (74.3%) of clinical nurses rated their overall knowledge as 'fair' and only 15% of their respondents had ever completed a VTE risk assessment. Gatson and White in 2013 as part of a Joanna Briggs Institute project carried out an audit on patients' notes in relation to VTE compliance, after completing this audit they then provided education to the nurses. Following this education they repeated the audit and discovered that 'both compliance with and knowledge of best-practice VTE risk assessment and prophylaxis increased following the education' (Gatson & White 2013 pg. 60). The Emergency Nurses Association (ENA) in the USA surveyed 948 ENA members by assessing their involvement in research and their involvement in implementing research into clinical practice. It was clear that emergency nurses lacked knowledge of appraising research and therefore preventing them from implementing appropriate evidence into their clinical practice. The study also highlighted a number of barriers at different levels (individual, unit and institutional). Barriers at the institutional level included a lack of support systems such as protected time to implement changes in practice (Chan *et al* 2011). As ANPs are diagnosing, treating and discharging patients with lower limb fractures in the ED setting, it was necessary to establish the level of knowledge that existed, as well as the willingness to avail of VTE education sessions, to improve their overall knowledge. It is also important in this research to establish any barriers that exist in preventing the knowledge translation of the clinical practice guidelines from evidence-based research to clinical practice and subsequently closing that theory-practice gap that exists.

1.9 Organisation of the Thesis

This thesis consists of seven chapters. Chapter Two presents an appraisal of the current literature relating to the research topic which includes, VTE guidelines, knowledge surrounding VTE, risk of VTE, VTE risk assessment compliance and adherence, VTE and lower limb immobilization, the registered advanced nurse practitioner and finally the theoretical framework. This review of the literature highlights the lack of research about VTE risk and lower limb injuries within the emergency setting. Chapter Three describes and provides a rationale for the research aims, research methodology and the research questions, discuss critical realism and pragmatism as philosophical approaches, mixed-method design and ethical considerations. In Chapter Four the quantitative results are presented and discussed. Chapter Five presents the qualitative findings and discusses them. Chapter Six includes the synthesis of both the quantitative results and qualitative findings and are presented in line with the parallel results convergent mixed-methods research design. Finally, Chapter Seven discusses the research findings in relation to the wider literature. The quality of this research study is critiqued, recommendations for the use of a behavioral change model to aid in changing clinical practice and future research are also addressed and finally, a comprehensive conclusion reaffirming the research findings is presented.

Chapter Two: Scoping Literature Review

2.1 Introduction

A scoping review as described by Colquhoun *et al* (2014) is a form of synthesising available knowledge and mapping the key concepts as well as the identified gaps.

2.1.1 Background

Isolated lower limb trauma requiring cast immobilization is a common condition with several thousand patient admissions into ED each day (Douillet *et al* 2019, pg.2). Meaney *et al* (2012) in a study found that 45% of all presentations to Irish EDs were as a result of an injury. People attending the ED believe that they have an 'injury or illness that could place their health in jeopardy or lead to an impairment of their quality of life and that Emergency Medicine (EM) care will remove or reduce this risk' (EMP 2012 pg. 30).

About one in six patients, not initially identified as being at high risk will experience a VTE event following a lower limb immobilisation if not prescribed thromboprophylaxis (Ettema *et al* 2009). However, Keenan *et al* (2021) claim that there is a 2% clinically significant risk of developing a VTE following temporary lower limb immobilisation after injury. Is this improvement only in the UK and as a result of the trust incentive and greater understanding?

Recent evidence has begun to focus on risk assessment models, to promote tailored thromboprophylaxis to those most likely to benefit (Nemeth *et al* 2015). There are several guidelines and risk assessment tools available to assist the physician or nurse practitioner in establishing objectively if the patient with lower limb immobilisation would benefit from thromboprophylaxis. However, for the physician or nurse practitioner to accurately establish if the patient requires thromboprophylaxis they need to be aware and have knowledge regarding the risk assessment and guidelines available in clinical practice.

The ANP is responsible for the patients' whole episode of care, therefore it is important to establish the ANPs' knowledge and current practice in relation to VTE risk in patients who have sustained a lower limb injury and require immobilisation in the ED. The author was aware that there was little research addressing ANP knowledge and practice of VTE risk assessment in the ED prior to commencing this review. With this in mind the author systematically undertook a review of the literature to explore ANP knowledge and practice of VTE risk

assessment in the ED about immobilisation of the lower limb, however it transpired that globally no literature existed about this problem. The author had to therefore expand the review search which will be discussed in this chapter.

2.2 Purpose

The purpose of this review was twofold. To critique and synthesise the available literature. My purpose was to identify what gaps existed if any in the literature about knowledge and current clinical practice about VTE risk assessment of nurse practitioners, clinicians and nurses. I also wanted to identify in the literature what facilitated the completion of these risk assessments or what barriers existed to prevent the completion of the risk assessment tools. There was also a need to establish what the literature documented in relation to VTE guideline adherence. I was hoping that when I had fully synthesised the literature that it would be clear to me what questions I needed to ask in my study.

My initial search explored nurse practitioners knowledge and/or practice of VTE risk in lower limb injuries in ED setting, unfortunately no literature was identified. As a result the review was revisited and reframed. As I was identify the gaps in the literature in relation to knowledge, clinical practice and VTE risk assessment it seemed logical to broaden the search and expand the search from only nurse practitioners to all nurses and clinicians and from solely the emergency setting to all hospital settings. This produced literature that was relevant to the key components of this scoping review and study.

2.3 Rationale for Review Methodology

Many writers use a scoping review as their literature review, enabling them to overcome the difficulties associated with literature reviews, that they can lead to a narrow focus and the researcher can they end up losing sight of the relevant literature to their study. In order to explore the evidence of knowledge and current practice of nurse practitioners, clinicians and nurses in relation to VTE risk assessment within the literature, a scoping review methodology was selected as it provides a summative "map" of the literature within this field of research (Arksey & O'Malley 2005). Unlike other reviews such as umbrella reviews and systematic reviews, scoping reviews do not seek to answer a specific question (Levac *et al* 2010). Scoping reviews tend to 'examine the extent, range, and nature of research activity, determine the value in undertaking a full systematic review, summarising and disseminating research findings, or identify gaps in the existing literature' (Levac *et al* 2010, pg. 1). Scoping reviews can be

conducted as part of an overall research or as a stand-alone summary (Arksey & O'Malley 2005). Researchers use these reviews to investigate broader topics or explore an area that has not been reviewed comprehensively in the literature before (Arksey & O'Malley 2005). As no literature exists regarding nurse practitioners' knowledge and current practice in evaluating VTE risk in patients with lower limb immobilisation in the ED, a scoping review was selected to map the range of evidence relating to knowledge and practice regarding evaluating VTE. The review will identify the research gaps in relation to knowledge and practice in VTE risk, to inform future research, guidelines and policies (O'Brien *et al* 2016, Colquhoun *et al* 2014).

A number of authors suggest using the Arksey and O'Malley's (2005) six-step framework for interpretive scoping literature reviews with modifications (Levac *et al* (2010), Daudt *et al* (2013), Scott (2013)). Arksey and O'Malley's (2005) five-step framework, the sixth being optional, involves, 1) 'identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, 5) collating, summarizing, and reporting the results'. In addition they also recommend a consultation exercise as an optional sixth component of the review when the reviewer consults with the relevant stakeholders to inform of the research findings. Levac *et al* (2010) suggest combining a broad research question with a clearly articulated scope of inquiry. This includes defining the concept, target population, and health outcomes of interest to clarify the focus of the scoping study and establish an effective search strategy (Levac *et al* 2010 pg. 3). A search framework is used by listing key concepts which are derived from the search question (Methley *et al* 2014). The Population, Concept and Context (PCC) mnemonic framework guided the completion of the comprehensive review by highlighting the key information of the review as well as guiding the construction of the inclusion criteria for the scoping review (McCausland *et al* 2017).

P	**C**	**C**
Population	**Concepts**	**Context**
Nurse Practitioners Clinicians Nurse	Knowledge Current practice	VTE risk assessment

Table 2.1 PCC Framework (McCausland *et al* 2017).

Different additional tools are also available to help the researcher devise scoping review questions. Depending on the type of questions being asked, population, intervention, comparator, and outcomes (PICo), sample, phenomenon of interest, design, evaluation, and research type (SPIDER), setting, perspective, intervention, comparison, and evaluation (SPICE), and finally expectation, client group, location, impact, professionals, and service (ECLIPSE) (Methley *et al* 2014, Wildridge & Bell 2002). The SPIDER approach concentrates more on the research design and samples rather than the population being researched. The SPICE approach primarily evaluates the outcome of an intervention or a project. The ECLIPSE focuses on evaluating the outcome of a policy, guidelines or a particular service

The scoping review questions of this study contain all three elements of the PCC framework as recommended by the Joanna Briggs Institute (JBI).

The specific questions that guided the review were:

- What knowledge do nurse practitioners, clinicians and nurses have of VTE guidelines and risk assessment tools as a result of lower limb immobilization?
- What practice habits do nurse practitioners, clinicians and nurses have in identifying and preventing patients who are most at risk of developing a VTE as a result of lower limb immobilization?
- What barriers and facilitators exist to optimal emergency management towards the prevention of VTE in patients with lower limb immobilisation?

Nurse practitioners, clinicians and nurses were included to allow a more detailed review therefore giving a better understanding of research problem. This review synthesises the available evidence of the knowledge and current practice that exists in relation to VTE and the healthcare provider.

As this chapter was carried out as part of a doctoral thesis, the review did not have ‘a scoping review’ in the title. Levac *et al* promote that the scoping review is carried out as a team approach. However, I had the support and guidance from my two supervisors who have immense methodological research experience and expertise and guided me with this review. The optional consultation process which is step six of Arksey and O’Malley's framework did not occur during the timeframe of this thesis and therefore does not form part of this review.

I commenced exploring, if a review had previously been conducted on VTE risk assessment. The search was performed using the National Institute for Health Research *International Prospective Register of Systematic Reviews* (PROSPERO) as well, the C*ochrane Database of Systematic Reviews* (CDSR). Using these databases helped in preventing redundancy and duplication of effort (Misra & Agarwal 2018). The PROSPERO register highlighted 10 reviews (published and ongoing) and Cochrane Database displayed 40 reviews using the search term VTE Risk Assessment, however, on closer investigation it was established that none of these attempted to answer the same review question and none of these had used a scoping review methodology. The majority of the reviews investigated different populations (pregnancy, cancer, bariatric, COVID-19, medical and surgical inpatients) none involved the ED patient as a cohort.

2.3.1 Objective

The objective of this review is to identify and map the available literature surrounding the nurse practitioners', physicians' and nurses' knowledge and practice habits regarding VTE risk assessment for patients with lower limb fractures requiring immobilisation within the ED setting.

2.3.2 PICoS

The PICoS (Centre for Reviews and Dissemination, 2009) search strategy was used to inform the search criteria. The PICoS (Population, Intervention, Comparison, Outcomes, Setting) mnemonic is commonly used to characterise a research gap (Robinson *et al* 2011). PICoS is recommended by Methley *et al* 2014 where reviews are limited by time and resources, as in the case of doctorate research. As no comparator studies exist for the research area of interest the 'C' was omitted (Table 2.2).

P	**I**	**O**	**S**
Population	**Intervention**	**Outcomes**	**Setting**
Nurse Practitioners, Physicians, Nurses	VTE risk assessment.	Knowledge and practice habits.	Acute hospital setting

Table 2.2 PICo Framework (Centre for Reviews and Dissemination, 2009)

2.4. Materials and Methodology

2.4.1 Information Sources and Search Strategy

A comprehensive search strategy was designed to focus on nurse practitioners', physicians', nurses' knowledge and practice regarding VTE risk within the lower limb immobilization population featured in both published and unpublished studies and reviews. All quantitative, qualitative and mixed-method studies, as well as systematic, Cochrane and PROSPERO reviews were included in this search. National and international guidelines surrounding VTE were also included, however local guidelines and protocols were excluded as there was a degree of uncertainty about the evidence used in their development (Ebben *et al* 2013).

Using the search words '*Venous Thromboembolism*' and '*Risk Assessment'* and '*Knowledge*', the following databases were searched: Cochrane library, Joanna Briggs Institute (JBI), Web of Science, Ovid, Medline, PubMed, EMBASE, ASSIA, Global Health Library, Clinical Key, CINAHL plus (Via EBSCO Databases) and Guidelines International Network (GIN) without date limits or language restrictions and using combinations of Medical Subject Headings (MeSH) and topic terms (Table 2.3) (Appendix 2).

Table 2.3 VTE Concept Search Template

Concept: Venous Thromboembolism Medline: (MH "Venous Thromboembolism") OR (MH "Pulmonary Embolism") OR (MH "Venous Thrombosis") CINAHL: (MH "Venous Thromboembolism/DI/ED/NU/RF") OR (MH "Venous Thrombosis+/DI/EC/ED/NU/RF") EMBASE: 'Venous Thromboembolism' OR 'Vein Thrombosis' 'Embolism' ASSIA: Venous Thrombosis Web of Science: Venous AND Thromboembolism Global Health Library: 'Venous Thromboembolism' OR 'Venous Thrombosis'
Keywords: "Venous Thromboembolism" OR "Thromboembolism Venous" OR "Thromboembolism" OR "Pulmonary Embolism" OR "Pulmonary Thromboembolism" OR "Deep-vein Thrombos#s" OR "Deep Vein Thrombos#s" OR "Venous Thrombos#s, Deep" EMBASE KEYWORDS: Venous Thromboembolism" OR "Thromboembolism Venous" OR "Thromboembolism" OR "Pulmonary Embolism" OR "Pulmonary Thromboembolism" OR "Deep Vein Thrombosis" OR "Embolism"

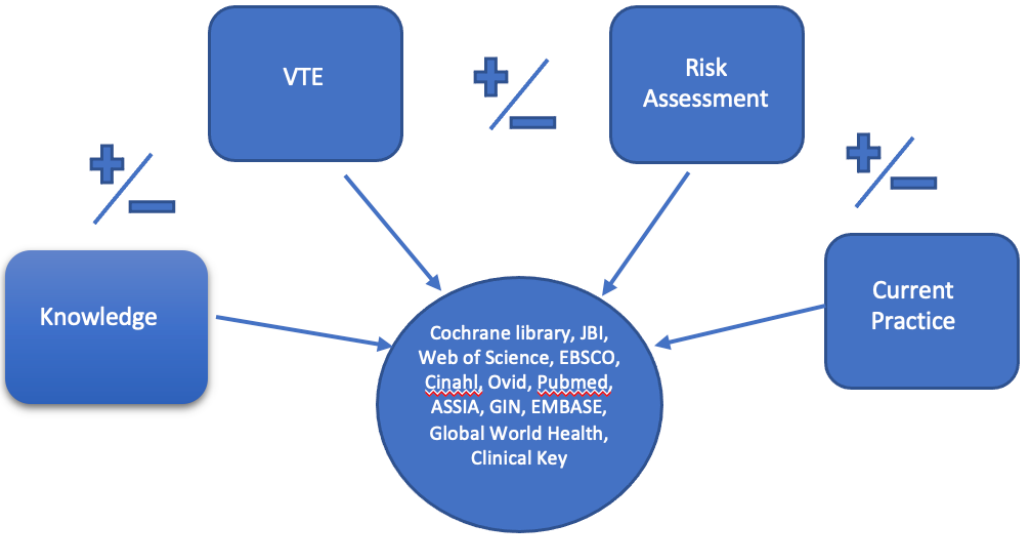
The initial search included a combination of control language and keywords to create a 'super search'. The control language is the suggested terms used in Pubmed and Cinahl Plus, these are also referred to as MeSH. Topic terms are unique to Web of Science and include both author-supplied keywords and Web of Science-assigned keywords (Keywords Plus), which consist of words and phrases harvested from the titles of the cited articles and subsequently result in a wider and larger search. The initial search commenced on 15th October 2017. A number of regular searches were performed throughout the course of the research project to test the various search terms and combinations of terms as recommended by Aromataris and Riitano (2014). A template was developed by the researcher for all the MeSH and keywords used under a number of concepts such as in Table 2.3, this enabled the completion of the same search all the time using the same exact headings ensuring consistency throughout this research.

Additionally, proximity searching in numerous other databases supported the capture of additional citations. This search included published conference proceedings as well as unpublished studies such as conference abstracts or dissertations using STORRE, Lenus and Google Scholar, however no additional literature was identified by this search. Finally, a review of the reference list of all selected articles were searched for any additional key papers that had not been found in the preceding search strategies, no additional literature was identified at this time. Methodological filters were applied to exclude editorials, comments, letters and newspaper articles.

A combination of truncation and wildcards resulted in the search strategy being more comprehensive and subject focused. In the initial search stage, it was found that many of the databases frequently had a variety of terms that consisted of different endings. The truncation symbol (*) retrieved all articles that contain words beginning with 'thrombo*' plus any additional characters. In addition to using truncation, wildcards were used during the database search. Wildcards are used for words that have the same meaning but have different spellings due to number of reasons. The words usually have spelling variations consisting of a single letter, wildcard symbols can be used in this case. Wildcards were useful in relation to the word 'orthop?edic' and immobili#ation, the database provided results for both 'orthopaedic' or 'orthopaedic' and immobilisation or immobilization. 'Orthop?edic' and immobili#ation were placed in the search bar to overcome the different spelling, especially American spellings. The wildcard symbol (?) replaces an extra letter or none as for the wildcard # replaces one letter

within the word. Finally, the use of AND, OR and NOT proved useful by providing a relationship between the words in the search, 'Risk AND Assessment' meant that both words were searched as a phrase rather than separately. The NOT allowed certain results to ignore certain results especially in relation to prophylaxis. The author also preformed proximity search by using the 'NEAR' operators. As nurse practitioners are called different titles globally the phase 'Nurse AND Practitioner NEAR2/N2' was used to capture all articles in the proximity.
I contacted authors from a few of the primary studies seeking clarification regarding questions and data involved in their studies. Literature was searched from January 2000 to May 2022, this date range was guided by the emergence of VTE clinical guidelines and risk assessments especially the NICE guidelines in 2010 and the developing a national quality requirement 2014/2015 by the NHS in the UK. I included dates prior to 2010 to assess the knowledge and practice prior to the published guidelines.
The literature search was last updated on 30th May 2022.

Figure 2.1: Online Database Search



2.4.2 Study Eligibility and Search Criteria

Inclusion criteria was primary quantitative, qualitative and mixed-method studies conducted worldwide in any of the seven regions of the world that reported on clinical staffs' VTE risk assessment knowledge and clinical practice in hospital setting. Clinical staff directly involved in patient care (nurse practitioners, physicians, nurses), VTE in all patients, research studies in all languages were included in this search.

Excluded criteria were editorials, letters, notes, discussion papers, case studies, unpublished thesis. All papers and studies directly relating to the treatment and diagnosis of VTE were excluded. All thromboprophylaxis research was excluded. Research studies that excluded clinical staff and only involved patients and families were also excluded as this study was looking at clinical staff and preventing VTE from occurring as a result of the knowledge and current practice of the clinical staff.

The shortlisted full-text articles were then reviewed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist (JBI 2017).

These eligible studies were exported to Covidence software (Veritas Health Innovation, n.d.), a web-based platform which assists with streamlining the production of standard intervention reviews. Covidence were used to screen and extract data. This search of studies and the literature followed the well-established PRISMA recommendations as discussed by Moher *et al*. (2009) and the new updated version in 2020 (Page *et al* 2021). The PRISMA extension for scoping reviews PRISMA-ScR checklist was utilised throughout this scoping review (Tricco *et al* 2018) (Figure 2.2).

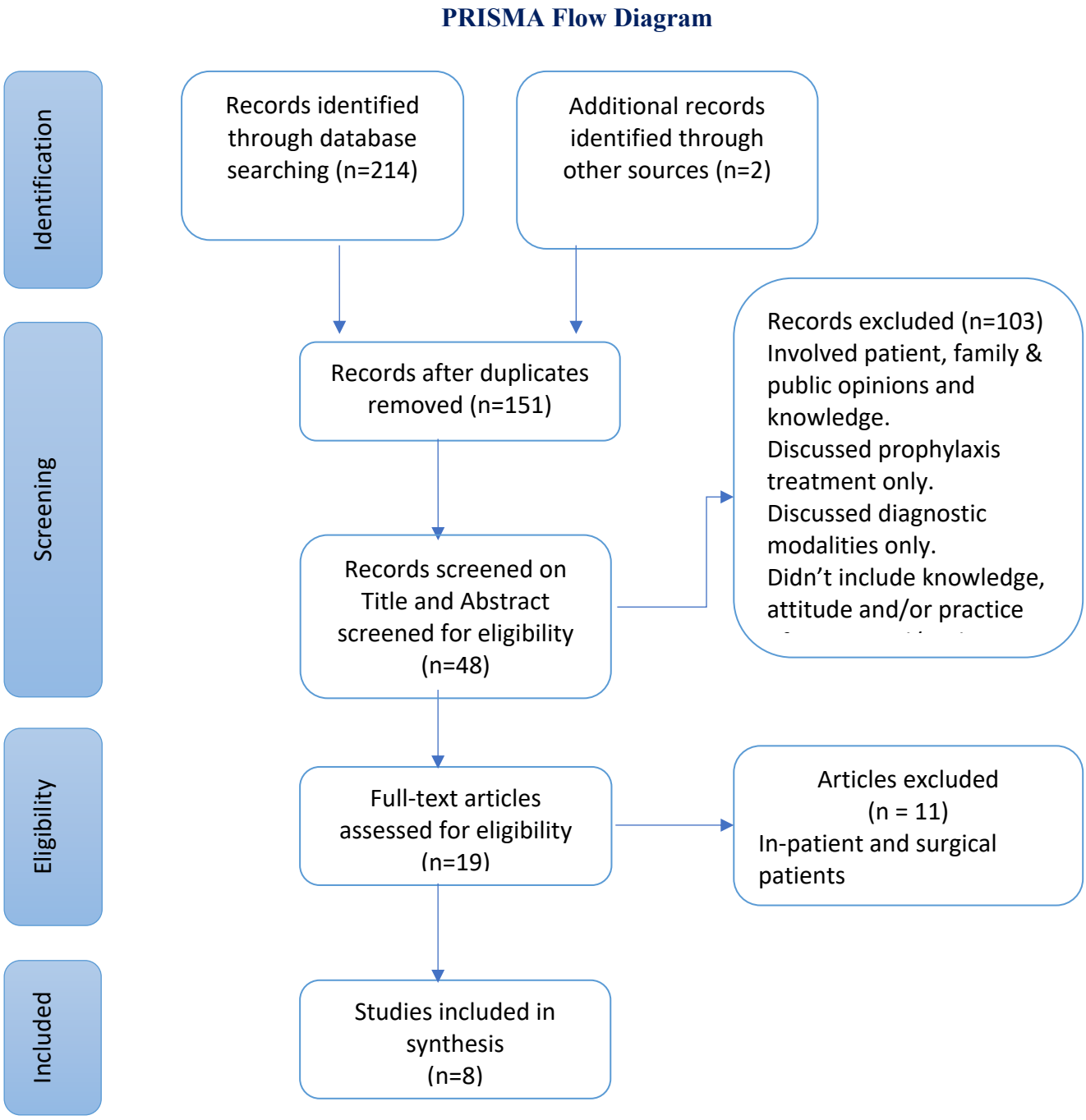


Figure 2.2 PRISMA Flow Diagram based on Moher *et al* 2009

2.4.3 Database Abstraction

Data searching and data extraction are two of the major steps in conducting a scoping review. Data searching involves searching for relevant articles in different databases using relevant keywords and MeSH terms. The next step in the data search is article selection and comparing these articles against the inclusion and exclusion criteria. It is advised that the researcher then

reviews the references in these articles to ensure that all relevant studies have been captured in the screening process. The next step after the search is data extraction and appraising of the data of the selected articles. A data extraction form should be used to help reduce the number of errors, and more than one person should record the data (Jahan *et al* 2016). Data should be collected on specific points like population type, study authors, agency, study design, humanitarian crisis, target age groups, research strengths from the literature, setting, study country, type(s) of public health intervention, and health outcome(s) addressed by the public health intervention. All this information should then be put into an electronic database.

I searched citations and selected studies. In the first level of manually searching, I retrieved all potentially relevant studies and reviewed the titles, abstracts and full texts of these papers for their eligibility as per the inclusion and exclusion criteria. The 19 full-text articles were reviewed using the JBI Critical Appraisal Checklist as well as inclusion and exclusion criteria. (JBI 2017). The final selection of full-text articles was based on the inclusion criteria and the PICoS selection criteria. A data extraction form was used during the literature search to provide a platform for the researcher to record study design descriptors, study participants, intervention groups, outcomes, data analysis. This form was adapted from the Cochrane Data collection form for intervention reviews: RCT and non-RCTs (Cochrane 2014) and ensured that I adhered to all Cochrane Methodological Expectations of Cochrane Intervention Reviews (MECIR) standards for collecting and reporting information regarding studies.

The review process illustrated in PRISMA (Figure 2.2) found articles in the electronic databases searched (n=214). There were two additional publications retrieved from hand searching. Following the removal of the duplicates, relevant publications were identified and screened by title and abstract, subsequent to the articles retrieved whose title and abstract met the inclusion criteria and these were then read in full text. Finally, eligible studies which included the clinical practice and knowledge in relation to VTE risk assessment were included for extensive review. These eligible studies were then mapped onto a data extraction table. This data extraction table was created to ensure alignment with the research objectives, as suggested by the protocol outlined by Armstrong *et al* (2011).

The searches described yielded eight research articles for inclusion in this critical review, ranging in date from 2006 to 2020. Of the 151 citations identified, only one study reviewed nurse practitioners, doctors or nurses' knowledge and practice within the ED setting as well as

the orthopaedic outpatients. An additional two involved the medical staff in orthopaedic outpatients only. There were an additional six studies that looked at either nurses' or doctors' knowledge surrounding VTE risk assessment in a variety of different hospital settings. It was originally the intention to look at the nurse practitioners' knowledge and practice habits of VTE risk and prevention within the lower limb immobilization population. However, due to there being no papers my search had to be widened and include other conditions not only lower limb injuries resulting in immobilization. As only one study mentioned ED in conjunction with orthopaedic outpatients, it was important not to exclude the studies from other clinical settings such as the medical ward and surgical department as these papers concentrated on the nurses' and doctors' knowledge and current practice which was the underpinning theme in this review. The electronic and literature search did not identify any other eligible studies surrounding knowledge and current practice within the ED setting for VTE risk assessment in non-surgical lower limb fractures.

It is not surprising that most of the literature was published within the last decade since the NICE 2007 VTE guidelines, as this highlighted the risk of VTE and the need for risk assessments. It was important to establish the quality, quantity and consistency of the studies. The eight included articles are presented in Table 2.4.

2.4.4 Study Quality and Risk of Bias

Brien *et al* 2010 stated that scoping reviews are more challenging to interpret due to the lack of quality assessment. Grant and Booth (2009) suggest that the scoping review can inform policymakers as to whether a full systematic review is necessary to carry out but that the lack of quality assessments limits the uptake of scoping review findings into policy and practice. The Joanna Briggs Institute (Peters *et al* 2020) suggests that unless the aim of the review is to answer a specific research question which will inform practice or change policy then assessing for quality of studies is not necessarily required.

I recognised the challenges that exist in assessing quality among the vast range of published and grey literature. As this review forms part of a larger doctoral thesis and is unlikely in its own right to inform practice, all studies meeting the inclusion criteria were included. The SORT taxonomy allowed transparency regarding the strength of the evidence of study and also reducing the potential risk of bias from myself as a single reviewer (Barnes *et al* 2016). Each study is analysed for its quality and then rated either Level 1 (good quality patient-orientated

evidence), Level 2 (limited quality patient-orientated evidence) or Level 3 (other evidence) as per SORT criteria (Ebell *et al* 2004).

Bias is described by Jahan *et al* 2016 as a deviation from the truth in relation to the results. Bias can impact any aspect of the review and therefore present a misinterpretation of the results or findings. The literature was assessed for methodological quality (risk of bias) assessment by utilising the Downs and Black scale, which is one of the mostly widely used and well-validated tools for the assessment of both randomised and non-randomised studies (Downs and Black 1998, Richmond *et al* 2013). The Downs and Black scale consisting of 27 questions relating to quality of the literature was used in this review to assess each paper with regard to quality, bias and rigour. Each study was a grade of 'excellent = 24–28 points', 'good = 19–23 points', 'fair = 14–18 points' or 'poor = <14 points' (O'Connor *et al* 2015) (Appendix 3). If there had been ten or more studies included in the scoping review then a funnel plot would have been constructed to visually inspect for potential publication bias (Lee and Holbrook 2017).

Table 2.4: The Data Extraction Table of Reviewed Articles

Study No.	First Author, (Year) Country of study	Research Question or Study Aims	Research Design	Data collection including research instruments	Study population Clinical Setting	Summary of findings	SORT Score	Notes
01	Batra *et al* (2006) England, Scotland & Wales, UK	"Investigate the current thromboprophylaxis practice among UK orthopaedic depts for patients immobilised with plaster for lower extremity injuries" pg.813	Quantitative	Telephone Survey Questionnaire Consisting of four main questions.	n=70 Doctors consisting of SHO & Registrars Three refused to take part 70 Orthopaedic departments in the UK	Shows inconsistency in orthopaedic depts in the UK. 62% of the departments had no protocols Failure to prescribe prophylaxis in high risk patients Lack of guidelines highlighted as poor clinical practice	Level 1	Current practice Medical Lower Limb Injuries
02	Iqbal *et al* (2012) England, Scotland Wales & Northern Ireland UK	"To assess the current practice across the NHS hospitals in the UK regarding DVT risk assessment and offering the appropriate prophylaxis to non-operative ankle fractures" pg.157	Quantitative	Telephone Survey Questionnaire	n=1 Consultant n= 23 Registrars n= 32 SHOs 56 Orthopaedic departments in the UK (44 = England, 6 = Wales, 5 = Scotland, 1 = Northern Ireland)	A large variation existed throughout the UK with poor risk assessment being carried out in patients. Only 5.35% hospitals in the UK had guidelines to preform VTE risk assessment in ankle fracture patients treated with cast immobilisation throughout the outpatients.	Level 1	Current practice Medical Lower Limb Injuries
03	Lee *et al* (2014)	"How do registered nurses perceive their knowledge and practice of VTE risk	Quantitative	Exploratory descriptive study utilizing a web-based,	n= 221 Registered Nurses (bedside)	30% of nurses reported that their knowledge was fair or poor.	Level 1	Current practice Nursing

	California USA	assessment and prevention" "What barriers do the nurse perceive in their practices of assessment and prevention for VTE" pg.19		anonymous voluntary survey method	Two acute hospitals Hospital A = academic hospital with level 1 trauma and 422 beds. Hospital B = large community hospital with level 2 trauma and 407 beds.	31% of nurses reported that they seldom complete VTE risk assessment forms. 7% of nurses had previously attended an in-service education session. Barriers included lack of time, lack of knowledge, lack of standardised protocol.		All patient types.
04	Mc Farland *et al* (2014) UK	"To explore the current practice of VTE prevention in acute trusts" pg.1	Qualitative	Face-to-face interview and telephone interviews. Four main themes	n= 17 n= 15 face-to-face n= 2 telephone 12 separate organisations/ trusts	Confusion regarding the responsibility for VTE risk assessment and treatment. Participants showed low level of knowledge and understanding and uncertainty over reduced mobility. Importance of continuous training.	Level 1	Current practice Medical& Nursing
05	Oh *et al* (2017) South Korea	"To examine Korean nurses level of perceived knowledge and practice of VTE risk assessment as well as prevention, self-efficacy and actual knowledge of VTE" pg. 427	Quantitative	Cross-sectional descriptive study paper-based surveys	n= 452 Registered Nurses. All wards within two university hospitals in Seoul South Korea	Nurses showed very low level of VTE knowledge 80% rated their knowledge as fair or poor. 72.8% of nurses reported that they had seldom completed a VTE risk assessment for their patients. Nurses aware of detection and identification of DVT rather than prevention of VTE.	Level 1	Current practice Nursing All patient types.

06	Da Silva *et al* (2020) *Sáo Paulo Brazil*	"To compare nurse' self-perceived and objective knowledge of VTE, identify risk assessment practices and perceived barriers and self-efficacy in preventing VTE" pg.1	Mixed-Methods	Cross-sectional descriptive study. Interview and paper or online surveys consisting of 21 questions divided in 5 sections	n= 81 Nurses One teaching hospital	The majority of nurses performed risk assessment in only a few patients, mainly due to the lack of standardised protocol and the lack of time. Self-efficacy on risk assessment, education and prophylaxis was low.	Level 1	Current practice Nursing All patient types.
07	Tang *et al* (2015) North China	"To explore how medical staff of ICUs in China comprehend and practice VTE prophylaxis" pg.1	Quantitative	Cross-sectional descriptive postal surveys consisting of 39 questions divided in 4 sections	n= 1681 participants n= 564 physicians n= 1117 nurses 52 ICUs in 23 tertiary hospitals in seven Chinese province in North China	Knowledge of the guidelines were insufficient. Physicians rarely assessed the risk of VTE in ICU patients. 60% of medical staff were not aware of VTE guidelines in China or abroad.	Level 1	Current practice Medical& Nursing ICU patients
08	Wallace *et al* (2017) Australia	"To identify areas of uncertainty in VTE management and whether self-reported practice is consistent with guidelines" pg.436	Quantitative	Cross-sectional descriptive online surveys consisting of 53 questions	n= 71 haematologists, n= 110 respiratory physicians. Throughout Australia	Considerable variability in VTE management practices across multiple areas. Based decisions on multiple guidelines rather than just one.	Level 1	Current practice Medical Focused more on PE

2.5. Results

The studies in this review (n=8) were conducted globally, the United Kingdom (n=3) (Batra *et al* 2006, Iqbal *et al* 2012, Mc Farland *et al* 2014), the United States of America (n=1) (Lee *et al* 2014), Australia (n=1) (Wallace *et al* 2017), South Korea (n=1) (Oh *et al* 2017), China (n=1) (Tang *et al* 2015) and finally Brazil (n=1) (da Silva 2020) all met level 1 criteria. From these studies, there was one qualitative study (Mc Farland *et al* 2014) and six quantitative studies (Batra *et al* 2006, Iqbal *et al* 2012, Lee *et al* 2014, Oh *et al* 2017, Tang *et al* 2015, Wallace *et al* 2017), only one study used a mixed-method approach (da Silva *et al* 2020). Out of the six quantitative studies, four of these were cross-sectional surveys (Lee *et al* 2014, Oh *et al* 2017, Tang *et al* 2015, Wallace *et al* 2017) and two were quantitative telephone-based surveys (Batra *et al* 2006, Iqbal *et al* 2012). The one qualitative study involved face-to-face and telephone interviews (Mc Farland *et al* 2014). The one mixed-method study consisted of both interviews and online surveys (da Silva *et al* 2020). Six studies were multicentric ranging from 2 to 71 hospitals (Batra *et al* 2006, Iqbal *et al* 2012, Mc Farland *et al* 2014, da Silva *et al* 2020, Tang *et al* 2015, Wallace *et al* 2017) and two studies were monocentric consisting of different wards within one hospital (Lee *et* al 2014, Oh *et al* 2017). No studies included nurse practitioners and three of the studies' participants, consisted of doctors (Batra *et al* 2006, Iqbal *et al* 2012, Wallace *et al* 2017), three studies focused on general nursing staff (Lee *et al* 2014, Oh *et al* 2017, da Silva *et al* 2020) and the remaining two studies included both doctors and nurses (Mc Farland *et al* 2014, Tang *et al* 2015). Two of the studies included the assessment of patients sustaining lower limb injuries (Batra *et al* 2006, Iqbal *et al* 2012) while the other six studies included a variety of patient conditions such as respiratory, haematology, surgical and medical ones (Lee *et al* 2014, Mc Farland *et al* 2014, Oh *et al* 2017, da Silva *et al* 2020, Tang *et al* 2015, Wallace *et al* 2017). The lower limb injury studies (Batra *et al* 2006, Iqbal *et al* 2012) took place in orthopaedic departments in the UK. The studies' sample sizes ranged from n=17 (Mc Farland *et al* 2014) to n=1681 (Tang *et al* 2015).

Four main themes that have emerged clearly throughout the eight included studies (Table 2.4) risk assessment of VTE, VTE guidelines, knowledge and education surrounding VTE and VTE risk assessment compliance and adherence. Review of each of these four themes will be discussed in turn, in the next section. Of note only two of these studies discuss lower limb immobilisation while the remaining six papers addressed clinical practice and knowledge in a variety of different cohort of medical conditions.

2.5.1 Risk Assessment of Venous Thromboembolism

Prolonged lower leg immobilization following an injury such as a fracture is associated with an increased risk of VTE however this issue was only discussed in two papers in this review (Batra *et al* 2006, Iqbal *et al* 2012). Iqbal *et al* state that 'all patients with lower limb cast immobilization should at least be risk assessed and thromboprophylaxis to be provided to those having high risk of DVT' (Iqbal *et al* 2012 pg.158). This is mirrored in Batra *et al* 2006 who advise that 'patients should be carefully assessed for risk of developing DVT before application of plaster and appropriate thromboprophylaxis prescribed accordingly' (Batra *et al* 2006 pg. 816). The further six papers (Mc Farland *et al* 2014, Lee *et al* 2014, Oh *et al* 2017, da Silva *et al* 2020, Tang *et al* 2015, Wallace *et al* 2017) all discuss the risks that are associated with developing a VTE from a more generic aspect. Oh *et al* 2017 in their study discovered that only '15% of the participants reported completing a VTE risk assessment on all (6%) or nearly all (8.4%) of their patients, whereas 18.6% reported completing the risk assessment on no patients' (Oh *et al* 2017 pg. 431) and 'most nurses (72.8%) reported that they seldom completed the VTE risk assessment form for their patients' (Oh *et al* 2017 pg. 432). Similar findings were found to occur in da Silva *et al* 2020 where 19.8% of the nurse in the study always completed a VTE risk assessment. In Lee *et al* 2014 the rate of VTE risk assessment was only slightly better with '26% (n=56) of respondents indicated completing a VTE risk assessment on all of their patients' (Lee *et al* 2014 pg. 20).

In all of the eight papers identified, there appears to be a consistent thread. Medical staff (doctors and nurses) are not assessing the majority of their patients and are discharging patients who sustained a lower limb injury, resulting in immobilization, as well as patients that are being discharged post-surgery or other medical conditions. Mc Farland *et al* 2014 in their study interviewing a consultant and VTE lead stated that

> 'one of the weaknesses of the current strategy is that the outcome that is being measured is the number of risk assessment forms completed. The focus needs to be on whether they have been completed correctly and clinicians have acted on that assessment. People think that it is about identifying whether a patient is at risk of thrombosis but a risk assessment tool is also there to identify whether a patient is at risk of complications of thrombo-prophylaxis and therefore it is essential that the information is used to guide practice. People are judged on completion of risk assessment forms, not necessarily the execution of the result of that form' (Mc Farland *et al* 2014 pg. 3).

Another participant in this study confirmed that VTE risk assessment is the responsibility of the team not just individuals 'From the hospital's point of view they need to understand that risk assessment and treatment of the patient is not just one person's responsibility. It becomes the responsibility of everyone who is involved in treating that person' (Mc Farland *et al* 2014 pg. 3). In da Silva *et al*'s 2020 study, the nurses reported that there was a lack of a standardised protocol and it was the main barrier (65.4%) to the lack of completion of VTE risk assessment across the 81 nurses in the study.

2.5.2 Venous Thromboembolism Guidelines

Healthcare providers should be keeping abreast of current VTE guidelines both nationally and internationally. Oh *et al* 2016 claim that 'healthcare providers, including physicians and nurses, should be aware of clinical guidelines for VTE prevention in hospitalised patients to improve VTE prevention and patient safety' (Oh *et al* 2016 pg. 433). Seven out of the eight papers that were reviewed (Table 2.4) discussed the various issues surrounding VTE guidelines. In da Silva *et al'*s 2020, study it was reported that the 'lack of a standardised protocol was the main barrier to VTE risk assessment' (65.4%) (da Silva *et* al 2020 pg. 5). Iqbal *et al* (2012) discovered that only 5.35% of hospitals in the UK actually had guidelines in place for preforming VTE risk assessment in ankle fracture patients who have a lower leg immobilization and who are treated in the outpatients. This issue also came to light in Batra *et al*'s (2006) study where 98.57% of their respondents were unaware of any existing guidelines and 62% of all departments had no VTE prophylaxis guidelines following cast immobilization for lower limb fractures. When comparing lower limb fracture studies with the medical and intensive care unit (ICU) studies, there is a slight improvement surrounding awareness of VTE prophylaxis guidelines. Sixty percent of medical staff working with critically ill patients surveyed in China were unaware of the guidelines that existed both in China and internationally (Tang *et al* 2015). Wallace and his colleagues had a more positive finding when they surveyed haematologists and respiratory physicians in Australia and found that only 5% of doctors were not familiar with any VTE prophylaxis guidelines (Wallace *et al* 2017). They further discovered that 77% of the respondents based their clinical decisions on one or more guidelines which could give rise to confusion and poor compliance. Iqbal *et al* (2012) suggest that due to the 'lack of specific guidelines regarding patients managed at outpatients clinics, risk assessment for these patients are not being carried out satisfactorily' (Iqbal *et al* 2012, pg. 159) and therefore this explains that in their study it emerged that in 64.3% of NHS hospitals, VTE

risk assessments are not being performed (Iqbal *et al* 2012). The variation seen in Batra *et al*'s study 'reflects the lack of guidelines on which to base good practice' (Batra *et al* 2006 pg. 816).

2.5.3 Knowledge & Education Surrounding Venous Thromboembolism

Knowledge of the relevant VTE risk assessment and guidelines is insufficient (Tang *et al* 2015). All eight papers investigated and discussed the issue of knowledge and education in relation to VTE prevention. Oh *et al* 2016 highlighted the fact that in their study their participants were knowledgeable in relation to the detection of a DVT but lacked knowledge in relation to prevention. Tang *et al* found that 'knowledge of the relevant guidelines were insufficient' (Tang *et al* 2015 pg. 7).

Lee *et al* found in their study that 'greater VTE knowledge was associated with better VTE prevention care' (Lee *et al* 2014, pg. 22). Therefore it is fair to say, that if the nursing and medical staff are lacking in knowledge then they are not equipped in the prevention of VTE for their patients. Lee *et al* (2014) in their study also found that 27.8% (58/208) of the nurses self-reported that their VTE knowledge was fair or poor and thirteen other nurses (13/221; 5.9%) did not even answer this question in the survey. However, Oh *et al* (2016) found that 74.3% of clinicians rated their knowledge as fair. In both these studies the research questions surrounding knowledge, were looking at VTE risk factors, signs and symptoms, prophylaxis and relevant diagnostic tests for VTE. Both nursing and medical staff should be equipped with knowledge to answer the questions in relation to these VTE facts.

Da Silva *et al*'s survey (2020) asked VTE-related questions to measure the nurses' knowledge and it transpired that 33.1% of nurses answered the VTE questions correctly and less than a third of the nurses were confident that they could educate their patients in relation to VTE prevention. The nurses in this study perceived the 'lack of knowledge as a barrier to VTE risk assessment' (da Silva *et al* 2020 pg. 7). In Mc Farland *et al*'s study they found that there were 'low levels of knowledge of VTE risk and prevention among staff in some acute trusts, even in orthopaedic hospitals where the majority of patients will be assessed at high risk. There was clearly a requirement for improved staff understanding without which there will remain an inability to pass on vital information to patients' (Mc Farland *et al* 2014 pg. 4). Participants in this study also suggested the importance of completing a VTE prevention module as part of their medical training (Mc Farland *et al* 2014).

It appears to be a common trend that in-service education sessions regarding VTE risk assessment and prevention are not often offered for staff working within an acute setting. Oh *et al* (2016) found that only 9.3% of their respondents had ever received in-service training on the topic of VTE. Lee *et al* (2014) found that only 7% of respondents had previously attended an excellent education on VTE care.

There is a need to identify the effect that this gap in knowledge has on patients that present to the ED setting. In Mc Farland *et al*'s (2014) study several of the participants highlighted the importance of continuous training to educate staff to take ownership in preventing VTE by effectively completing the risk assessment and not just completing a tick box exercise. One of the participants who was interviewed in Mc Farland *et al*'s study, reviewed education in all healthcare disciplines and concluded that there was huge variability in education around VTE. Varying from virtually no teaching to eight weeks of haematology teaching between the different medical schools. 'If one looks at the nursing syllabus, the midwives have nothing, there's no module at all on VTE and the nursing modules vary so there is a huge need for improvement in education' (Mc Farland *et al* 2014 pg. 4).

2.5.4 Venous Thromboembolism Risk Assessment Compliance and Adherence

There were only five papers (Batra *et al* 2006, Lee *et al* 2014, Mc Farland *et al* 2014, da Silva *et al* 2020, Tang *et al* 2015) that investigated the issue surrounding compliance and adherence when it comes to completing a VTE risk assessment on patients within the healthcare setting. There were a number of issues that fed into the lack of adherence and compliance with the utilisation of the VTE guidelines and the risk assessment models within the clinical setting. As Batra *et al* (2006) highlighted 62% (n=43) of departments had no VTE protocols in situ and only 11% of departments used risk assessment, this makes it very difficult to implement and adhere to these guidelines and protocols when they do not exist. They also found that 98% of the participants in their study was unaware of any VTE guidelines in the UK (Batra *et al* 2006). Tang *et al* (2015) state that VTE guideline adherence is only 40% and that 50% of the medical staff in their survey implement a non-standard approach to VTE prevention and treatment. Lee *et al* 2014 and da Silva *et al* (2020) claim that barriers exist in clinical practice that prevent adherence form occurring.

Da Silva *et al* (2020) identified nurses' self-perception of barriers in completing the VTE risk assessment was 65.4% due to the lack of standardised protocol, 29.6 % from a lack of time,

13.6% down to the lack of education and 1.7% due to a language barrier. These findings were echoed in Lee *et al*'s (2014) study where the most common perceived barrier in performing VTE risk assessments were due to the lack of knowledge (21%), lack of time (21%), standardised protocol (13%) and language barrier (5%). Another frequently cited barrier in this study was that 'physicians do risk assessment', 'not nurses independent role' and 'it is easy to forget to do it' (Lee *et al* 2014 pg. 21). Mc Farland *et al*'s (2014) study suggests that a successful way to overcome the problem is in establishing 'knowledge of where the responsibility falls, within each individual member of the clinical team, along with a backup system to make sure that risk assessment are being carried out' (Mc Farland *et al* 2014 pg. 3). One of the participants in the study stated that the nursing staff and the pharmacy staff remind the doctors ensuring a 'three-pronged attack' (Mc Farland *et al* 2014 pg. 3). There is consensus in the literature that improved education and training can overcome the deficits resulting from the lack of knowledge and in turn improve the compliance and adherence of VTE guidelines and therefore improving patients outcomes.

Da Silva *et al*'s study 'suggests that education programs on VTE risk, prevention and treatment, if frequently preformed and associated with attractive teaching strategies may be positive' (da Silva *et al* 2020 pg. 7). A number of participants in Mc Farland *et al'*s interviews commented on their organisational education strategies. In Mc Farland *et al*'s (2014) study there was a variety of suggests in relation to educational training from e-learning VTE modules to short training sessions, however, all participants recommended, that the education should be mandatory within the employees' organisation. Initiatives like this need to be implemented globally to overcome the lack of adherence and to improve guidelines and risk assessment compliance.

2.6 Discussion

This is the first review of practitioners' practice when evaluating VTE risk due to lower limb injuries within the emergency setting. Nurse practitioners have evolved in many countries and are unique in their position as they fulfill the nursing role while also being an independent autonomous practitioner solely responsible for the safety and welfare of their patients. There was an obvious gap in research in relation to nurse practitioners' positions in relation to VTE risk assessment knowledge and current practice for their patients. The global diversity of the articles in this review highlights the fact that this is a global health issue that needs highlighting

and research. This critique was undertaken to examine the evidence about practice in ED surrounding VTE risk assessment in patients with lower leg immobilisation. Despite this clinical issue, there remains no research guiding the ED management of the risk of VTE in patients with lower limb immobilisation following an injury. There is an abundance of literature focused on VTE prophylaxis and diagnosing VTE in patients in a wide variety of clinical settings. There is little evidence addressing risk assessment knowledge and current practice. Nevertheless, the reviewed literature clearly demonstrates that issues exist around VTE risk assessment knowledge and practice of doctors and nurses in the healthcare setting. As there are only two studies addressing lower limb immobilization this clearly is under researched. The VTE management guidelines developed by NICE have obviously not yet translated to the ED setting for this vulnerable cohort of patients.

International guidelines continue to recommend different clinical management options for patients in temporary immobilisation after an injury. The UK advises routine risk assessment and individualised thromboprophylaxis prescribing, while the US guidelines advise against thromboprophylaxis in patients with lower limb immobilisation as a whole (NICE 2019, Falck-Ytter *et al* 2012). The National Institute for Health and Care Excellence (NICE) gives advice regarding thromboprophylaxis in admitted patients who sustained a lower leg fracture (NG89) however no specific guidelines have been initiated for patients managing their lower leg fracture as an outpatient ambulatory patient (NICE 2019). Literature suggests that pharmacological prophylaxis significantly reduces VTE risk (Horner *et al* 2020, Zee *et al* 2017, Skeik & Westergard 2020). A Cochrane Review demonstrated 'that the use of LMWH in outpatients reduced DVT when immobilization of the lower limb was required, when compared with no prophylaxis or placebo' (Zee *et al* 2017 pg. 1). However, this is disputed by Horner *et al* (2016) who claim that there has been no clear consensus on the role of Low Molecular Weight Heparin (LMWH) in patients with lower limb injuries. Due to the significant risk of bleeding and other side effects associated with thromboprophylaxis medication, it is important that patients are accurately assessed and that the benefits outweigh the side effects for every individual patient. Batra *et al* (2006) found that in 52.9% of the departments involved in their study prescribed no VTE prophylaxis and the remainder of the departments showed no consistency in the type of VTE prophylaxis used. This ranged from aspirin throughout the period of immobilization (15.7% n=11), Low Molecular Weight Heparin (LMWH) throughout the period of immobilization (12.9% n=9) to LMWH while in hospital followed by aspirin throughout the remaining period of immobilization (Batra et al 2006). These findings were

replicated in Iqbal *et al*'s (2012) study which revealed that 50% of the correspondents stated that routine thromboprophylaxis was not required for patients suffering from ankle fractures that were treated with a cast immobilization. Kocialkowski *et al* (2016) and the VTE committee working with him recognized the need to provide VTE prophylaxis for this cohort of patients but were concerned that the low-risk patients were being over-treated and therefore unnecessarily exposed to the risk associated with LMWH. They developed a risk assessment form that the treating clinician could complete and discuss with the patient to assess the accurate risk of the patient developing a VTE. After six months the VTE committee audited the practice of clinicians and found that only 50% of the patients had been risk assessed in either ED or the fracture clinic but a specialist nurse rather than a doctor however mostly completed this. A large amount of the literature also mentioned issues surrounding the risk of VTE in a variety of different hospital settings and the issues surrounding prophylaxis. One study revealed that 68% of staff admitted to witnessing an incorrect use of VTE prophylaxis within the previous three months of the study (Gao and Kause 2010). There is a need for all nurse practitioners, doctors, nurses, pharmacists and anyone with direct patient care to be fully aware of the guidelines and risk assessment in their organisation. There are a variety of guidelines that address VTE in general, but unfortunately, there are no specific guidelines addressing VTE in lower limb ambulatory patients discharged from ED. Gaston and White (2013) recommend that all patients attending hospital should be assessed for risk, using a validated risk assessment tool in accordance with best-practice guidelines. There are also a number of risk assessment forms which can be used in ambulatory lower limb immobilisation patients, these include Guidelines in Emergency Medicine Network (GEMNet), Plymouth and Leiden Thrombosis Risk in Plaster-cast (L-TRiP-cast) rules, and modified caprine score to name a few. All of these have similar risk factors and therefore are applicable in the ED setting. The NICE guideline (2010), SIGN (2014) and the College of Emergency Medicine (Roberts *et al* 2013) all recommend that patients who are immobilized in a lower limb cast and have another risk factor should receive prophylactic LMWH. This is challenged by Kocialkowski *et al* (2016) in their study and recommended in their local protocol that patients must 'score sufficiently highly on a number of risk factors to be automatically prescribed thromboprophylaxis' Kocialkowski *et al* (2016) pg. 2). Watson *et al's* (2016) study evaluating the risk assessment models available discovered that risk assessment 'tools designed specifically for this group showed greater potential for use in the clinical environment than the tools applicable to all patients on admission to hospital' (Watson *et al* 2016 pg. 194). Testroote *et al* (2008) found that the risk of VTE ranges from 4.3% to 40% in patients with lower limb

immobilisation for at least one week and who have not received prophylaxis. This is why the researcher feels that it is necessary to have specific guidelines and risk assessment for patients who are in lower leg immobilisation as a result of a lower leg injury and are being discharged from the ED setting.

The NICE (2015) guidelines estimate that the incidents in patients developing a VTE post lower limb immobilization lie between 4-40%. Clinicians need to increase knowledge and increase prevention measures. Gatson and White's (2013) study assessed participants' VTE risk assessment knowledge both pre and post-implementation of an education session, they found that there was a 23% increase in staff correctly identifying the need for a VTE risk assessment to be completed for a certain cohort of patient. Lockwood *et al* (2018) highlight that when healthcare organisations offer VTE in-service education programmes and then follow up on the outcomes, it results in thromboprophylaxis adherence increasing. Literature denotes that the introduction of guidelines and protocols along with education positively impacts on knowledge (da Silva *et al* 2020, Al-Mugheed and Bayraktar 2018).

Staff compliance in using VTE guidelines and risk assessment protocols was a theme that also emerged from the literature. Gao and Kause (2010) found that there were only 32% compliance among the staff across two hospital sites in the UK. Kocialkowski *et al* (2016) however, introduced a new local policy on VTE risk assessment for patients immobilized in lower limb plaster casts in a method to improve compliance within the trust. They also implemented regular training sessions for staff in a way to improve compliance. They believed that with this risk assessment tool and appropriate in-service training in relation to the risk assessment tool that 'good compliance with the process is achievable in the ED and fracture clinic' (Kocialkowski *et al* 2016 pg. 3). Lees and Mc Auliffe (2010) aimed to identify the barriers and issues that prevented compliance of the NICE guideline. One of the main findings from this study was that the nurses were willing to remind others to complete the risk assessment form but were not willing to complete it themselves due to the issue of the prescriptive authority regarding VTE prophylaxis. This barrier was overcome with the aid of regular educational sessions within the hospital as well as computer screen savers 'Stop the clot, risk assess your patients'. When re-audited after the interventions they found that compliance with VTE had increased by 70%. The common theme running through the literature regarding the improvement of staff compliance is education. Gatson and White (2013) demonstrated that compliance improved following evidence-based educational sessions which provided the

nurses with knowledge, therefore empowering them to take responsibility for completing the VTE risk assessments. As recommended by Grol and Wensing (2004) it is necessary for the researcher to acquire a good understanding of the problem. Having reviewed the literature it would be my recommendation that in-service educational sessions should be regularly provided for nursing staff to ensure that compliance is maintained and that their knowledge is kept up to date with the current VTE guidelines.

2.7 Strengths and Methodological Limitations

The main strengths of this review were the systematic approach that was implemented and the adoption of a reproducible method. Unambiguous search MeSH terms, topic terms and keywords were used and were adopted to meet the specific requirements of the twelve databases searched. The risk of bias was minimized by following procedures for selected studies and applying both the SORT taxonomy and the Downs and Black scale. The quality of the literature was also assessed by implementing the SORT taxonomy and in-turn insured consistency.

The review was limited due to the fact that there was only publications looking at medical staff's practice and knowledge in relation to lower limb injuries. However, this was addressed by including studies from a variety of clinical settings.

2.8 Conclusion

The risk of developing a VTE increases within the first week of the patient's injury if they are immobilised in a plaster cast or brace and have not received prophylaxis. This risk is exacerbated in the since COVID 19 as fracture clinics are being performed virtually and therefore the nurse practitioner in the ED may be the only clinician to ever assess the patient. This is why it has been referred to as the hidden killer; due to the fact that its occurrence is commonly concealed in patients in plaster casts and only revealed upon its removal (Batra *et al* 2006, Iqbal *et al* 2012).

There is a lack of knowledge about this topic and it needs to be addressed. This scoping review highlighted the lack of empirical evidence for evaluating VTE risk due to lower limb injuries in the ED setting managed by a ANP and has highlighted a number of questions that need to be asked.

1. How do emergency advanced nurse practitioners' evaluate VTE risk in patients with lower limb injuries in their clinical practice?

2. What is the current knowledge that emergency advanced nurse practitioners have regarding VTE risk assessment and prophylaxis in patients with lower limb immobilisation?

3. How do emergency advanced nurse practitioners identify patients who are most at risk of developing a VTE as a result of lower limb immobilisation?

4. What barriers or facilitators exist to prevent the risk of VTE in patients with lower limb immobilisation?

Having highlighted the questions that have emerged from the literature, the methodology and methods to address these questions is discussed in the next chapter.

Chapter Three: Research Methods

3.1 Introduction

Understanding ANPs practice when evaluating VTE risk due to lower limb injuries within the emergency setting has not previously been studied on a national nor global platform. This chapter will present the methods used in this research study including research purpose, the research questions and the reasoning behind adopting a parallel results convergent design approach. The research design and analytic methods will be evaluated and an ethical considerations for this particular research study will be discussed, ensuring the aims and objectives of the research study were met.

3.2 Research Objective

The aim of this study was to explore practitioners' knowledge and current practice regarding VTE risk assessment and treatment of patients with lower limb injuries which required immobilisation within the emergency setting. A parallel results convergent mixed-methods research design was used which entailed that the quantitative and qualitative data be collected in parallel, analysed independently then merged together to give an overall picture of the problem. An online survey instrument was used to investigate the nurse practitioners' current practice and knowledge in relation to VTE risk assessment in lower limb injuries requiring immobilisation. This study concentrated on nurse practitioners' that work in either emergency settings (emergency departments or local injury units). This study was a national study and therefore included the emergency departments and local injury units throughout the Republic of Ireland. The online survey used a two-prong approach, consisting of closed questions and open questions collected at the same time with the same population. The open-ended questions within the survey instrument were used to collate qualitative data that allowed exploration of therapeutic commitment and the factors that influence it. The reason for this approach was to discuss and compare the similarities and differences between the two forms of data, bringing greater insight into the understanding of the theory and its influencers than would be gained by either type of data separately.

3.3 Philosophical Underpinnings

When making decisions regarding research design, it is important that the researcher, not only concentrates on the method of data collection and research design but also how the knowledge can be best generated and how important that knowledge will be to the wider population. 'All researchers work, within frameworks or paradigms of underpinning philosophical assumptions about the nature of knowledge (epistemology), the nature of reality (ontology) and the philosophy of science' (Rolfe 2013: 19). Creswell and Plano Clark (2017) recommend, that the researcher uses a worldview mixed-method approach, to embark on the philosophical journey throughout their research. Paradigms can be viewed as a system of beliefs and practices that influence how researchers select both the questions they study and the methods they used to study them (Morgan, 2007). The vast amount of literature that exists discussing the different paradigms and their perceived differences in philosophical assumptions (Teddlie and Tashakkori 2009, Doyle *et al* 2016). The belief is that the two philosophies could never be mixed due to the inherent differences underlying them. Critical realism is one such philosophy which supports the belief that quantitative and qualitative research can work together (Shannon-Baker 2016) offering strategies for mixed-methods researchers to better understand the context of what they study (Maxwell and Mittapalli, 2010).

Teddlie and Tashakkori (2010) and Morgan (2007) advocate the importance of pragmatism as another important philosophy in mixed method studies as it focuses on understanding the research problem and then solving a practical problem. Over the last decade the notion of fusing these two philosophies together as Pragmatist–Critical Realist (PCR) has emerged (DeForge & Shaw 2012, Heeks *et al* 2019 and Elder-Vass 2022). This involves generating the knowledge from the two bases critical realism = theoretical knowledge and pragmatism = practical knowledge (Figure 3.1). Both pragmatists and critical realists promote a fallibilist understanding of knowledge (Bhaskar 2020, Elder-Vass 2022). Critical realists have recognise shortcomings of pragmatist thinkers as well as realist elements within pragmatism.

An important characteristic of critical realism is that it maintains a strong emphasis on ontology. As a consequence, the first and foremost tenet of critical realism is that the world exists independently of what we think. Critical realism builds on the post-positivism, underpinning a realistic outlook and looks at the real world irrespective of the researcher's

perception (Curtis & Drennan 2013: 133). It primarily focuses on ontology and begins with questions about what exists in the real world (Bergin *et al*. 2008; Frauley & Pearce 2007). Wong & Fui (2012) state that there is actually 'no fixed definition for pragmatism as it takes on a variety of different epistemological positions" (pp 361). Creswell (2014) agrees that there are many different forms of a pragmatic philosophy and that it does not readily sit on a research paradigm continuum (Heeks *et al* 2019). Pragmatism most characteristic feature is it's human action in relation to solving practical problems (Elder-Vass 2022). Mounce (1997) highlights that practical knowledge should be preferred over theoretical inquiry and that decisions should be made on the basis of solving the problem at hand at the time. However, knowledge from a pragmatic point of view does not need to be accurate but rather what they believe as the problem.

Heeks *et* al (2019) goes on further to say that critical realism looks at the ontological and epistemological aspect while pragmatism looks at the methodological component. The main difference between critical realism and pragmatism seems to be the start and end point of the research. Critical realism starts at inquiring knowledge from the truth and the reality, as for pragmatism starts at what is believed to be a problem and translate that into a practical action and solution.

Figure 3.1 Knowledge building under PCR (adapted from Johnson & Duberley 2000)

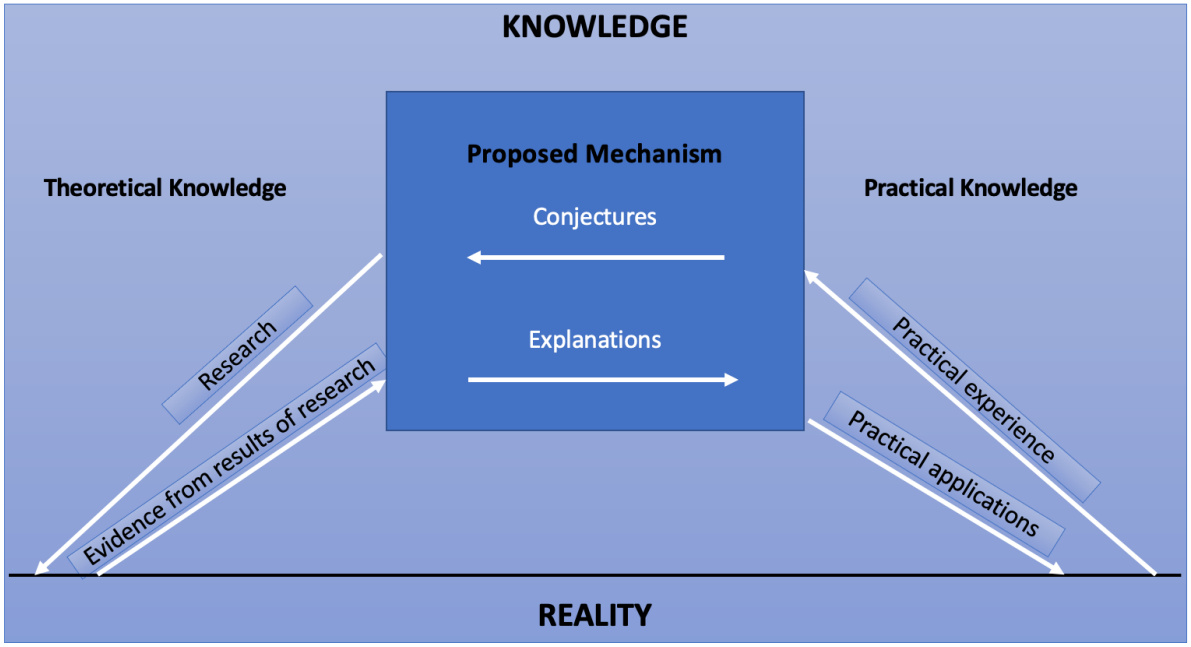


Figure 3.1 highlights how knowledge can be developed when a practical experience in conjunction with a person's opinion or hypothesis (conjectures) can be tested by research. The results from the research will either confirm or refute their opinion/hypothesis. The explanation and analysis from the research findings will contribute to the generation of new knowledge leading to a more effective practical application.

One problem of adopting a purely pragmatist approach would be developing the body of knowledge in relation to the extent of the problem for this study.
Imran (2024) claims that the combination of PCR and mixed method research addresses any limitations of each individual method by providing depth and context to the findings obtained through quantitative methods, and vice versa ensuring an all-inclusive approach to research (pp. 5957)

The realist philosophy will form the cornerstone in acquiring the level of knowledge and education by asking questions to the ANPs about the reality of their current practice when assessing patients with lower limb injuries within the ED setting. Then the pragmatic approach will be the problem solving the issues that arise, such as the possibility of the lack of education and or the lack of clinical knowledge in relation to VTE. This combination of critical realism and pragmatism allows for the exploration of various phenomena to support mixed method research (Imran 2024).

3.4 Research Method and Design Appropriateness

The research design key requirement is to have sufficient scientific merit to answer, robustly, the main research question, while reducing ambiguities such as bias (Lane, 2018), and at the same time being coherent and fit for purpose (Denscombe, 2010) while supporting or rejecting the hypothesis (Lane 2018). The research design is considered the blueprint that will enable the researchers to answer a specific research question (Bhattacherjee, 2012; Bloomfield and Fisher, 2019). To meet the aims and objectives of the study it was necessary to select the most appropriate design (Parahoo 2006). Up until the late 1980s nursing research acknowledged only two major theoretical approaches for the scientific attainment of knowledge – a quantitative and qualitative approach (Burns and Grove 2007). Then researchers and writers started discussing ways to combine and link both these methods, and how the data could be mixed and integrated. This gave rise to "the third research paradigm" (Johnson & Onwuegbuzie, 2004 pg.14) mixed-method pragmatism approach bridges the schism between quantitative and qualitative research and allows the researcher to use techniques, that are more relevant to clinical practice.

Mixed-method research, is defined by Creswell and Plano Clark (2017) as a type of research in which the researchers combine 'elements of qualitative and quantitative research approaches for the purposes of breadth and depth understanding and corroboration' (Pg. 4). Wurtz (2015) describes mixed-methods research as a technique to enable the researcher, to investigate, unfold and to understand a better and deeper knowledge of the behaviour being examined (Wurtz 2015). Mixed-methods research has been described as 'multiple ways of seeing and hearing' (Greene 2007, pg. 20) by integrating both quantitative and qualitative methods to collect and analyse data therefore providing answers to the proposed research questions (Creswell & Plano Clark, 2017). This combination of quantitative and qualitative methods allows for a better understanding of the research problem than any single method (Creswell 2012). Creswell and Plano (2017) advocate that mixed-methods go beyond just the research method but is a methodology that is surrounded by theory and philosophy. Mixed-methods research is seen as a new, third methodology (Tashakkori and Teddlie 2003; Johnson and Onwuegbuzie 2004). A variety of mixed-method designs and typologies have emerged over time. Tashakkori and Teddlie (2010) distinguish between two basic categories of mixed-method designs, equivalent status versus dominant/less-dominant designs and sequential versus parallel/simultaneous designs. These four approaches can be mixed together leading to

different combinations depending on which suits the research. An equivalent status sequential design is employed when a researcher uses qualitative and quantitative methods on an equal basis to understand the research problem. Creswell (2012) discusses the categorization of mixed-method strategies by grouping the different designs into decision choices between, types of implementation (sequential vs. non-sequential), priorities among research approaches (qualitative priority vs. quantitative priority vs. equal priority), integration of research (at data collection, analysis, interpretation, or some combination) and finally theoretical perspectives (explicit versus implicit). However, Mingers (2001) differentiates between sequential, parallel, dominant, multi-methodological, and multi-level types of research design. All these research frameworks enable the researcher to organise the research systematically. Having immersed myself into all different forms of research methodologies and debated with myself as to the most appropriate fit for this research. After much deliberation between a survey design or a mixed method design, I finally decided that my study best fitted as a mixed method research this decision was also supported by Creswell and Hirose (2019) claiming that both survey methods and mixed methods research can both 'be combined in a single mixed methods study' (pg. 1). In this paper the authors also discuss how a questionnaire can be used in a mixed method study. Åkerblad *et al* (2021) and Creswell and Hirose (2019) stated that the core methodological concept in a mixed methods research is the integration of both the quantitative and qualitative elements and that endeavours to provide a more complete holistic interpretation and understanding. Sonnenberg *et al* (2017) developed a six step approach when conducting a mixed methods survey investigation (Figure 3.2). These six steps were adhered to in this research, these are discussed in the following chapters.

Figure 3.2 Steps in a mixed methods survey investigation (adapted from Sonnenberg *et al* 2017).

Step 1	Articulate the rationale for mixed methods study	Important to understand the extent of the problem of VTE assessment. Mixed method allows for holistic approach.
Step 2	Create the quantitative and qualitative databases	Rigorous procedures were used in the development of the online survey. The survey was carefully design to incorporate the collection of both quantitative and qualitative. The characteristics of the sample were reported and response rate was high for both components. Frequencies, means and SD were calculated for each item. Qualitative data analysis consisted of coding and the generation of themes.

Step 3	Identify a mixed methods design	Parallel results convergent mixed methods research design. QUAN + qual (quantitative driven). All data was analysed independently and then the results of both data sets were merged at the point of interpretation as seen in Figure 3.4.
Step 4	Analyses and report the results of the quantitative and qualitative databases	Analysis was preformed using separate software for both sets of data. Quantitative = SPSS Qualitative = NVivo The data report mirrors the design with both the quantitative results and qualitative findings analysed and reported independently. Statistical tests were performed on the Quantitative data and reported in tables in Chapter 4. While the Qualitative data was reported with themes and quotation following detailed coding process.
Step 5	Present and show integration	Chapter 6 shows Joint display of integrated data analysis for knowledge, guidelines, clinical practice, barriers and facilitators as well as new knowledge.
Step 6	Explicate the value of using mixed methods	The qualitative data added rich insight into the knowledge, education needs and prescribing authority issues.

In this research a quantitative priority parallel results convergent mixed-methods research design methodological approach was taken.

3.4.1 Convergent Design

The parallel results in convergent mixed-methods research design sometimes called the convergent design or concurrent triangulation design (Hong *et* al 2017, Creswell and Creswell 2018; Creswell and Plano Clark, 2017), is used to address an overarching research question. The purpose of the convergent design is 'to obtain different but complementary data on the same topic' (Morse 1991 pg. 122) allowing the research problem to be understood. This design is adopted when the researcher wishes to triangulate the methods by 'directly comparing and contrasting quantitative statistical results with qualitative findings' (Creswell & Plano Clark 2017 pg. 77) for a more complete understanding of a phenomenon (Figure 3.4).

The philosophical assumption behind the convergent design is the need to engage an encompassing paradigm. I decided that critical realism was the most suited paradigm to guide the quantitative and qualitative components of this study allowing the merging of results and findings and giving rise to a better understanding of the issue surrounding VTE risk assessment

in lower limb injuries. Then a pragmatistic approach will guide the problem solving and drive a change in practice.

The procedure for implementing a convergent design consists of four critical steps (Creswell & Plano Clark 2017). Firstly the quantitative and qualitative data are collected concurrently. Secondly, the analysis of 'both data sets separately and independently from each other using the typical quantitative and qualitative analytical procedures' (Creswell & Plano Clark 2017 pg. 78). The researcher in the third attempts to synthesize both sets of results by comparing and contrasting the results and themes that emerged. The final step is interpretation of the these merged results by summarising and discussing the data and how they relate to each other.

As appealing as convergent design sounds, the researcher needs to be aware of the challenges that exist with this method prior to adopting the approach in their research. One of the major challenges for any researcher to consider is, what if the quantitative and qualitative results do not agree so instead of converging, the findings actually diverge. Researchers adopting this design want their results and findings to converge enhancing the validity of their research. There is a need to keep an open mind and to except that divergence is not necessarily a bad thing. When designing their study researchers need to address the same concepts for both the quantitative and qualitative component so that when results and findings are being merged it allows for meaningful conclusions. A convergent design can also prove difficult due to problems in relation to the sample size and the sample itself as both quantitative and qualitative method need different sampling strategies to ensure an adequate sample size for in-depth analysis. The major advantage of this design is that it is an efficient design allowing both types of data to be collected at the same time within the same population and provides the researcher with the opportunity to 'give a voice' to the statistical data as comparisons and contrasts can be made (Creswell & Plano Clark 2017). The decision the researcher needs to make is when the synthesis occurs. I decided that the synthesis for this study would occur at the interpretation of the results (Hone *et al* 2017).

3.5 Research Questions

When conducting any type of research the nucleus of the study needs to answer the questions related to the phenomena being investigated (Robson 2009). Farrugia *et al* 2010 stated the 'challenge in developing an appropriate research question is in determining by which clinical uncertainties could or should be studied' (Farrugia *et al* 2010 pg. 278). The researcher's in-

depth knowledge and comprehensive review of the literature regarding a subject is key as this may generate a number of questions. At this point, it is important to establish what is already known about the subject in question or what needs further studies. The scoping review discussed in Chapter 2 highlighted the questions that emerged from the literature, the next stage was to establish the most effective method to address questions that have arisen. When the researcher generates the question of interest it is necessary to establish if one research study will answer this or if multiple studies are necessary. A poorly designed research question may affect the choice of study design. The research questions are a constructive way to find the answers to the research problem. Hulley advocated the use of the FINER criteria for developing a sound research question and therefore improving the overall research project (Hulley *et al* 2003). FINER (Feasibility, Interest, Novelty, Ethics and Relevance) criteria contains components to help the researcher to formulate a good research question (Cummings *et al* 2013) (Table 3.1).

Table 3.1 FINER Criteria (adapted from Hully *et al* 2003).

Component	Criteria	VTE Risk Research
Feasibility	Recruits target population strategically Aims an achievable sample size Opts for appropriate and affordable frame time	ANP via professional bodies. Recruitment for study voluntary Six-month data collection and write up with timeframe of clinical doctoral studies.
Interest	Presents a different perspective on the problem	VTE research to date on types of prophylaxis or post-surgical, none on ambulatory patients discharged from ED with lower limb immobilization post injury.
Novelty	Resolves a gap in the existing literature	Gap in literature regarding patients with lower limb immobilisation and their risk in developing a VTE.
Ethics	Complies with local ethical committees	Ethical committees approval granted from University of Stirling and Health Service Executive Committees in Ireland.
Relevance	Generates new knowledge Contributes to improve clinical practice	Generate new knowledge surrounding VTE risk assessment in patients with lower limb immobilization and hopefully highlight an issue that needs to improve ANP clinical practice and address the lack of guidelines and risk assessment protocols in the clinical setting.

Research questions are the cornerstone to mixed-method research as they enable the researcher to set a clear direction. Different research approaches require different types of research questions (Creswell & Plano Clark 2017). Quantitative research questions tend to take a predetermined approach for qualitative research questions tend to employ an emerging approach (Creswell 2012). In this study, the quantitative research questions were required to understand the ANP level of knowledge and current practice in relation to the management of patients in the ED setting with a lower limb injury and their potential risk of developing a VTE. The qualitative research question in this study was used to explore the factors that relate to either barriers or facilitators in the management of patients in the ED setting with a lower limb injury and their potential risk of developing a VTE. The mixed-method question was posed to support the converging of the quantitative and qualitative data arriving at more in-depth richer understanding of the problem surrounding the management of patients with lower limb immobilisation and their risk of developing a VTE (Fig 3.3).

The overall question is:

1. How do emergency advanced nurse practitioners' evaluate VTE risk in patients with lower limb injuries in their clinical practice?

Specific approach-related research questions were devised as:

Quantitative Questions;

2. What is the current knowledge that emergency advanced nurse practitioners have regarding VTE risk assessment and prophylaxis in patients with lower limb immobilisation?

3. How do emergency advanced nurse practitioners identify patients who are most at risk of developing a VTE as a result of lower limb immobilisation?

Qualitative Question;

4. What barriers or facilitators exist to prevent the risk of VTE in patients with lower limb immobilisation?

Hybrid Question (Mixed-Method);

> 5. Has the qualitative findings helped explain the results from the quantitative phase of the study?

The research hypothesis is developed from the research question at the beginning of the research process. This in turn will influence the research design, sampling strategy, data collection tool and data analysis techniques. Having established the research hypothesis it is important to develop the research objective which will define the specific aims. The research objective is an 'active statement about how the study is going to answer the specific research question' (Farrugia *et al* 2010 pg. 280). Objectives state the outcomes that will be measured and help guide the direction of the research study.

The quantitative 'null' hypothesis;

> *That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation.*

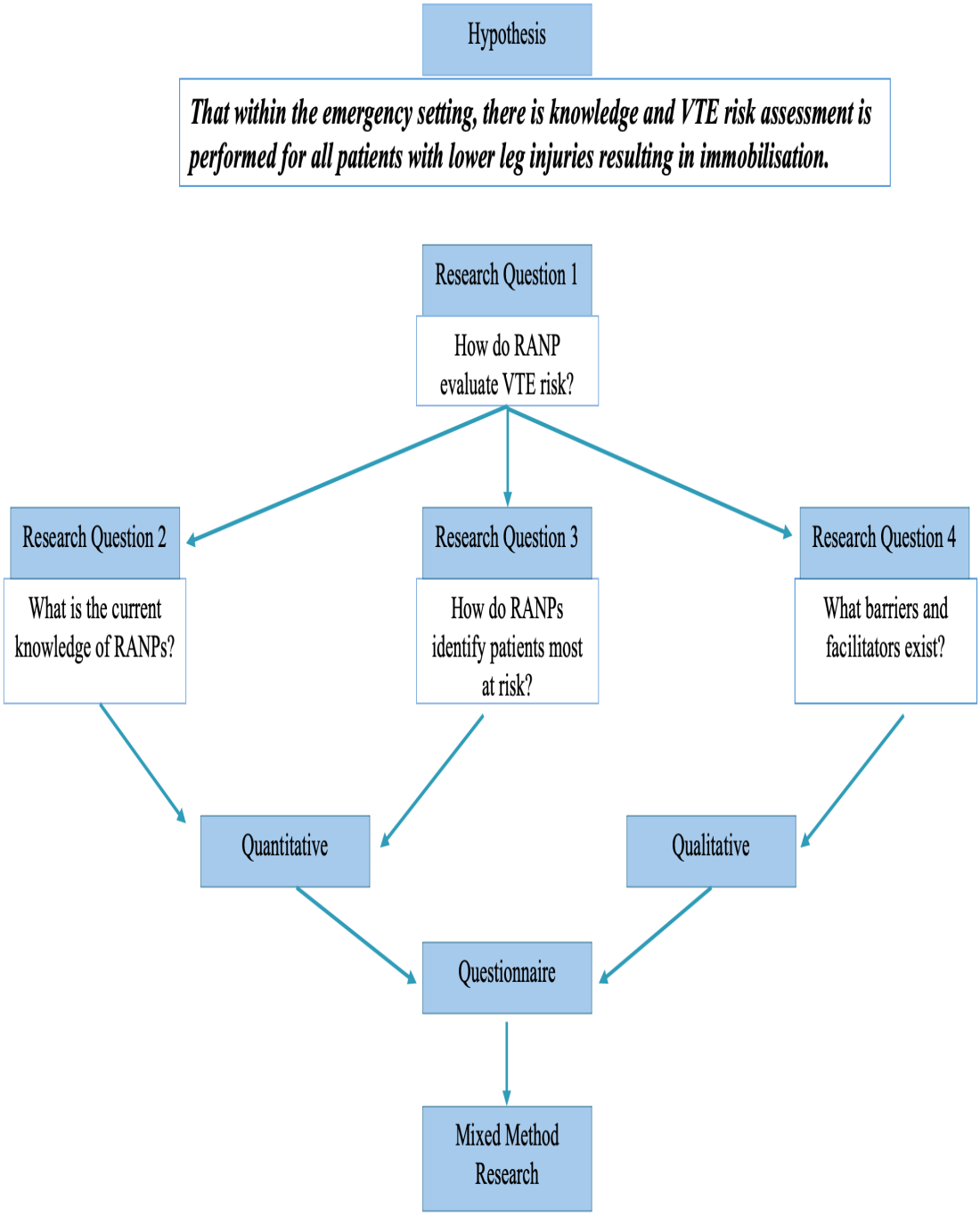
The quantitative 'alternative' hypothesis;

> *That within the emergency setting the knowledge and execution of VTE risk assessment for patients with lower leg injuries resulting in immobilisation is poor.*

The aim of this research;

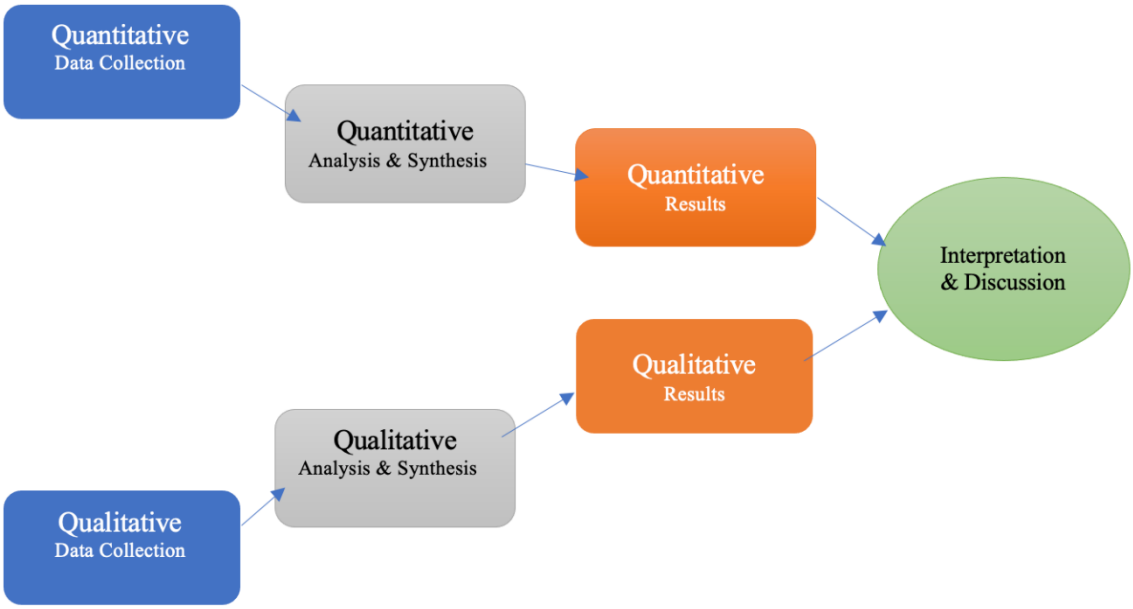
> Is to understand patient care by investigating emergency advanced nurse practitioners' knowledge and current clinical practice surrounding VTE risk assessment for patients with lower limb injuries.

Figure 3.3 Research Plan



3.6 Research Design

Figure 3.4 The Parallel Results Convergent Design (adapted from Hong *et al* 2017)



A quantitative approach was utilised in this study to collect data surrounding the current knowledge and practice of the ANP regarding VTE risk assessment in patients with lower limb immobilisation. It also began to identify barriers and facilitators that hinder or enable ANPs to preform VTE risk assessments on patients with lower limb injuries.

The qualitative approach in this study was employed to collect and understand what the ANPs perceived were barriers and facilitators to optimal emergency management towards the prevention of VTE in patients with lower limb immobilisation.

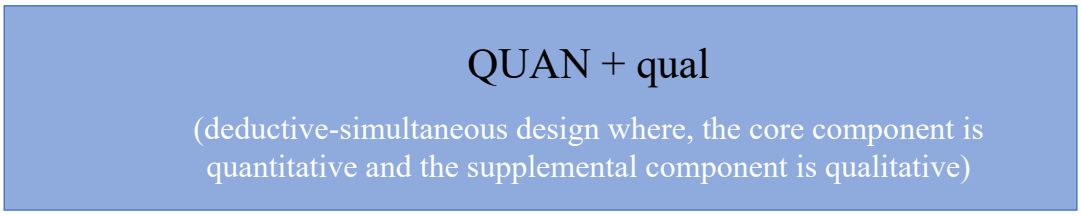
The quantitative data resulting from the deductive theory being tested was seen as having greater priority (Fig 3.5) because it measured the levels of knowledge and current practice that exists using a validated tool with the aim to generalise the findings to clinicians within the emergency settings.

The qualitative data was collected at the same time as the quantitative data but was used to assist in explaining and interpreting the quantitative results during the data analysis stage. This approach is consistent with the research questions, so the qualitative data served a secondary purpose (Plano Clark and Ivankova 2016). The combination of these results and findings

provided an opportunity to contrast and compare them, therefore forming an in-depth and better understanding of ANPs knowledge and current practice in relation to VTE risk assessment in patients with lower limb injuries.

An online questionnaire link was forwarded to all ANP emails to complete the questionnaire and comment boxes, the tool used collected both the quantitative and qualitative data in parallel. There are some controversies in the literature that claim that collecting qualitative data from a quantitative-driven questionnaire reduces the quality of qualitative data (Adu *et al* 2022). As the methods in this study occurred concurrently and the design is a parallel result convergent design, the concepts remain parallel within the same population (Figure 3.4).

Figure 3.5 Notation Diagram (adapted from Morse and Niehaus 2009 pg.25)



The parallel results convergent design in this study was quantitative driven meaning that the quantitative method had greater priority than the qualitative. All the data was analysed independently and then the results of both data sets were merged at the point of interpretation as illustrated in Figure 3.4.

3.7 Ethical Approval and Ethical Considerations

Nursing research requires honesty and integrity (Burns & Grove 2016) and must balance the desire to carry out research for the greater good with the rights of all individuals involved (Burns & Grove 2016). Ethical considerations should be viewed as an integral part that underpins every decision made about a study. As a researcher, there is an ethical responsibility to conduct the study to the highest standards. It is essential that ethical approval is granted prior to the commencement of the research (Ingham-Broomfield 2017). This section will discuss how I sought ethical approval for this study. As I was doing my research in Ireland, I had to get national ethical approval as well as the University of Stirling ethical approval. I will discuss how I addressed issues such as confidentiality, consent, autonomy, non-maleficence and beneficence and the principle of justice.

3.7.1 Ethics

Prior to the research commencing, a number of ethical considerations needed to be explored and adequately addressed. Before commencing this research, ethical approval was obtained from the University of Stirling NHS, Invasive or Clinical Research (NICR) Committee on the 11th December 2018 (Ref 18/19 paper 007) and amendment (Ref 18/19 paper 008) (Appendix 4 and 5).

As the participants for this study were ANPs working in Ireland ethics was required in Ireland as well. This was obtained from the HSE North East Research Ethics Committee (REC) on 29th March 2019 (Ref REC/19/014) (Appendix 6). Ethics committees need to satisfy themselves that the participants involved in the study will not be harmed or their position jeopardized. Risks of harm and vulnerability were minimal in this research study since it did not involve any patients or adults with incapacity as defined by the Adults with Incapacity Act (2000) (Scottish Parliament 2000) or any experimental intervention implemented. It is also important that all the participants receive fair treatment throughout the research process.

The researcher highlighted four potential ethical dilemmas that may exist in this research study: firstly the principle of full disclosure, secondly the right to fair treatment, thirdly the right to privacy, and finally informed consent. The researcher dealt with each of these prior to submission into NICR and REC and ethical approval was obtained. All ANPs were informed about the measurement procedures involved in this study and relevant additional information, was attached including participant information sheets and consent forms (full disclosure). The information sheet the participants were provided with had both the researchers' and dean of faculty's contact details so if they had any issues or questions relating to the research, they could contact either myself or the dean of faculty at the University of Stirling prior to completing the questionnaire (full disclosure) (Appendix 7).

3.7.2 Confidentiality

Confidentiality and anonymity were integral considerations throughout the research process in line with the eight Caldicott Principles (NDG 2020). The Data Protection Act as well as the General Data Protection Regulation (GDPR) in both the UK and Ireland were also adhered to with regard to confidentiality of the data emerging from the questionnaires (EUGDPR 2018). All participants commencing the study, were informed by a detailed information sheet (Appendix 7), highlighting that their replies in the questionnaires were anonymous and confidential.

No identifying data which would allow for the identification of individuals or clinical settings were collected ensuring anonymity. More importantly, no individual identifying information was entered onto computer files or identification numbers used (right to privacy). Participants were advised not to mention or include anything that may identify them or their clinical setting on the questionnaire. All computer datasets including SPSS and NVivo are password protected and only known to the researcher (right to privacy). Data were and will only be used for the purposes disclosed. The researchers did not have access to any of the potential participants' email addresses, all emails to the potential participants came from their professional bodies (right to privacy).

3.7.3 Consent

The Royal College of Nursing (RCN) states that informed consent is "the process of agreeing to take part in a study based on access to all relevant and easily digestible information about what participation means, in particular, in terms of harms and benefits" (RCN, 2011, pg.3). Consent should be viewed as an ongoing process, and not a single act at one point in time. ANPs were informed about the nature of the research being studied and that they are entitled to not participate in the study if they so choose (informed consent). Respondents were unable to access the survey until they indicated informed consent by ticking the consent box after reading the information sheet (Appendix 7). Participants were informed that all completed questionnaires implied data consent.

3.7.4 Autonomy, Non-Maleficence and Beneficence

Autonomy, refers to the individual having the freedom to make his or her own decisions. In order to protect the individual's autonomy during this research, the participants were free to make their own informed decisions regarding participation. All participants in the study were given clear and concise information relating to the purpose of this research. The ANPs were assured that they did not need to complete the survey if they did not wish to and that refusal to participate in the study would in no way impact on their professional integrity (the right to fair treatment).

Non-maleficence and beneficence are two of the most fundamental principles that underpin clinical practice and clinical research. Non-maleficence means to do no harm and beneficence means to do good (Curtis & Drennan 2013). The ultimate goal of this research, is to benefit ANPs clinical practice within the ED setting and in turn benefit the patient who presents with

a lower limb injury. It was my aim to ensure that no harm would occur to any ANP taking part in this study, furthermore involvement in this study would not place anybody at a disadvantage. The ANPs, involved in this research should have gained insight into their own clinical practice and increase their knowledge surrounding this cohort of patients.

The potential dilemma of respondent burden was also considered (the right to fair treatment). Lavrakas (2008) stated that the psychological stress of invasive questions can contribute to respondent burden in survey research. Therefore, I needed to consider this prior to administering a survey instrument, as too great an average burden will yield lower-quality data and is therefore counterproductive (Lavrakas 2008, pg.). To address the respondent burden in this research each concept and individual component of the survey has been considered to optimize survey length and quality of the information gathered (Appendix 7). If the respondents found the completion of the survey to be challenging they did not need to continue completing the survey as they could withdraw at any stage (the right to fair treatment).

3.7.5 Justice

The principle of justice includes the participant's right to fair treatment and their right to privacy (Polit & Beck 2020). As this research invited ANPs working in an ED setting to volunteer in the completion of the questionnaires, there were no vulnerable group involved in this research. However, if the participant did require any special considerations they could have contacted the researcher or the faculty dean at the University of Stirling prior to completing the questionnaire and they would have ensured that specific mechanisms were put in place to allow them to complete the survey. While risk is present in all research (Polit & Beck 2020), the risk to participants was minimal in this research. The researcher was sensitive and respectful to all participants that choose to take part. Reassurance was given to the participants that any answer that they gave was confidential and would not be reported to their employer. At the end of the data collection the participants were given a debriefing information sheet if any further issues arose (Appendix 8) they were also provided with the opportunity to print out their responses to the survey questions. The participants were also provided with a certificate of completion that they could include in the future in their continuing professional portfolio (Appendix 9).

The researcher ensured adherence was complied with throughout the research as per the University of Stirling, the HSE Research Ethics, An Bord Altranais agus Cnáimhseachais na hÉireann 2007 as well as the adhering at all times to the Code of Professional Conduct and Ethics (NMBI 2014).

3.8 Participants

Collins, Onwuegbuzie, and Jiao (2007) describe sample selection as a fundamental stage in mixed-method research. The sample selected needs to be representative and generalised beyond the current mixed-method study (O'Dwyer and Bernauer, 2014, Sharp *et al* 2012). Creswell and Plano Clark (2017) describe purposeful sampling as intentionally recruiting participants who have experience in relation to the concept being studied. For this study, a purposive sampling strategy was employed to recruit ANPs working in ED setting as they are the clinicians managing patients with lower limb injuries. Non-probability is described as selecting individuals who are available (Creswell & Plano Clark 2017).

The sample population was drawn from a sampling frame which contained the information related to the population of interest. The sampling frame for this study was all ANPs who worked in emergency departments and local injury units within the Health Service Executive (HSE) and were members of the Irish Association of Advanced Nurse and Midwife Practitioners (IAANMP) and/or Emergency Medicine Programme (EMP) and/or Irish Association of Emergency Medicine (IAEM) databases of registered ANPs at the time of the study. A non-probability approach was also adopted in this study based on these databases, to secure a sample of ANPs in Ireland who were registered with the NMBI and would be available to answer the research questions within this study (Bryman 2015).

3.8.1 Sample Size

The total population for this study was all Registered Advanced Nurse Practitioners (ANPs) who were working within either emergency departments (ED) and/or local injury units (LIU) at the time of the study. All ANPs working in the emergency setting are registered with Bord Altranais agus Cnáimhseachais na hÉireann (Nursing & Midwifery Bord of Ireland (NMBI)), I contacted the NMBI to establish the number of ANPs working in Ireland in the ED setting, according to their register there were 85 ANP (Appendix 1). Ensuring an adequate sample size supporting the quality standards of a mixed-method study is vital (Andrews and Halcomb 2009, Halcomb and Andrew 2007). As this research study is quantitatively driven, it was decided to include the total population rather than a subset within the population.

3.8.2 Eligibility Criteria

Inclusion criteria, were ANPs registered on the NMBI Advanced Practice Register and currently employed as an ANP in emergency departments or local injury units within the Health Service Executive sector. The ANP also needed to manage and autonomously treat patients who present with lower limb injuries that require lower limb immobilisations. Potential participants were required to confirm the criteria to ensure they were emergency ANPs during the consent phase of the online survey.

Not included were advanced midwife practitioners, candidate advanced nurse practitioners and registered advanced nurse practitioners who do not work in the ED setting.

Verifying the participants' identify was impossible as the survey was self-administered online (Teitcher *et al* 2015). The invitation to participate was forwarded by email to ANPs by the IAANMP and IAEM who all hold databases of ANPs, therefore allowing a level of certainty around the invited sample. Participants were also asked before completing the survey to verify that they met the inclusion criteria. Once eligibility was confirmed, informed consent was obtained online before the respondents were granted access to the survey.

3.8.3 Process of Recruitment

I had planned to capture the ANPs working in Irish ED settings who autonomously manage patients presenting with lower limb injuries requiring immobilisation. There were 85 registered advanced nurse practitioners in Ireland at the time of the study (Appendix 1). As it was advantageous to study the entire Irish population of ANPs, all 85 ANPs were recruited.

To recruit respondents, three professional organisations were approached as each hold the email addresses of the emergency ANP. The researcher contacted the chairpersons of the Irish Association of Emergency Medicine (IAEM), The Irish Association of Advanced Nurse and Midwife Practitioners (IAANMP) and the Advanced Nurse Practitioner Advisor to the Emergency Medicine Programme (EMP), explaining the research and seeking their support in this study (Appendix 10 and Appendix 11). The IAANMP is the main association of ANP within Ireland and therefore their support as gatekeeper was influential but not coercive in relation to recruitment. This association was developed to support and develop the role of advanced nursing practice within Ireland. Using these three organisations was an attempt to reach as many of the ANPs working in the ED setting at the time of dissemination. The Twitter forums @EMP, @IAANMP and @IAEM also published the online survey link.

An invitational email was sent to ANPs (1st May 2019) via the three organisations (IAANMP, IAEM and the EMP) after the NICR and REC ethics approval was granted. While there is a possibility that a number of the potential participants existed on the email lists of the three professional organisations and therefore may have been contacted numerous times, this issue was addressed in the introductory email where the respondents were asked to only respond once. The invitation email, clearly stated that the email was sent on behalf of the researcher, and included the purpose of the study and a link to the online survey.

The response rate goal of the researcher should be approximately 60% (Fincham 2008, pg.43) In the literature researchers have stated that census sampling should optimise a higher response rate than probability sampling. No evidence has confirmed that a response rate of 80% or higher is the optimal response rate (Hendra & Hill 2019, Wu *et al* 2022*).* The goal of this study was to have a response rate of at least 51 participants. With this in mind, I adopted the Tailored Design Method (TDM) internet survey implementation method suggested by Dillman *et al* (2014) to ensure all participants respond within resource and time constraints. The underlying principles established by Dillman originally in 1974 have been adapted in line with modern technological advances. Dillman *et al* (2014) recommend that when the researcher is conducting a survey they need to consider three fundamental principles to ensure a positive response rate. Firstly, the survey needs to be scientific to reduce the risk of survey error and non-response and to ensure quality of the information collected. Secondly, developing a set of survey procedures using different forms of communication to encourage all participants to respond to the survey. Finally, build a positive social exchange and encourage response by taking into consideration elements such as survey sponsorship (Dillman *et al* 2014). Each step of the dissemination of the survey was guided by Dillman *et al* (2014) TDM, from the three professional bodies adopting survey sponsorship to the questionnaire link sent via email and the Twitter pages (Dillman *et al* 2014, pg.16). According to Dillman *et al (*2014) four mailings helps reduce non-response when administering internet surveys. This was demonstrated by Dillman and colleagues in three separate studies where they achieved a 70% response rate (Smyth *et al* 2010, Messer & Dillman 2011, Edwards *et al* 2013). Therefore, I ensured that reminder emails were sent out to the ANPs via the three professional bodies on a monthly basis over the four months from 1st May 2019 to 1st September 2019. I did not personally send any reminder emails to the ANPs to ensure that the participants did not feel pressured or to risk bias. Bromley *et al* (2015) claim that an aspect of recruiting participants is to ensure that they enter the study of their own volition.

However, I did send a reminder email to the three professional bodies six weeks following the initial distribution (18th June 2019). A follow-up thank you and a final reminder were sent 17 weeks after the first distribution (28th August 2019). The survey was available to potential respondents for the remaining five days following the final reminder as the survey closed on 1st September 2019). I was dependent on the professional organisation to send out the reminders and had to adhere to when they sent out these emails.

3.9 Data Collection

The ANP were able to access the survey link at a time that suited them. Putting the link on Twitter enabled them to access it on their phone if they did not have access to the email provided to the professional organisation. The utilisation of JISC™ online survey software was used to ensure anonymity and collect the data. This was available via software licence issued from the University of Stirling. Upon accessing the survey link, the ANPs were directed to the study information page and were requested to give consent to participate by ticking 'yes' to all six consent question (Appendix 7 and Appendix 8). When the potential respondents gave their consent they gained access to the survey. If they did not indicate consent (chose "No"), they were thanked for their time and contribution but the survey then exited. The survey took approximately 10 minutes to complete which is in line with the maximum web-based survey length recommended (Revilla & Ochoa 2017). The respondents were informed in the information sheet that they could only complete the survey in one sitting otherwise if they exited they had to start at the start again. This prevented the participants from referring to evidence-based literature regarding the topic and therefore an untrue representation of the current knowledge and practice that exists. They had the option to discontinue at any time and subsequently, their responses would not be saved. Incomplete surveys were not available to me. Respondents needed to 'submit' the survey on the final page for the data to be available to the researcher. No personal identifying information on respondents was collected, thereby ensuring the anonymity of the respondents.

Data collection took place from 1st May 2019 to 1st September 2019 in one phase as per the parallel results convergent design method. Descriptive studies have an important role in nursing research and have greatly increased our knowledge about what happens in the clinical environment. Descriptive designs identify challenges that actually exist, in which there is little or no previous research completed (Sax *et al*. 2003).

3.9.1 Response Rate

The exact response rate is based on the presumption that all ANP on the NMBI advanced practice register emergency path at the time of dissemination were on the emailing list of one or all of the three professional bodies. The NMBI confirmed with the researcher that there were 85 ANP (Emergency) registered at the time of the survey being disseminated (Appendix 1). Fincham states, that the response rate goal of the researcher should be approximately 60% (Fincham 2008, pg.1). Using SPSS to determine the sample size for this study the power value was set at 95% statistically significant effect, the practical significance is indicated in a medium effect (d=0.5) as per Cohen (1988) and the p-value was set at 0.5% meaning that there is a 5% probability that the null hypothesis will be rejected.

Table 3.2: Power Analysis Table

		Actual Power[b]	**Test Assumptions**			
	N		**Power**	**Null**	**Alternative**	**Sig.**
Pearson Correlation[a]	46	.954	.95	0	.5	.05
a Two-sided test. b Based on Fisher's z-transformation and normal approximation with bias adjustment						

Therefore, for this study based on the power analysis calculation of N=46 and Fincham (2008) recommendation of 60% of the total population N=51, I decided to aim for a response rate of at least 51 participants.

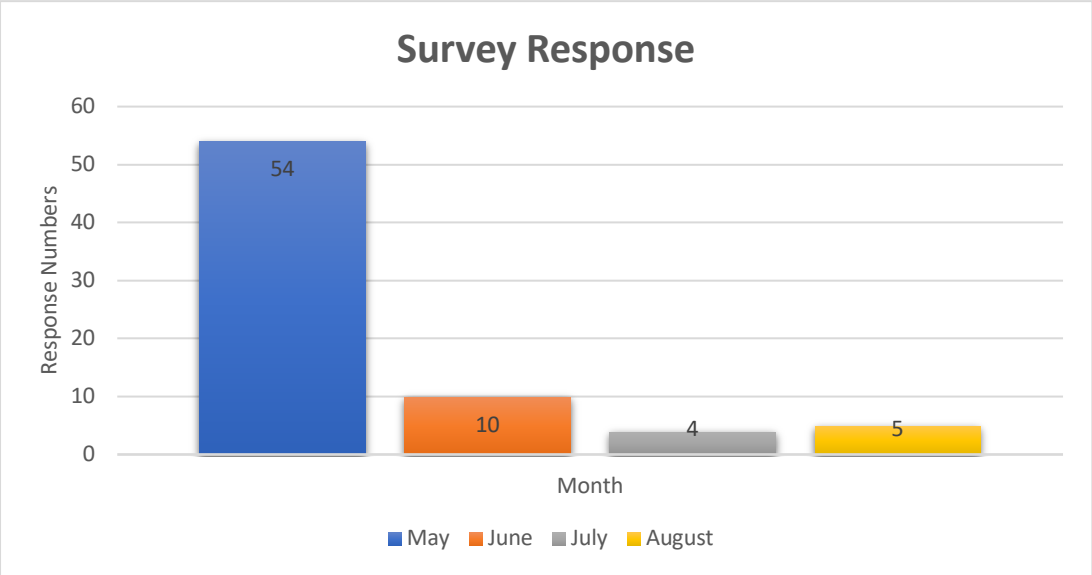
3.9.2 Overcoming Poor Response

The study was dependent on a good response rate. If the response was low it could have a significant impact on the usefulness of the findings. The lower the response rate, then the less representative the achieved sample is likely to be of the target population (Parahoo 2006). Wu *et al* (2022) documented that the response rate for online surveys is 44.1% (pg. 1). Particular times of the year are also known for poor response rate during data collection. Tracey and Hyde (1999), state that Christmas and Summer periods are particularly unsuitable, however as this study was running over a period of four months and ED settings are slightly quieter in summer than during winter it was deemed that May to September would be suitable for data collection and would overcome the risk of a poor response.

3.9.3 Rate of Survey Response

The population for this survey was 85 registered advanced nurse practitioners (ANP) in the Republic of Ireland. The survey was sent to the professional bodies on 24th April 2019 one week before the study commenced. The three professional bodies emailed the questionnaire to the ANPs on the 1st May 2019. Within the first month 54 participants completed the questionnaire. A reminder email was sent six weeks (18th June 2019) after the initial email reminding the ANPs to complete the online questionnaire. During the month of June 10 participants completed the questionnaire. A further four ANPs completed the questionnaire during the month of July after another reminder email on the 4th July 2019. A final reminder and thank you email was sent by the professional bodies on 28th August 2019 where a further five participants completed the questionnaire before the survey closed on the 1st of September 2019. Over the four months of data collection there was a total of 73 ANP participated in the survey (Figure 3.6)

Figure 3.6 Monthly Survey Response



3.9.4 Measurement

It has been noted in the literature that without an accurate and precise measurement the researcher cannot have a true understanding of the subject they wish to study (Strickland 1993). Questionnaires are by far the most common method of data collection within health research (Parahoo 2014). Burford *et al*. (2009) stated that a questionnaire allows for responsive changes in the healthcare environment by providing a snapshot of opinions over a short period.

Questionnaires can contribute to the production of knowledge and information, on which concepts and hypotheses, can be formulated (Parahoo 2014). A survey approach was adopted in this study due to its usefulness for testing links between variables of interest (Mc Laren 2013). Using a survey questionnaire is seen as an economical way to collect volumes of information from a larger sample over a wider geographical area, it can be self-administered (completed by the respondents) and therefore the researcher does not need to be in attendance, the dissemination is frequently inexpensive, and surveys facilitate confidentiality and anonymity (Bryman 2012, Jones *et al* 2013, Murdoch *et al* 2014). As all the questions on the survey are predetermined this allows for the responses from each participant to be comparable due to the standardised format (Hedges 2015). Sutton (2004) also highlights that the use of open-ended questions on the survey questionnaire provides comparability, allowing the researcher to collate the qualitative information easier. The qualitative component allows for a further in-depth understanding (Dworkin 2012). The aim of this research, is to discover new facts by questioning the ANPs' viewpoint of their natural surroundings and practice (Silverman 2017). Qualitative open-ended questions will allow the researcher to understand and explore the world from the ANPs' experiences and points of view (Kvale 1999). I was confident that the most appropriate fit for this study is the use of a "simultaneous design where quantitative and qualitative data are merged together in a complementary fashion" (Palinkas *et al.* 2016. Pg.6).

True representation of the population is important when it comes to the completion of survey questionnaires, I was confident that with the dissemination from the three professional bodies and the information and questions at the start of the online survey that only ANP working in the emergency setting would partake (Cowles & Nelson 2015). As survey design attempts to describe and explore human behaviour, I was satisfied that this method of data collection was appropriate for this study (Ponto 2015).

The VTE risk assessment in the lower limb injuries questionnaire (VTE ralli questionnaire) used a self-administered questionnaire and is based on the combination of three previously validated questionnaires (see 3.9.5) used in previous studies looking at VTE in different clinical settings as well as the risk assessment criteria as highlighted in the Plymouth Risk Assessment Form. The three questionnaires are mentioned in the following paragraph. Streiner *et al* (2015) discuss the benefits of using instruments designed and tested by other researchers.

1. The UCIMC Nurse Survey on Venous Thromboembolism (VTE) Risk Assessment and Prevention was used by Dr Lee and her colleagues to look at risk assessment factors and knowledge of clinical ward-based nurses (Lee *et al* 2014).
2. Dr Keiffer developed a questionnaire investigating the clinical practice guidelines on VTE (Keiffer 2015).
3. Dr Wallace and his team developed a questionnaire to survey the Self-reported management of Venous Thromboembolism by physicians in their clinical practice (Wallace *et al* 2017).

The VTE ralli Questionnaire, in principle, followed a similar format and design to these three questionnaires however this study combined elements together from all three to give an overall holistic instrument. I engaged in careful consideration when adapting the components of the above questionnaires as validity and reliability of the VTE ralli questionnaire was paramount (Boynton and Greenhalgh 2004). Permission was sought and granted from Dr Jung-Ah Lee, Dr Melanie Keiffer and Dr Rory Wallace for the use of their questionnaires in this study and the advice that they imparted was extremely beneficial to the development of the questionnaire in this study (Appendix 12).

In the VTE ralli questionnaire developed for this study the researcher developed demographic questions. The participants were asked to complete demographic details at the start of the questionnaire as a gentle introduction. The demographic variables collected, serve to describe and provide a picture of the population sample (Burns and Grove 2016). The participants were asked to complete questions regarding their age, gender, qualifications, length of experience as an ANP (Alan *et al* 2019, Rosing & Jungmann 2015, Curtis *et al* 2011). No personal identifiers were included in the questionnaire (Appendix 13).

3.9.5 Psychometrically Tested Instruments (Three Questionnaires)

1. Evaluation of hospital nurses' perceived knowledge and practices of venous thromboembolism assessment and prevention – Lee *et al* 2014

   The *UCIMC Nurse Survey on Venous Thromboembolism (VTE) Risk Assessment and Prevention* survey questions were developed by experts in VTE research and instrument development, including two nurse researchers. The committee consisted of anticoagulation specialized pharmacists, dieticians, clinical nurse educators, nurse case managers, patient education specialized staff, and nursing faculty in an academic

hospital, reviewed the survey for completeness and clarity of the questionnaire and data collection procedures for feasibility. The Cronbach Alpha for the self-efficacy portion (which was the section used for the VTE ralli questionnaire) of the survey was 0.84, indicating very good reliability (see 3.11.1.1).

2. Utilisation of Clinical Practice Guidelines: Barriers and Facilitators - Keiffer, 2015
   The *Clinical practice guidelines on VTE survey* tool was designed with statements and open-ended questions to assess mechanisms that influence the use of clinical practice guidelines. This tool assessed a variety of barriers relating to knowledge, attitudes and behaviours of practitioners toward clinical practice guidelines. Face validity and a pilot survey evaluated the tool and pilot survey (see 3.11.2.1).

3. Venous thromboembolism management practices and knowledge of guidelines: a survey of Australian haematologists and respiratory physicians – Wallace *et al* 2017
   The *Self-reported management of venous thromboembolism by physicians in Australia: A survey of current practice* survey was developed by Dr Rory Wallace and his team it concentrated on knowledge and guidelines as well as assessment and risk of pulmonary embolism (PE). The survey was reviewed by 10 physicians (respiratory physicians, general physicians and haematologists) at the Royal Melbourne Hospital and Peter McCullum Cancer Centre who provided face validity on question content and survey design.

3.9.6 Development of VTE ralli Questionnaire

ANPs are in a prime position to lead clinical practice initiatives. As lower limb injury management comes under the remit of the ANP and VTE management in lower limb injuries within the ED setting has not been investigated prior to this study the researcher had to develop a questionnaire that would answer all the questions. The previously mentioned psychometrically tested instruments formed the basis of the questionnaire along with clinically recognised risk assessment guidelines.

The researcher aimed to design a robust questionnaire covering all aspects. The technology used in this study was the JISC™ online survey and emailed to the ANP in ED settings via the three professional organisations. JISC™ online survey is a secure, web-based software tool provided reporting and data manipulation, functionality and data export to Excel™. Anonymity

was insured through the JISC™ online survey secure database by de-identification of respondents. The front page of the JISC™ consisted of the University of Stirling logo to ensure it looked official. The introductory page consisted of the explanation of the purpose of the questionnaire and the participant information sheet and consent questions. For some questionnaire items, participants were asked to rate their agreement or disagreement regarding certain statements using a four-point Likert scale ranging from "strongly agree to strongly disagree" and "serious concern to no concern' this was used to extract a positive or negative response, eliminating the neutral response elicited a more discriminating (Jamieson, 2023) and thoughtful response (Schwartz, 2023). It was the researcher's intention to eliminate any neutral response and to encourage the participant to deliver a more thoughtful response. The scales consisted of 1= strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree and 1= strongly concerned, 2 = moderate concern, 3 = mild concern and 4 = no concern. The survey was purposeful in design and included both positive and negative wording encouraging participants to carefully read all the questions. The rest of the questions, within the questionnaire consisted of a tick-the-box system where they had numerous options to choose the most applicable.

The questionnaire was divided into five main sections and designed as follows. Part one was developed with eight demographic question to establish an overall picture of the participants. Part two consisted of seven knowledge-based questions to establish if participants had attended previous courses and their level of knowledge relating to the subject being researched. Part three investigated the clinical guidelines that exist in the participants' organisation and the risk assessment forms that are used for this cohort of patients. Part four reviewed the ANP current clinical practice in relation to VTE risk assessment for patients attending the ED setting with lower limb injury and if they prescribe prophylaxis or not to patients at risk. Finally, part five looked at what barriers and facilitators exist that enable or hinder the ANP to do risk assessment or utilisation to guidelines for patients with lower limb injuries that result in immobilisation within the ED setting.

Demographic

This section was initiated to enable the researcher to collate demographic information about the participants. This consisted of eight questions surrounding the participants' gender, age, current position, experience and qualification. The speciality question was ensuring that they were all emergency-based ANPs. Hospital settings and patient presentation numbers, this was to ensure that the sample population included all aspect of emergency settings from the local injury units to rural and urban emergency departments.

Knowledge

This section contained seven questions which three of these questions stemmed from the UCIMC Nurse Survey on Venous Thromboembolism (VTE) Risk Assessment and Prevention survey by Lee *et al* 2014, and the remainder included the potential risk assessment criteria as the document on the Plymouth Risk Assessment Guidelines (Keenan et al 2021). My study expert panel consisting of 14 members reviewed this section and a consensus was agreed that the statements all firmly related to the concepts they were measuring, no further alterations were made (see 3.11.2.1). All statements were fully completed due to the fact that the participant could not move onto the next section until all questions were answered.

Clinical Guidelines

This section contained six questions, these questions were built from principles in the Clinical practice guidelines on VTE survey by Dr Keiffer 2015 but related to European and UK-based guidelines rather than American guidelines as appeared in her study. The same applied for the risk assessment forms that were both European and UK-based rather than American-related guidelines. My studies expert panel again reviewed this section and a consensus was agreed that the statements firmly related to the concepts they were measuring, no further alterations were made. All statements were fully completed since the participant could not move onto the next section until all questions were answered.

Clinical Practice

This section contained six questions, these questions were built from principles in the *Self-reported management of venous thromboembolism by physicians in Australia: A survey of current practice* survey which was developed by Dr Wallace and his team however the majority of the questions were looking at pulmonary embolism as opposed to VTE and was focused on physicians practice within Australian healthcare. My studies expert panel again reviewed this section and a consensus was agreed that the statements firmly related to the concepts they were measuring, no further alterations were made.

Barriers and Facilitators

This section of the questionnaire consisted of ten questions which were built from the researcher's knowledge having completed a detailed scoping review as documented in Chapter 2. The participants were asked if barriers existed in their clinical site and if so to specify them.

They were also asked if there were procedures in place that help deliver the appropriate care in relation to VTE risk assessment to patients with lower limb immobilisation. The expert panel again reviewed this section and a consensus was reached that the statements related to the concepts they were measuring, no further alterations were made. All statements were fully completed because the participant could not move onto the next section until all questions were answered.

Oppenheim (1992) postulates that having open-ended questions in a survey allows participants a degree of freedom to express their comments adding to further knowledge and understand relating to the subject being studied. Four open-ended questions and eight open comment sections relating to the five headings above were developed by the researcher and shared with the panel of 14 experts to ensure there was no ambiguity or possible bias. After a detailed discussion, a consensus was agreed that the questions were added to the survey by allowing the combination of both the quantitative and qualitative data and adhering to parallel results convergent design as set out by the researcher. It was important for the researcher to keep foremost in mind that a mixed-method approach is described as 'multiple ways of seeing and hearing' (Greene 2007, p 20).

Final page

The final page was designed as a thank you for participating in the study and consisted of a certificate that the participant could print off or download and submit into their professional portfolio for future reference (Appendix 9).

3.10 Pilot

The rationale for conducting a pilot study is variable in the literature (Curtis & Drennan 2013) and there is an assumption that researchers who conduct a pilot study are more prepared for the challenges of the main study (Malmqvist *et al* 2019). Pilot work identifies indecipherable questions that result in unquantifiable responses (Oppenheim 1992) and tests if the data collection tool is user-friendly and answers the questions that the researcher is expecting (Bryman 2012). The VTE ralli questionnaire was not formally piloted in this study as the researcher did not want to exclude any ANPs from the main study and it was felt that the pilot would take away from the main study. Instead myself and two nurse practitioners from the USA completed the questionnaire to assess if the tool was practical and readable and that the

JISC™ software was useable. I decided that a panel of experts to test the validity would be more beneficial for this study than a formal pilot study.

3.11 Reliability & Validity of the Questionnaire

3.11.1 Reliability

Reliability testing is seen as a measure of the amount of random error in the measurement technique as well as the consistency between an instrument and the measures it produces (Burns and Grove 2005, Krabbe 2017). The reliability of the instrument tool is the degree of consistency, therefore a reliable instrument tool will yield the same results when repeated (Polit & Hungler 2013). The concept of reliability is also important in interpreting the results of statistical analyses. Statistical reliability refers to the probability that the same results would be obtained with a completely new sample of participants, therefore meaning a reliable instrument will yield the same results when repeated (Polit & Beck 2020). There are three main types of reliability (Mokkink *et al*. 2010; Polit and Yang 2016), stability, internal consistency and equivalence. However, the most widely used reliability tool is the testing of internal consistency. In this study, the Cronbach coefficient alpha was used to test the reliability by examining internal consistency of the sections throughout the questionnaire. Cronbach's alpha is measured between 0 and 1, with 1 showing perfect internal consistency (Christmann & Van Aelst 2006). When it comes to reliability in qualitative research this can pose a challenge, as peoples' opinions are not consistent and can change over time. The qualitative data was transcribed verbatim and analysed by the researcher where then a detailed thematic analysis was performed giving rise to codes and themes that had emerged from the open questions.

3.11.1.1 Internal Consistency

For the tool to be seen as consistent, the internal reliability needed to be tested. This was achieved by calculating Cronbach's alpha coefficients for each of the sections within the questionnaire. Cronbach's alpha is measured between 0 and 1, with 1 showing perfect internal consistency (Field 2018). Evaluation of the internal consistency of the sub-scales for the patient needs questionnaire was carried out by calculating the Cronbach Alpha coefficient. This coefficient ranges from 0 - 1. Cronbach's alpha coefficients > 0.7 represented acceptable reliability (Jones *et al* 2004). Large Cronbach Alpha values indicate a high consistency of the questions of which the sub-scale consists. The 'Cronbach Alpha if item deleted' index was used to identify the questions that reduced the internal consistency of the questionnaire

however none of the questions needed to be excluded. The repeatability of the questionnaire was evaluated also by using the Intraclass correlation coefficient (ICC), which takes values between -1 and +1. Values proximate to +1 show a high repeatability of the questionnaire. The results are shown as ICC (95% confidence interval) (Polikandrioti *et al* 2011). The overall Cronbach's alpha score for the questionnaire was 0.830 (Table 3.3).

Table 3.3 Questionnaire Cronbach's Alpha Coefficient

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.830	.907	86

Cronbach coefficient alpha formula $\alpha = \left(\frac{k}{k-1}\right)\left(1-\sum\frac{s_i^2}{s_t^2}\right)$

The alpha coefficients for the knowledge, clinical practice and barriers and facilitators scales are as follows 0.931, 0.853 and 0.806 respectively (Table 3.4)

Table 3.4 Mean, Standard Deviation and Cronbach Alpha of Questionnaire

Cronbach's alpha Coefficient	Mean	(SD)	Dimension
Knowledge	138.19	(16.361)	0.931
Clinical Practice	44.97	(13.212)	0.853
Barriers & Facilitators	21.55	(3.6)	0.806

The repeatability of this questionnaire was important to evaluate. As previously mentioned this is done by using the Intraclass correlation coefficient (ICC), which takes values between -1 and +1. As seen in Table 3.5 the lower is 0.768 and upper is 0.882 giving this questionnaire a high repeatability score.

Table 3.5 Intraclass Correlation Coefficient (ICC Calculation in SPSS Using Single-Rating, Absolute-Agreement, 2-Way Random-Effects Model)

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.054[a]	.037	.080	5.865	69	5865	.000
Average Measures	.830[c]	.768	.882	5.865	69	5865	.000

ICC estimates and their 95% confident intervals were calculated using SPSS statistical package version 26 (IBM 2019) based on a mean-rating (k = 3), absolute-agreement, 2-way mixed-effects model (Koo & Li 2016).

3.*11.2 Validity*

Validity refers to whether a measurement instrument accurately measures what it is supposed to measure (Frost *et al.* 2008, Burford *et al* 2009). This is the second aspect of measurement that must be considered when deciding on using a questionnaire for research in clinical practice. An instrument can be reliable but not valid. There are a number of validation processes that the researcher can employ in their research, the most common of which are translational, criterion and construct (Polit and Yang 2016, Curtis & Drennan 2013). In this section, I will discuss the different forms of validity and how they were utilised in this study.

Translational validity deals with the operationalization of the instrument being measured and it covers three methods, face validity, content validity and factorial validity (DeVon *et al* 2007). There are mixed opinions in the literature regarding face validity and if it is a true value of validity. Curtis and Drennan (2013) note that face validity is basically commenting on the instrument in terms of does it make sense and can it be understood by potential participants. However Curtis and Drennan (2013) claim that content validity 'is certainly a measure of validity in the true sense, and in some respects the most important aspects of validity' (pg. 324).

Content validity is an assessment of an instrument of how logically and comprehensively it measures what it is intended to measure (Holli *et al.* 2007). Content validation is a fundamental step in developing new, high-quality instruments and the relevance to the concept it intends to measure (Rothman *et al* 2009). This entails the evaluation of a predesigned questionnaire by a panel of experts (both lay and professional) on the content of interest. The items are then judged by professionals who have expertise in the field being researched for their relevance and clarity

in representing the underlying concept (Burford *et al* 2009, Waltz *et al* 2016). The researcher gets the expert to rate the important items on the questionnaire, therefore allowing the researcher an insight into the relevance of each item. The proportion of the agreement between the experts can be expressed as the content validity index (CVI). A CVI = 0.9 indicates good agreement between the experts (Polit & Beck 2020).

Factorial validity is sometimes referred to as 'structural validity' and is related to the relationship between the items within the questionnaire (Watson & Thompson 2006). However, the basic requirement is that you have more respondents than items and ratios of 1:10 are considered best (Kline 1994). Curtis and Drennan 2013 claim that 'factor analysis is very complex and it is not to be undertaken lightly' (Curtis and Drennan 2013 pg. 325).

Criterion validation involves determining the relationship between an instrument and some criterion or 'gold standard' (DeVellis 2012).

Construct validation is concerned with the theoretical underpinnings of the construct and seeks to determine the extent to which instrument measures the concept (Curtis & Drennan 2013). This questionnaire provided a valid assessment of opinions and experience of ANP who manage patients attending the emergency setting with lower limb injuries that requires immobilisation and their risk for VTE so having reviewed all the types of validity in the literature it was decided that face validity and more importantly content validity would be utilised for this study.

3.11.2.1 Face Validity

As mentioned earlier face validity asks if the instrument looks as if it makes sense and if will it be clearly understood by participants (Curtis and Drennan 2013 pg. 324). In this research, the face validity and the content validity were preformed conjointly and will be discussed simultaneously with content validity.

3.11.2.1 Content Validity

Content validity is regarded as a true measurement of validity and is seen as covering the most important aspects of validity (Curtis and Drennan 2013). Yusoff (2019) states that content validity is vital to ensure the overall validity of the questionnaire and that it needs to be performed systematically. For this reason, the researcher regarded content validity as a better

fit for this study. As the study was reviewing treating clinicians (ANP) and their management of patients who are at risk of developing a VTE as a result of lower limb immobilisation in the ED setting it was decided to form an expert panel who are also in the ED setting and treat this cohort of patients but who will not be included in the study. As there were only 85 ANP in the ED setting it was decided not to diminish this number further by getting them to review the measurement tool. It was also decided that there was no guarantee that they would complete the online questionnaire and therefore contaminate the data. There was also a risk that if ANP were involved in the expert validation panel then they would discuss this with colleagues and this would result in bias. So after serious consideration, the panel was invited to review the measurement tool in the form of a questionnaire. Content validity is an assessment of an instrument usually by a panel of experts of how logically and comprehensively it measures what it is intended to measure (May & Williams 2006). The panel for this study consisted of three emergency consultants from three different emergency departments and three different settings (emergency department urban, emergency department rural and local injury unit), three specialist registrars, three registrars, three senior house officers (SHO) and two associate professors from a different university. Both associate professors had previously worked as nurse practitioners in emergency departments. Due to the difficulties in arranging a formal meeting, communication between all the panel members and the researcher occurred via email and via Zoom so that everyone was aware of everyone's views and open discussion was enabled. The panel evaluated and discussed all aspects of the questionnaire including all the closed and open questions as well as any gaps in the survey. The measurement tool was evaluated under separate parts: knowledge, clinical guidelines, clinical practice and barriers and facilitators. Once this was done, it was then evaluated as an overall survey tool. This validation process aimed to ensure that the VTE ralli questionnaire was presented as a clear, simple and understandable document. The panel evaluating the questionnaire helped enhance the quality and clarity of its content and design. It also enlightened the researcher about the perceptions that participants might have about the questions and the meaning behind each question. Content validity however is a subjective process. However, Lynn (1986) proposed a two-step for determining content validity. Firstly, the individual items are evaluated by the experts using a 4-point scale, ranging from 1= not relevant to 4 = very relevant and succinct, this determines if the items should be retained or rejected. After this is completed a content validity index (CVI) score is computed. In this study, there were 14 experts on the panel therefore according to Lynn (1986) the acceptable CVI value is at least 0.78. CVI, relevance rating needs to be coded as 1 (relevance scale of 3 or 4) or 0 (relevance scale of 1 or 2) as per

the experts opinion this was all recorded on an excel sheet as shown in Table 3.6 (Appendix 14). The I-CVI score based on the average proportion of items judged as relevance across the 14 experts was scored at 0.993 as this is greater than 0.78 and also greater than 0.9 as per (Polit & Beck 2020) this questionnaire is regarded as having good agreement.

Table 3.6 The relevance ratings on the item scale by fourteen experts

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	Expert 14	Experts in a	I-CVI
1	1.a. I understand that I don't have to take part in this study and that I can opt out at any time. I understand that I don't have to give a reason for opting out.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
2	1.b. I am aware of the potential risks and benefits of this research study.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
3	1.c. I am satisfied that my information will be kept private and confidential.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
4	1.d. I have voluntarily agreed to participate in this research study.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
5	1.e. I am 18 years or older.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
6	2. I have read the information provided. I give my informed consent to have my data processed as part of this research study.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
7	3. What is your current position?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
8	4. What is your specialty?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
9	5. How many years have you worked in your specialty?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
10	6. Which settings do you practice?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
11	7. On average how many patients does your department see a year?	1	1	1	1	1	1	1	1	0	1	1	1	1	1	13	0.93
12	8. Are you male or female?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
13	9. What is your age?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
14	10. What is your highest level of qualifications?	1	1	1	0	1	1	1	1	1	1	1	0	1	1	12	0.86
15	11. Have you ever attended a course or in service program that provided information on venous thromboembolism (VTE) risk assessment and prevention?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
16	12. How would you rate your overall knowledge of venous thromboembolism (VTE) risk assessment?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
17	13. Which of these guidelines for venous thromboembolism management are you familiar with? (You may select more than one)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
18	14. Which risk assessment forms are you familiar with? (You may select more than one)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
19	15.1. Patients with a lower limb immobilisation are not at risk of developing a VTE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
20	15.2. VTE prophylaxis should be prescribed for all patients with lower limb immobilisation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
21	15.3. VTE prophylaxis should not be prescribed for patients with lower limb immobilisation	1	1	1	1	1	1	0	1	1	1	0	1	1	1	12	0.86
22	16. All these patients are a potential risk of developing a VTE (tick the most applicable).	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
23	16.1. Patients with a BMI over or equal to 30KG/m2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
24	16.2. Patients older or equal to 60 years old	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
25	16.3. Recent pelvic surgery	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
26	16.4. Recent lower limb surgery	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
27	16.5. Recent abdominal surgery	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
28	16.6. Patients on anticoagulations	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
29	16.7. Patients sustaining an achilles tendon injury	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
30	16.8. Patients on oral contraceptive pill (OCP)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
31	16.9. Patients on hormone replacement therapy (HRT)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
32	16.10. Recent pregnancy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
33	16.11. Patients with Varicose Veins	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
34	16.12. Patients with Cancer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
35	16.13. Patients with heart disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
36	16.14. Patients with lung disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
37	16.15. Patients with bowel disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
38	16.16. Patients with hormone disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
39	16.17. Patients with history of thrombophilia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
40	16.18. Patients with history of deep vein thrombosis (DVT)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
41	16.19. Patients with history of pulmonary embolism (PE)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
42	16.20. Family member who had a DVT or PE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
43	17. Please rate the the level of your concern regarding the risk of developing a VTE (tick the most applicable).	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
44	17.1. Patients older than or equal to 60 years old	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
45	17.2. Patients with a BMI over or equal to 30KG/m2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
46	17.3. Recent pelvic surgery	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
47	17.4. Recent lower limb surgery	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
48	17.5. Recent abdominal surgery	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
49	17.6. Patients on anticoagulations	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
50	17.7. Patients sustaining an achilles tendon injury	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
51	17.8. Patients on oral contraceptive pill (OCP)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
52	17.9. Patients on hormone replacement therapy (HRT)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
53	17.10. Recent pregnancy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
54	17.11. Patients with Varicose Veins	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
55	17.12. Patients with Cancer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
56	17.13. Patients with heart disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
57	17.14. Patients with lung disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
58	17.15. Patients with bowel disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
59	17.16. Patients with hormone disease	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1

3.11.3 Threats to Validity

Internal Validity

When the ANPs are completing the Likert scales there may be a tendency for the participants to only answer in the positive or close to the neutral, resulting in the possibility of a central tendency bias. However, to reduce this, the questionnaire includes both positive and negative statements.

As mentioned in 3.10 a pilot study was not performed prior to commencing the main study to ensure that there was not a threat to the internal validity, as the total population of recruitment was only 85 ANPs and the risk that a pilot study could also take part in the main study therefore contaminating the main study and risking additional bias it was deemed not advisable to complete a formal pilot in this research study.

External Validity

A threat to the external validity with regard to the recruited population of this study is that inclusion is voluntary. There was a possibility that several ANP could have declined to participate in the study and this would limit the ability to generalise to the whole population however as the response rate was 85.8% this was not the case and it can be presumed that the study is generalised to the whole ANP population.

In conclusion, the questionnaire used in this study has been prove to be both a valid and reliable measurement instrument in researching the ANPs' practice when evaluating VTE risk due to lower limb injuries within the ED setting.

3.12 Data Analysis

Data analysis pulls elements or information together to present a clear picture of all the information collected, but it does not interpret or describe the implications for the practice of that picture of the information (Macnee and McCabe 2008). The steps in the analysis were, "preparing the data for analysis, exploring the data, analysing the data, representing the

analysis, interpreting the analysis, validating the analysis and interpretations" (Creswell & Plano Clark 2011: 204). The challenge in a parallel results convergent mixed-methods research design is the merging of the data after both datasets are analysed separately (Hong *et al* 2017, Creswell 2014). For this study, the merging of the data occurred in the form of 'a joint display approach' as seen in Chapter 6 (Creswell 2014).

3.12.1 Quantitative data analysis

Quantitative research is defined as 'a formal, objective, systematic process in which numerical data are used to obtain information about the world' (Burns & Grove 2008, pg27). The raw quantitative data collected via the VTE ralli questionnaire was verified as accurate using the check recheck method, and then the data was converted into numerical values and manually entered and transferred into the IBM Statistical Package of Social Sciences (SPSS) software program version 26. Primarily, data was converted to a form that was amenable to computer analyses, by coding the questionnaire, as computers are unable to analyse information such as "yes", "no" and "don't know" as utilised in the questionnaire. Coding is the process by which responses are transformed so that they can be analysed by a computer (De Vaus 2013). A codebook was developed to guide the inputting of the data systematically and to enable the researcher to recheck for errors against the completed questionnaires. A number of methods exist for ensuring correct data input is achieved. In this study, each questionnaire was given a number and the data entered into an SPSS statistical package. All demographic data was entered as nominal except for questions 5,7 & 9 which were entered as ordinal. Ordinal and nominal data are both categorical data, however, they are defined as ordinal data following a 'natural order' as nominal data involves data that follow 'no natural order or rank' (Curtis & Drennan 2013, pg. 349).

Statistical analysis consisted of both descriptive and inferential statistics, resulting in the data set being analysed with the use of univariate or bivariate statistics. Descriptive statistics are statistics that describe and summarize the data (Polit & Beck 2020), inferential statistical analysis describe correlational links between two or more variables, and is based on the assumption that the sample was obtained randomly (Burns and Grove, 2016) rather than an experimental intervention (Botti & Endacott 2008). Descriptive analysis was conducted on the demographic, knowledge, clinical guidelines, clinical practice, barriers and facilitators. Analyses conducted, included frequencies for categorical data and means for continuous data.

Within the literature there is a debate among some methodologists about the appropriate statistical methods which should be initiated in analysing data resulting from Likert scales (Willits *et al 2016,* Asun *et al* 2016, Stratton 2018). This debate discusses whether the data generated from Likert scales is either ordinal or interval data (Stratton 2018). There appear to be arguments in the literature that state that Likert scales fit under the remit of interval data (Willits *et al* 2016, Wadgave & Khairnar 2016). However, Sullivan and Artino discuss the differences between 'serious concern, moderate concern, mild concern, no concern' and state that the responses are not necessarily equal. 'In other words, one cannot assume that the difference between responses is equidistant even' (Sullivan & Artino 2013, pg. 541). Dr. Geoff Norman, has comprehensively reviewed this controversy and concluded parametric tests can be used with ordinal data, and that they are more accurate than non-parametric tests (Norman 2010). All the above statistical tests will need to have a significance level of ≤ 0.05 ($p \leq 0.05$) or greater to be considered a statistically significant result.

3.12.2 Qualitative data analysis

The analysis of qualitative data is an active and interactive process. Data analysis is described as a range of techniques for sorting, organizing and indexing qualitative data (Mason 1996). One of the qualitative approaches aims to explore and understand a particular phenomenon from the respondents' perspective (Creswell 2014). Reflexivity at the data analysis stage also should include examining the ontological and epistemological assumptions built into particular methods of data analysis. The researcher must be aware of their own biases, theoretical predisposition and preferences during the research process in its entirety (Parahoo 2006). Finlay (2002) advocates that the researcher needs to be honest about the subjective areas that may impact the study to ensure the integrity and trustworthiness of the study are upheld.

The analysis of qualitative data is a laborious process. "Qualitative researchers typically scrutinize their data carefully and deliberatively, often reading the data over and over again in a search to find meaning and deeper understanding" (Polit and Beck 2010: 464). Written data, from the ANP was coded, categorized and analysed. However, so that qualitative data does not lose its narrative character the data was managed using the NVivo software (version 12.0) computer-assisted qualitative data analysis software. This software allows the researcher to identify key themes and subthemes. Inductive and deductive codes were created and used to identify and link segments of the data together and to generate overarching themes to establish an accurate and transparent picture of the qualitative data (Braun & Clarke 2006). To ensure

the accuracy of the findings, I reviewed and transcribed verbatim all the transcripts prior to data analysis. As the open-ended questions in this study were linked to the main themes in the quantitative closed questions the researcher felt that the use of thematic analysis was fitting for the parallel results convergent mixed-methods research design approach. They clearly define the thematic analysis model which sets out the phases necessary to complete before being able to identify the final themes that are generated from the data collected (Braun & Clarke 2006).

The goal of the thematic analysis is 'to achieve an understanding of patterns of meanings from data on lived experiences' (ANPs) regarding the research questions (Sundler *et al* 2019, pg. 733). The researcher needs to be flexible as thematic analysis can be complex. Thematic analysis consists of a six-step approach, step one is 'familiarising oneself with the data' step two 'generating initial codes', step three 'searching for the themes', step four 'involved reviewing the themes', step five 'defining and naming themes' and the final step consisted of the researcher 'producing the report' (Braun & Clarke 2006). To ensure rigor and transparency in this process the researcher's interpretations of the data were supported by extracts from the written data transcriptions allowing the readers to make their own judgements regarding the quality analysis. Further details of the process of qualitative data analysis in this study is detailed in Chapter 5.

3.13 Data Integration

The research commenced with the point of data collection consisting and collecting both quantitative and qualitative data via one instrument (Morse and Niehaus 2009). The survey instrument which included the quantitative closed questions and the qualitative open-ended questions were based on the main research themes therefore enabling the merging of the results and findings (Fetters *et al* 2013). Both quantitative and qualitative data were analysed separately allowing for different results and findings to emerge independently. After the analysis and according to the parallel results convergent design, the merging of both the quantitative results and qualitative findings occurred allowing the researcher to identify if the qualitative findings were confirmed and built on the quantitative results.

Furthermore, the integration of the quantitative results and qualitative findings produced new knowledge and further understanding of the ANP clinical practice for patients at risk of developing VTE as a result of lower limb injury. This in turn provides an answer to the mixed-

methods research question formerly mentioned by providing a holistic picture (Creswell and Plano Clark 2017). As Greene (2007) stated mixed-methods research has been described as 'multiple ways of seeing and hearing' (Greene 2007, p20) by the integration of both quantitative and qualitative data. In Chapter 6 the researcher developed a joint display table where both the quantitative results and qualitative findings were integrated providing a visual concurrent display of the merged themes (Guetterman *et al* 2015).

3.14 Quality in Mixed-Method Research

The quality of both the quantitative and qualitative approaches has an impact on the quality of the overall mixed-method study (Creswell & Plano Clark 2017, Teddlie & Tashakkori 2009). The methodologists in the literature have debated how best to assess the overall quality of the mixed-method research as quantitative and qualitative methods are driven by different philosophical views (Teddlie & Tashakkori 2009, Dellinger and Leech 2007). The development of criteria checklists has emerged over the past two decades from Onwuegbuzie and Poth's (2016) 32-item quality list as well as Fetters and Molina-Azorin's (2019) 20-element checklist to Bryman's (2014) 6-item criteria. However, Hirose and Creswell's (2023) six core criteria were a better fit for this study.

1. Advance a rationale for the use and appropriateness of mixed-methods methodology.
2. Write quantitative, qualitative, and mixed-methods questions or aims.
3. Report the quantitative and qualitative data separately.
4. Name and identify the type of mixed-methods design and present a diagram of it.
5. State the use of integration in a joint display.
6. Discuss how meta-inferences and value resulted from the integration analysis.

(Hirose & Creswell 2023)

3.15 Data Governance

All computerised research quantitative and qualitative data, were stored on my personalised computer. I ensured that the computerized data was encrypted and password protected on the computer which I kept safe in a locked filing cabinet when not in use. Both quantitative results and qualitative findings were only made available to myself and my two University of Stirling-

based research supervisors. All data generated electronically, was held on a secure server and was password protected and encrypted to maintain complete confidentially. No participant's personalised details were requested to be completed on the questionnaire. No participant's personal or hospital details or opinions were reported in the research thesis nor published in any journal articles. In accordance with the University of Stirling archiving data guidelines, all research data including paper data and electronic data will be deleted and shredded by myself after a minimum of ten years (University of Stirling 2018).

3.16 Research Funding

This research was self-funded and formed part of my doctoral thesis (Appendix 15).

Chapter Four: Presentation of Quantitative Results

4.1 Introduction

A systematic method was adopted to conduct the analysis. The first stage was to analyse the predominant quantitative data which measured the ANPs' level of knowledge, clinical practice and barriers and facilitators in the management of patients with lower limb immobilization. Second was the analysis of the qualitative data by the thematic analysis method to provide different perspectives, in particular, identify themes that facilitated or caused a barrier to ANPs in their clinical management of patients with lower limb immobilization.

The following three chapters present the results of the study. This chapter concentrates on the quantitative results, Chapter Five is focused on the qualitative findings and Chapter Six merges both chapters to discuss the synthesis of the quantitative results and qualitative findings.

The chapter sets out to compile the study results testing the hypotheses, which proposes '*That within the emergency setting there is an in depth level of knowledge and the VTE risk assessment forms are always used for patients with lower leg injuries resulting in immobilisation'* by analysing the quantitative data.

The chapter begins by describing the characteristics of the population studied. It explores and reports the data as described by the ANPs' knowledge, clinical guidelines used in the emergency setting, clinical practice and decision making and barriers and facilitators that impede or aid in the management of patients with lower limb immobilization.

4.2 Missing Data

As previously mentioned in Chapter 3 there were no missing data in this study due to the way that the online questionnaire was set up (Table 4.1 and Table 4.9)

Table 4.1. Completed Questionnaires

	Cases					
	Included		Excluded		Total	
I have voluntarily agreed to participate in this research study	N	Percent	N	Percent	N	Percent
	73	100.0%	0	0.0%	73	100.0%

All participants had agreed to voluntarily take part in this research. The questions in the questionnaire were set up in a way that would not allow the participant to continue to the next section unless the question was answered. Any part-answered questionnaires were not saved and therefore not included in the data analysis.

4.3 Sample Characteristics

The population was the national cohort of ANPs (N=85) working in either emergency departments (n=26) or local injury units (LIU) (n=11) in the Republic of Ireland. The professional bodies, mentioned in Chapter 3, acted as the gatekeepers for this study by emailing the questionnaire link to those on their email lists. Additionally, the questionnaire link was published on the Twitter of @EMP, @IAANMP and @IAEM allowing the participants to access the questionnaire. A total of 73 ANP completed the online questionnaire during the data collection timeframe of four months (May to September 2019). Therefore, enabling a response rate of 85.8% for each question in this research study (Table 4.2).

Table 4.2: Study Sample

Recruitment throughout 37 Emergency Settings in the Republic of Ireland	
Total Number of ANP (N)	85 (N=85)
Sample recruited (n)	73 (n=73)
Response Rate (%)	85.8%
Missing Data for exclusion	0

At the initial stage of data analysis, I needed to establish if any outliers were present that may affect the data analysis, this was done visually with the aid of box plots. However, it was concluded that no outliers were identified during the cleaning of the data.

As previously mentioned, the ANPs in the study were supposed to be working in an emergency setting, however, as one of my gatekeepers, the Irish Association of Advanced Nurse and Midwife Practitioners (IAANMP) are the professional body for all ANP in Ireland regardless of the speciality, there needed to be a question confirming their speciality so that the data remained true.

Table 4.3 shows the frequency and percentage of the participants according to their speciality (Emergency Medicine n=73) and therefore clarifies that 100% of the respondents in this study were from the emergency setting.

Table 4.3: Participants Specialty
What is your specialty?

	Frequency	Percentage
Emergency Medicine	73	100
Orthopedics	0	0
General Medicine	0	0
Hematology	0	0
Other	0	0
Total	73	100

Table 4.4 shows the frequency and percentage of the respondents according to gender. It clarifies that 80.8% (n=59) of the respondents were females as opposed to 19.2% (n=14).

Table 4.4: Participants Gender
Are you male or female?

	Frequency	Percentage
Male	14	19.2
Female	59	80.8
Non-binary	0	0
Prefer not to say	0	0
Total	73	100

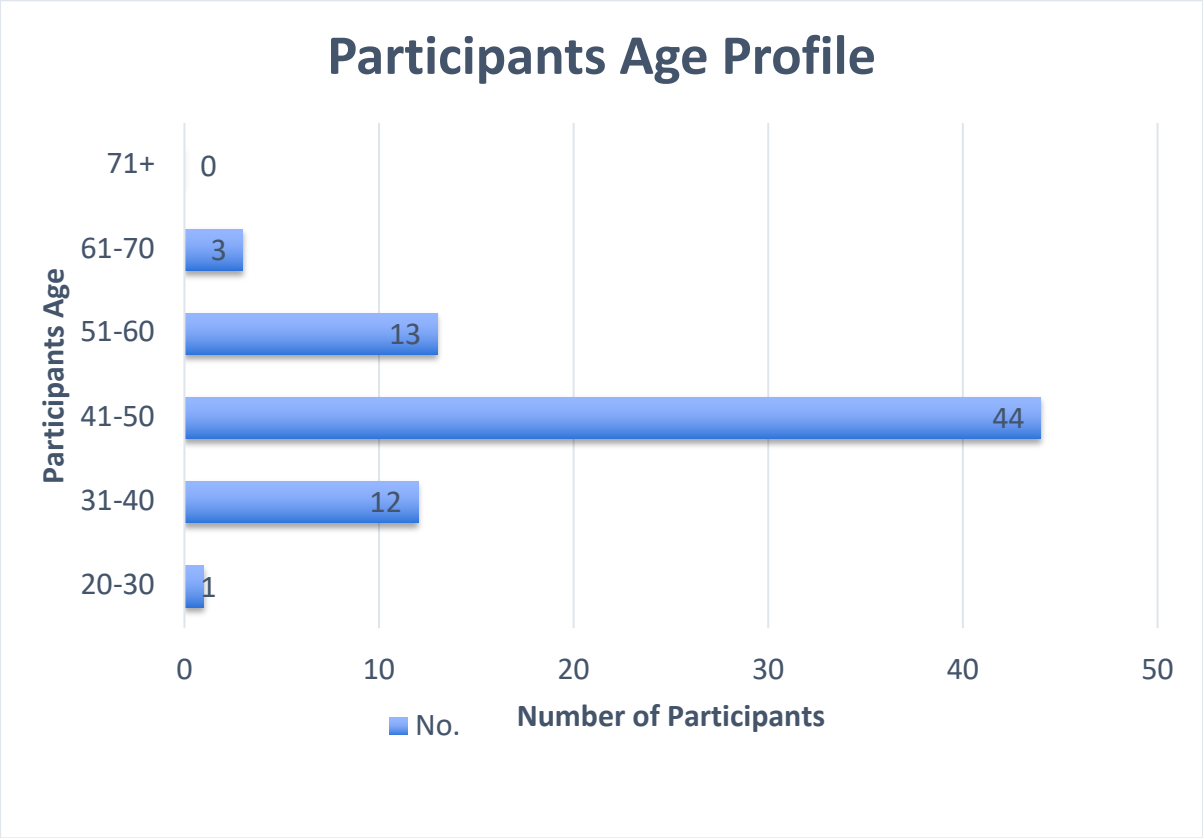
Another characteristic of this cohort of ANP is the current age profile.

Table 4.5 shows the frequency and percentage of the respondents according to age groups. It clarifies that the majority of respondents, 60.3% (n=44) belonged to the age group of 41-50 years, followed by 17.8% (n=13) to the age group of 51-60 years, while the lowest percentage 1.4% (n=1) belonged to the age group of 20-30 years (Figure 4.1).

Table 4.5: Participants Age
What is your age?

	Frequency	Percentage
20-30	1	1.4
31-40	12	16.4
41-50	44	60.3
51-60	13	17.8
61-70	3	4.1
71+	0	0
Total	73	100

Figure 4.1: ANP Age Profile



The Emergency Medical Programme Model of Care regards local injury units as having a major role in treating a specific cohort of patients including patients with lower limb injuries requiring lower lag immobilisation (EMP 2019). In this study, a similar number of ANP were from both urban (45.2%, n=33) and rural (39.7%, n=29) emergency departments (ED) while only eleven (15.1%, n=11) were working in local injury units (LIU) (Figure 4.2).

Figure 4.2: Clinical Settings

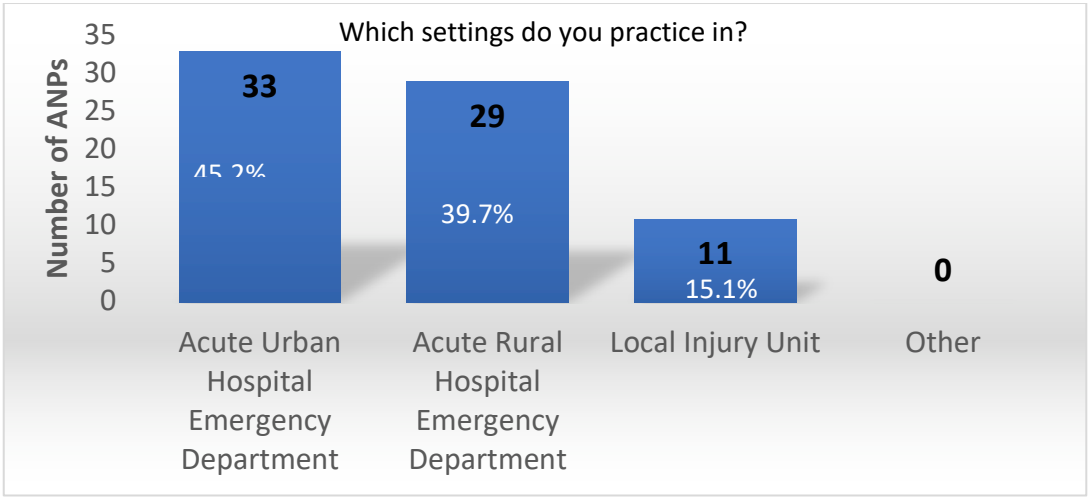


Table 4.6 shows the frequency and percentage of the participants according to how many patients the participant department sees on average per year. It clarifies that the majority of respondents 26.0% (n=19) see 20,001 – 30,000 patients, followed closely by 20.5% (n=15) that see 30,001 -40,000 patients, next was 13.7% (n=10) that see 50,001 – 60,000 patients, while the lowest percentages 2.7% (n=2) see 70,001 -80,000 patients. Thus this highlights the range of emergency settings that ANP work across within the ED setting.

Table 4.6: Patient Attendances

On average how many patients does your department see a year?

	Frequency	Percentage
<10,001 patients	6	8.2
10,001 – 20,000 patients	4	5.5
20,001 – 30,000 patients	19	26.0
30,001 -40,000 patients	15	20.5
40,001 -50,000 patients	6	8.2
50,001 – 60,000 patients	10	13.7
60,001 -70,000 patients	7	9.6
70,001 -80,000 patients	2	2.7
80,001 + patients	4	5.5
I don't Know	0	0
Total	73	100

75.3% (n=55) of the population had worked in the ED setting for more than 10 years (Table 4.7). The data collected highlighted that the length of time that the person worked as a ANP in the ED setting had no significance on patients presenting with lower limb injuries as the p-value (p-value = .137) was greater than .05. (Table 4.8).

Table 4.7: Years Working

How many years have you worked in your specialty?

	Frequency	Percentage
1 - 5 years	18	24.7
6 – 10 years	0	0
11 -15 years	12	16.4
16 -20 years	17	23.3
21 + years	26	35.6
Total	73	100

Table 4.8: Chi-Square Years Working

How many years have you worked in your specialty?

One-Sample Chi-Square Test Summary

Total N	73
Test Statistic	5.521[a]
Degree of Freedom	3
Asymptotic Sig (2-sided test)	.137

[a] There are 0 cells(0%) with expected values less than 5. The minimum expected value is 18.250.

Patients who had a lower limb injury requiring immobilisation were not treated the same by an ANP who had less than 5 years' experience or one with less than 20 years' experience. However, there were three ANPs with more than 21 years in their speciality who did not see lower leg immobilisation as a risk factor for VTE (Table 4.9).

Table 4.9: Crosstabulation

How many years have you worked in your specialty? Patients with a lower limb immobilisation are not at risk of developing a VTE Crosstabulation						
			Patients with a lower limb immobilisation are not at risk of developing			
			Strongly Disagree	Disagree	Agree	Total
How many years have you worked in your specialty?	1 - 5 Years	Count	12	6	0	18
		% within patients with a lower limb immobilisation are not at risk of developing a VTE	24.5%	28.6%	0.0%	24.7%
	11 – 15 Years	Count	9	3	0	12
		% within patients with a lower limb immobilisation are not at risk of developing a VTE	18.4%	14.3%	0.0%	16.4%
	16 – 20 Years	Count	10	7	0	17
		% within patients with a lower limb immobilisation are not at risk of developing a VTE	20.4%	33.3%	0.0%	23.3%
	21 + Years	Count	18	5	3	26
		% within patients with a lower limb immobilisation are	36.7%	23.8%	100%	35.6%

		not at risk of developing a VTE				
Total		Count	49	21	3	73
		% within patients with a lower limb immobilisation are not at risk of developing a VTE	100%	100%	100%	100%

4.4 Normality of the Data

Assessing the data for normality should be completed prior to using parametric or non-parametric statistical tests. It is important to establish the normality assumption so that the correct statistical tests can be used. The literature states the most popular test for normality is the Kolmogorov-Smirnov test (K-S test), however, there is an argument that it should no longer be used owing to its low power (Ghasemi and Zahediasl 2012). It is recommended that normality be assessed both from a visual perspective and through statistical normality tests (Ghasemi & Zahediasl 2012). The Shapiro-Wilk test is recommended for sample sizes of 50 and lower and the Kolmogorov-Smirnov test for sample sizes greater than 50, however, it is noted that the sample size is not always relevant to the normality test preformed. The data in this study was analysed using both the Kolmogorov-Smirnov and the Shapiro-Wilk tests for normality under all themes. As the sample size was 73 the researcher decided both tests would ensure accuracy. Table 4.10 highlights the Kolmogorov-Smirnov test and the Shapiro-Wilk tests for the knowledge questions, however, this was performed for each section: clinical practice, guidelines, barriers and facilitators. The significance level (Sig values) is less than .05 in both tests indicating that the data deviated from the normal distribution (Field 2018).

Table 4.10: Tests of Normality

Do you have this in full initially?

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
Have you ever attended a course or in-service program that provided information on venous thromboembolism (VTE) risk assessment and prevention?	.442	73	.000	.576	73	.000
How would you rate your overall knowledge of venous thromboembolism (VTE) risk assessment?	.310	73	.000	.836	73	.000
Which of these guidelines for venous thromboembolism management are you familiar with?	.243	73	.000	.860	73	.000
Which risk assessment forms are you familiar with? (May select more than one)	.241	73	.000	.909	73	.000
Patients with a lower limb immobilization are not at risk of developing a VTE?	.415	73	.000	.643	73	.000
VTE prophylaxis should be prescribed for all patients with a lower limb immobilization?	.292	73	.000	.846	73	.000
VTE prophylaxis should not be prescribed for patients with lower limb immobilization?	.312	73	.000	.778	73	.000

[a] Lilliefors Significance Correction

As recommended in the literature it is best to preform a histogram and a Q-Q plot or P-P plot to confirm the normal distribution (Mohr *et al* 2022). As visualised in Figures 4.3, 4.4 and 4.5, the data shows a positive skew. In Figure 4.5, the dots are seen sagging both above and below the line with no dots on the horizontal line. The data will be treated as non-parametric as confirmed by the Kolmogorov-Smirnov test and the Shapiro-Wilk test for normality calculations previously seen in Table 4.10 as the data deviated from the normal distribution (Field 2018).

Figure 4.3: Histogram - Knowledge of VTE risk assessment and patients in immobilsation

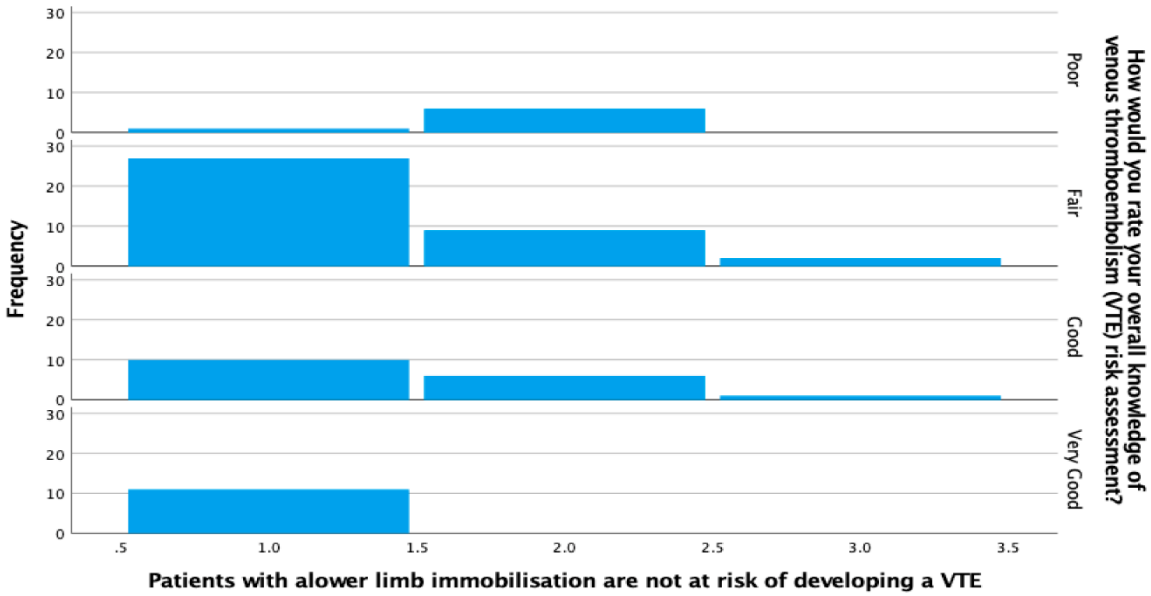


Figure 4.4: Histogram (ANP Knowledge)

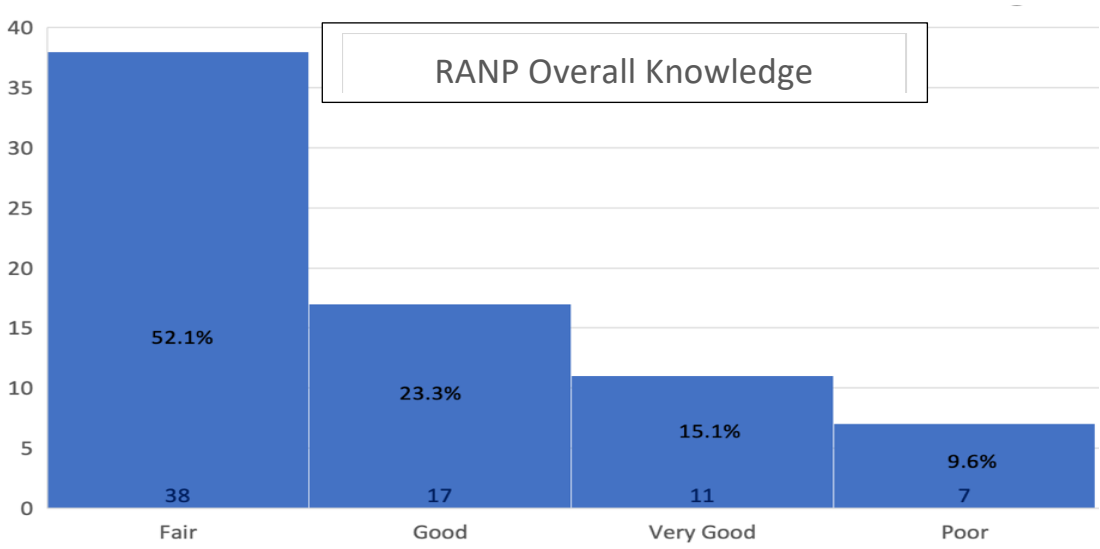
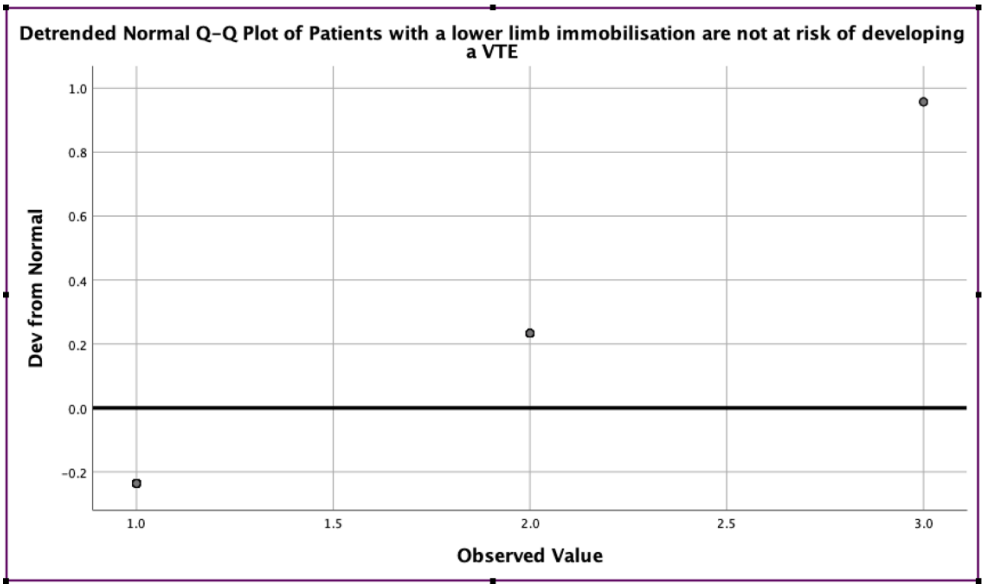


Figure 4.5: Q-Q Plot - Displaying not a normal distribution



4.5 Knowledge

As mentioned in previous chapters, knowledge underpins the ANP clinical practice within the emergency setting. There was a need to establish the level of knowledge that exists and the exposure to courses in the management of patient's risk of VTE with lower leg immobilisation. Table 4.11 shows that there is a significance (p-value = .001) ANPs' knowledge if they had attended a course about VTE. However, as seen on the binomial graph in Table 4.12 and Figure 4.6 as well as the descriptive Table 4.11, only 30% (n=22, red in observed) out of the 73 participants had ever attended any type of course concerning VTE.

Table 4.11 shows the frequency and percentage of the respondents according to whether they have ever attended a course or in-service program that provided information on VTE risk assessment and prevention. It clarifies that the majority of the respondents 69.9% (n=51) had not attended a course or in-service program that provided information on VTE risk assessment and prevention.

Table 4.11 Have you ever attended a course on VTE?

Have you ever attended a course or in-service program that provided information on venous thromboembolism (VTE) risk assessment and prevention?

	Frequency	Percentage
Yes	22	30.1
No	51	69.9
I don't know	0	0
Total	73	100

Have you ever attended a course on VTE?

One-Sample Chi-Square Test Summary

Total N	73
Test Statistic	11.521[a]
Degree of Freedom	1
Asymptotic Sig (2-sided test)	.001

[a.] There are 0 cells(0%) with expected values less than 5. The minimum expected value is 36.500.

Figure 4.6: Participants who have attended a course

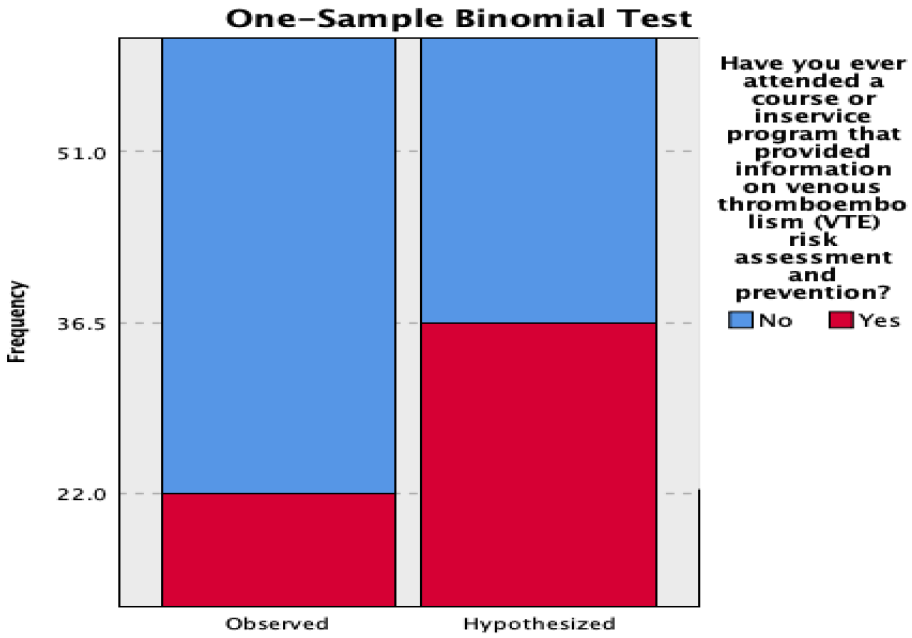


Table 4.12 shows there are five subgroups of respondents based on how would they rate the quality of the information they received when they responded (as yes) when they were asked whether they have ever attended a course or in-service program that provided information on VTE risk assessment and prevention. Even though only 30.1% (n=22) of participants had

responded ‘Yes’ 37% (n=27) ANPs answered this question. A majority of respondents 13.7% (n=10) belonged to the rating group of ‘very good’, while the lowest percentage 2.7% (n=2) belonged to the rating group of ‘excellent’.

Table 4.12: Quality of Information Received

If yes, how would you rate the quality of the information you received?

	Frequency	Percentage
Poor	3	4.1
Fair	4	5.5
Good	8	11.0
Very Good	10	13.7
Excellent	2	2.7
Total	27	37

Table 4.13 shows there are four subgroups of respondents based on how would they rate their overall knowledge of VTE risk assessment. The majority of respondents 52% (n=38) belonged to the rating group of ‘fair’, followed by 23.3% (n=17) belonged to the rating group of ‘good, followed by 15.1% (n=11) of ‘very good’, while the lowest percentage 9.6% (n=7) belonged to rating group of ‘poor’.

Table 4.13: Overall Knowledge of VTE Assessment

How would you rate your overall knowledge of venous thromboembolism (VTE) risk assessment?

	Frequency	Percentage
Poor	7	9.6
Fair	38	52
Good	17	23.3
Very Good	11	15.1
Excellent	0	0
Total	73	100

Table 4.14 shows there are seven subgroups of guidelines for venous thromboembolism management that respondents were familiar with. With this question, the respondents were invited to enter more than one guideline if they knew more. The majority of respondents, 67.1% (n=49) were familiar with the National Institute for Health and Clinical Excellence (NICE guidelines), followed by 23.3% (n=17) with the College of Emergency Medicine, then 17.8% (n=13) were not familiar with any of the guidelines that were mentioned ‘None of the above’ group, 11% (n=8) were familiar with the Scottish Intercollegiate Guidelines Network (SIGN), followed by 8.2% (n=6) to ‘I don’t know’ while the lowest was 2.7% (=2) belonging to the

'other' group. These were 'Emed.ie' and 'Wells Score', both not guidelines for this cohort and this will be discussed further in Chapter 6 and 7. In relation to the respondents that answered multiple answers, 10.96% (n=8) answered three guidelines, 4.11% (n=3) stated NICE, SIGN and ACCP and 6.85% (n=5) NICE, SIGN and CEM. 24.66% (n=18) answered two guidelines, these included 13.7% (n=10) NICE and CEM, as well as 10.96% (n=8) NICE and SIGN.

Table 4.14: VTE Guidelines you are Familiar With?
Which of these guidelines for venous thromboembolism management are you familiar with?

	Frequency	Percentage
National Institute for Health and Clinical Excellence (NICE): 2012 guidelines	49	67.1
Scottish Intercollegiate Guidelines Network (SIGN) (SIGN 122) guidelines	8	11
European Society of Anesthesiology (ESA) 2017 guidelines	0	0
College of Emergency Medicine 2012 (CEM)	17	23.3
BCSH Guidelines	0	0
ACCP Guidelines	4	5.5
None of the above	13	17.8
All of the above	0	0
I don't Know	6	8.2
Other	2	2.7
Total	99	135.6

Table 4.15 shows there are eight subgroups of risk assessment forms that respondents were familiar with. With this question, the respondents were invited to enter more than one risk assessment tool, if they knew more. The majority of respondents 45.2% (n=33) were not familiar with the mentioned risk assessment (None of the above), followed by 16.4% (n=12) that belonged to familiar with 'other' guidelines (which will be discussed in Chapter 6), followed by 15.1% (n=11) in the (I don't know) group, followed by Plymouth V3 12.3% (n=9) and Plymouth V2 11% (n=8). In relation to the respondents who answered multiple answers 4.11% (n=3) stated they were aware of four risk assessment tools, Plymouth 2 & 3, GEM and Modified Caprini Score. The remaining 13.7% (n=10) answered two risk assessments, 8.22% (n=6) Plymouth V2 & V3, 4.11% (n=3) stated PlymouthV3 and L-TRIP and finally 1.37% (n=1) L-TRIP and Modified Caprini Score.

Table 4.15: Risk Assessment Forms you are Familiar With?
Which risk assessment forms are you familiar with?

	Frequency	Percentage
Plymouth Rule Version 2	8	11
Plymouth Rule Version 3	9	12.3
GEMNet Risk Factors Score	4	5.5
L-TRIP Score	3	4.1
Modified Caprini Score	6	8.2
None of the above	33	45.2
All of the above	0	0
I don't know	11	15.1
Other	12	16.4
Total	86	117.8

Table 4.16 highlights the three questions that were asked to determine the relation between how they would rate their overall knowledge of VTE risk assessment statements and knowledge comments. The question means were ranged between (1.37 – 2.38). The lowest mean belonged to question one which stated: "Patients with a lower limb immobilisation are not at risk of developing a VTE (M=1.37)" followed by the third question "VTE prophylaxis should not be prescribed for patients with lower limb immobilisation (M=1.86)" then question two "VTE prophylaxis should be prescribed for all patients with lower limb immobilization (M=2.38)".

A chi-square test of independence was performed to examine the relation between the question of how would you rate your overall knowledge of VTE risk assessment and the specific VTE knowledge-based questions (Table 4.16).

The result between these variables was significant in terms of the first statement "Patients with a lower limb immobilisation are not at risk of developing a VTE", X2 (6, N = 73) 17.586 with $p < 0.05$. Thus, the concept "There is a relation between how you would rate your overall knowledge of VTE risk assessment statements and varied knowledge comments "Patients with a lower limb immobilisation are not at risk of developing a VTE" – The null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge that exists.

The second statement X2 (9, N = 73) 6.943 with $p = 0.643$ and the third statement X2 (6, N = 73) 7.451 with $p = 0.281$, shows no statistical difference. Thus, the concept "There is a relation between how would you rate your overall knowledge of VTE risk assessment statements and

varied knowledge comments "VTE prophylaxis should be prescribed for all patients with lower limb immobilization" and "VTE prophylaxis should not be prescribed for patients with lower limb immobilization" there is evidence to fail to reject the null hypothsis "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* .

Table 4.16: Chi-Square overall Knowledge VTE Risk Assessment

How would you rate your overall knowledge of venous thromboembolism (VTE) risk assessment comments Chi-Square

	Mean	SD	X2	df	P
Patients with a lower limb immobilisation are not at risk of developing a VTE	1.37	1.37	17.586	6	.007
VTE prophylaxis should be prescribed for all patients with lower limb immobilization	2.38	2.38	6.943	9	.643
VTE prophylaxis should not be prescribed for patients with lower limb immobilisation	1.86	.631	7.451	6	.281
Total	1.54	1.46			

Note: SD=Standard Deviation. X2=Chi-Square. df=Degree of Freedom. P=Significance level

Table 4.17 askes twenty questions were asked to determine the relation between how would you rate your overall knowledge of VTE risk assessment potential risk factors of developing a VTE statement and varied potential risk factors of developing a VTE.

In regards to varied potential risk factors of developing a VTE, SD = .688 M=3.15. "How would you rate your overall knowledge of VTE risk assessment potential risk factors of developing a VTE" 'strongly agree' was between (3.25 – 4.00). The questions means were ranged between (2.70 – 3.68). The lowest mean belonged to question sixteen which stated: "Patients with hormone disease (M=2.70)" followed by question fifteen "Patients with bowel disease (M=2.71)" then question six "Patients on anti-coagulations (M=2.82)". Question three "Recent pelvic surgery (M=3.37)", question nineteen "Patients with history of pulmonary embolism (PE) (M=3.67)" and question eighteen that stated "Patients with a history of deep vein thrombosis (DVT) (M=3.68)" had the three largest mean values.

A chi-square test of independence was performed as shown above to examine the relation between how would you rate your overall knowledge of VTE risk assessment potential risk factors of developing a VTE Statement and varied potential risk factors of developing a VTE.

The result was significant in terms of the third statement "Recent pelvic surgery", X^2 (9, N = 73) 22.719 with p <0.05. Since the Chi-square values are greater than the (critical Chi-square value = 16.92) at (df = 9 crossed with p = 0.05) this informs the researcher that the notion "There is a relation between how would you rate your overall knowledge of VTE risk assessment potential risk factors of developing a VTE and varied potential risk factors of developing a VTE "Recent pelvic surgery". The null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge that exists in relation to the potential risk factors of developing a VTE.

In terms of the eighteenth statement "Patients with a history of deep vein thrombosis (DVT)", X^2 (9, N = 73) 23.312 with p <0.05. is significant. Since the Chi-square values are greater than the (X^2 = 16.92, df = 9, p = 0.05). Thus, the hypothesis "There is a relation between how would you rate your overall knowledge of VTE risk assessment potential risk of developing a VTE and varied potential risk factors of developing a VTE", "Patients with a history of deep vein thrombosis (DVT)" As the null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge that exists in relation to the potential risk factors of developing a VTE.

In terms of the nineteenth statement, the result was significant "Patients with a history of pulmonary embolism (PE)", X^2 (6, N = 73) 15.706 with p <0.05. Since the Chi-square values are greater than the critical chi-square value = 12.59 at (df = 6 crossed with p = 0.05). Thus, the view "There is a mean relationship between "how would you rate your overall knowledge of VTE risk assessment potential risk factors of developing a VTE" and 'Patients with a history of pulmonary embolism (PE)' The null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge that exists in relation to the potential risk factors of decveloping a VTE.

All other statements in Table 4.18 were not significant and since the yield, Chi-Square values were less than the Critical chi-square values, at their (df) crossed with (p = 0.05). Thus, the hypothesis "There is a relation between how would you rate your overall knowledge of VTE risk assessment potential risk of developing a VTE and varied potential risk of developing a VTE" (statements 1, 2,4,5,6,7,8,9,10,11,12,13,14,15,16,17 and 20) there is evidence to fail to

reject the null hypothsis "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* .

Table 4.17: Chi-Square Potential Risk Factors Knowledge

How would you rate your overall knowledge of VTE risk assessment, potential risk factors of developing a VTE Chi-Square

		Mean	SD	X2	df	P
1	Patients with a BMI over or equal to 30KG/m2	3.32	.643	5.176	9	.819
2	Patients older or equal to 60 years old	3.10	.690	2.585	9	.979
3	Recent pelvic surgery	3.37	.613	22.719	9	.007
4	Recent lower limb surgery	3.36	.653	7.588	9	.576
5	Recent abdominal surgery	3.29	.634	10.028	9	.348
6	Patients on anticoagulation	2.82	.872	5.692	6	.459
7	Patients sustaining an Achilles tendon injury	3.01	.808	7.663	9	.568
8	Patients on oral contraceptive pill (OCP)	3.29	.697	11.233	9	.260
9	Patients on hormone replacement therapy (HRT)	3.11	.657	7.252	6	.298
10	Recent pregnancy	3.19	.739	6.477	9	.691
11	Patients with Varicose Veins	2.96	.696	5.919	9	.748
12	Patients with Cancer	3.36	.653	13.815	9	.129
13	Patients with heart disease	3.03	.645	3.154	6	.789
14	Patients with lung disease	2.92	.702	3.479	6	.747
15	Patients with bowel disease	2.71	.716	10.216	9	.333
16	Patients with hormone disease	2.70	.701	4.763	6	.575
17	Patients with history of thrombophilia	3.00	.782	9.043	9	.433
18	Patients with history of deep vein thrombosis (DVT)	3.68	.574	23.312	9	.006
19	Patients with history of pulmonary embolism (PE)	3.67	.554	15.706	6	.015
20	Family member who had a DVT or PE	3.18	.733	5.240	9	.813
	Total	3.15	.688			

Note: SD=Standard Deviation. X2=Chi-Square. df=Degree of Freedom. P=Significance level

Table 4.18 looks at twenty questions that were asked to determine the mean relationship between how the participants would rate their overall knowledge of VTE risk assessment concerns and their varied levels of concern regarding patients' potential risk of developing a VTE. In regards to varied levels of concern regarding the risk of developing a VTE, a standard deviation (SD = .739) and total Mean = 2.99 that was located third in the four Likert Scale as "Mild concern toward how would respondents rate their overall knowledge of venous thromboembolism (VTE) risk assessment concern" the perception was between (2.50 – 3.24). The questions means were ranged between (1.89 – 3.82).

A chi-square test of independence was performed as shown above to examine the relation between how respondents rate their overall knowledge of VTE risk assessment concern statement and the varied levels of concern regarding the risk of developing a VTE. The result was significant in terms of only the ninth statement "Patients on hormone replacement therapy" (HRT)', X2 (9, N = 73) 17.455 with p <0.05. Since the Chi-square values are greater than the (X^2 = 16.92) at (df = 9 crossed with p = 0.05). Thus, the presumption "there is a relation between how would respondents rate their overall knowledge of VTE risk assessment concern and their level of their concern regarding patient on hormone replacement therapy, risk of developing a VTE". The null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge that exists in relation to the potential risk factors of developing a VTE.

On the other hand, all other statements in Table 4.19 were not statistically significant. Thus, the hypothesis "There is a relation between how would respondents rate their overall knowledge of VTE risk assessment concern and varied levels of your concern regarding the risk of developing a VTE" (statements 1, 2,3,4,5,6,7,8, 10,11,12,13,14,15,16,17, 18,19 and 20) there is evidence to fail to reject the null hypothsis "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* .

Table 4.18: Chi-Square VTE Risk Assessment Concerns

How would you rate your overall knowledge of VTE risk assessment concerns Chi-Square

		Mean	SD	X2	df	P
1	Patients with a BMI over or equal to 30KG/m2	3.26	.782	9.510	9	.392
2	Patients older or equal to 60 years old	2.71	.690	10.148	9	.339
3	Recent pelvic surgery	3.37	.656	11.813	9	.224
4	Recent lower limb surgery	3.42	.686	3.169	6	.787
5	Recent abdominal surgery	3.23	.698	16.516	9	.057
6	Patients on anticoagulation	1.89	.718	4.805	9	.851
7	Patients sustaining an Achilles tendon injury	2.78	.901	7.687	9	.566
8	Patients on oral contraceptive pill (OCP)	3.03	.707	4.299	6	.636
9	Patients on hormone replacement therapy (HRT)	2.79	.799	17.455	9	.042
10	Recent pregnancy	2.99	.790	13.041	9	.161
11	Patients with Varicose Veins	2.78	.786	5.064	9	.829
12	Patients with Cancer	3.23	.755	12.625	9	.180
13	Patients with heart disease	2.86	.839	10.983	9	.277
14	Patients with lung disease	2.77	.825	6.427	9	.697

15	Patients with bowel disease	2.45	.851	7.287	9	.607
16	Patients with hormone disease	2.56	.799	5.350	9	.803
17	Patients with history of thrombophilia	2.85	.967	6.190	9	.721
18	Patients with history of deep vein thrombosis (DVT)	3.82	.385	3.211	3	.360
19	Patients with history of pulmonary embolism (PE)	3.82	.385	1.823	3	.610
20	Family member who had a DVT or PE	3.22	.768	7.348	9	.601
		2.99	.739			

Note: SD=Standard Deviation. X2=Chi-Square. df=Degree of Freedom. P=Significance level

4.6 Clinical Guidelines

The clinical guidelines that exist in hospitals are what guide the practice of attending ANP when they are treating patients. For this study data was collected to establish what, if any, guidelines or protocols exist to assist them in the management and treatment of patients at risk of a VTE from having a lower leg immobilised. However, from the 73 ANPs that participated in this study only 49.3% (n=36) are aware of guidelines that exist to aid in their clinical practice (Table 4.19). Table 4.20 shows the frequency and percentage of the respondents according to "Does your hospital have local protocols or guidelines to aid in the management of VTE in patients with lower limb immobilisation?" It clarifies that the majority of respondents 49.3% (n=36) belonged to positive responded "Yes", followed by 42.5% (n=31) responded "No", while only 8.2% (n=6) responded "I don't know".

Table 4.19: Does Your Hospital Have Protocols or Guidelines?

Does your hospital have local protocols or guidelines to aid in the management of VTE in patients with lower limb immobilization?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	36	49.3	49.3	49.3
	No	31	42.5	42.5	91.8
	I don't know	6	8.2	8.2	100.0
	Total	73	100.0	100.0	

Of the 49.3% (n=36) of the participants who answered yes that their hospital had local protocols or guidelines to aid in the management of VTE, were then asked what these guidelines were. 21.9% (n=16) stated that they did not know which guidelines the hospital used.

Table 4.20 also shows the frequency and percentage of the respondents according to "If yes then which guidelines does your hospital use": it clarifies that the majority of respondents do.

Table 4.20 also shows the frequency and percentage of the respondents according to "If Yes then which guidelines does your hospital use": It clarifies that the majority of respondents 31.5% n=23) belonged to the positive response "None of the above", followed by 21.9% (n=16) to the "National Institute for Health and Clinical Excellence (NICE): 2012 guidelines" and "I don't know" groups, then 13.6% (n=10) belonged to "Other", followed by 5.5% (n=4) to "College of Emergency Medicine 2012" then 2.7% (n=2) to "Plymouth Guidelines" while 1.4% (n=1) belonged to the statements "Scottish Intercollegiate Guidelines Network (SIGN) (SIGN 122) guidelines" and "ACCP Guidelines". It also highlights that 5.5% (n=4) use more than one set of guidelines, which is not good practice.

Table 4.20: Which Guidelines Does Your Hospital Use?
If Yes, which guidelines does your hospital use?

	Frequency	Percentage
National Institute for Health and Clinical Excellence (NICE): 2012 guidelines	16	21.9
Scottish Intercollegiate Guidelines Network (SIGN) (SIGN 122) guidelines	1	1.4
European Society of Anesthesiology (ESA) 2017 guidelines	0	0
College of Emergency Medicine 2012	4	5.5
Plymouth Guidelines	2	2.7
BCSH Guidelines	0	0
ACCP Guidelines	1	1.4
I don't know	16	21.9
All of the above	0	0
None of the above	23	31.5
Other	10	13.6
Total	73	100

Table 4.21 shows the frequency and percentage of the respondents according to "Do you use any other guidelines to aid in the management of VTE in patients with lower limb immobilisation?": It clarifies that the majority of respondents 67.1% (n=49) answered 'No', followed by 19.2% (n=14) answering 'I don't know', while only 13.7% (n=10) answered 'Yes' group. In this 'Yes' group the participants stated that they use the 'Wells Score' however this is not a guideline for this cohort of patients and this will be further discussed in Chapter 7.

Table 4.21: ANP Use of Guidelines
Do you use any other guidelines to aid in the management of VTE in patients with lower limb immobilisation?

	Frequency	Percentage
Yes	10	13.7
No	49	67.1
I don't know	14	19.2
Total	73	100

In Table 4.22 there are five subgroups of respondents based on "If Yes, then which of these guidelines do you use". 54.8% (n=40) of the respondents did not answer the question, the majority of respondents, 20.5% (n=15) belonged to the 'None of the above' group, followed by 9.6% (n=7) to the 'I don't know' group, followed by 8.2% (n=6) to the (other) group, followed by 5.5% (n=4) to the 'National Institute for Health and Clinical Excellence (NICE): 2012 guidelines' group, while only 1.4% (n=1.4) belonged to the 'College of Emergency Medicine 2012'.

Table 4.22: Which Guidelines do ANP Use?
If Yes, which of these guidelines do you use?

	Frequency	Percentage
National Institute for Health and Clinical Excellence (NICE): 2012 guidelines	4	5.5
Scottish Intercollegiate Guidelines Network (SIGN) (SIGN 122) guidelines	0	0
European Society of Anesthesiology (ESA) 2017 guidelines	0	0
College of Emergency Medicine 2012	1	1.4
Plymouth Guidelines	0	0
BCSH Guidelines	0	0
ACCP Guidelines	0	0
I don't know	7	9.6
All of the above	0	0
None of the above	15	20.5
Other	6	8.2
Missing	40	54.8
Total	73	100

In Table 4.23 there are seven subgroups of respondents based on "Which risk assessment form does your hospital use?" The majority of respondents 39.7% (n=29) belonged to 'None of the above' group, followed by 35.6% (n=26) to 'I don't Know', followed by 11.0% (n=8) to 'other', followed by 4.1% (n=3) to 'GEMNet Risk Factors Score' and 'Modified Caprini Score', and only 2.7% (n=2) to 'Plymouth Rule Version 2' and 'Plymouth Rule Version 3' groups each. In the comment box for the 'other' section the respondents had written 'Wells

Score' and 'policy based on Plymouth guidelines', however as previously mentioned in Table 4.21 this is not a guideline for this cohort of patients and this will also be further discussed in Chapter 7.

Table 4.23: Risk Assessment Forms Used in Hospitals
Which risk assessment form does your hospital use?

	Frequency	Percentage
Plymouth Rule Version 2	2	2.7
Plymouth Rule Version 3	2	2.7
GEMNet Risk Factors Score	3	4.1
L-TRIP Score	0	0
Modified Caprini Score	3	4.1
I don't know	26	35.6
All of the above	0	0
None of the above	29	39.7
Other	8	11.0
Total	73	100

In Table 4.24 there are seven subgroups of respondents based on "Which risk assessment form do you use in clinical practice?" The majority of respondents 53.4% (n=39) belonged to "None of the above" group, followed by 17.8% (n=13) to the "I don't Know" group, followed by 11% (n=8) to the "other" group, followed by 5.5% (n=4) to "Plymouth Rule Version 2" and 6.8% (n=5) "Plymouth Rule Version 3" groups, followed by 4.1% (n=3) to "Modified Caprini Score" and only 1.4% (n=1) belonged to "All of the above" group. In the comment box for the 'other' section the respondents had written 'Wells Score' for seven of the responses and one had responded with 'policy based on Plymouth guidelines', however these are not risk assessment forms and would not be used for this cohort of patients, this will also be further discussed in Chapter 7.

Table 4.24: ANP Use of Risk Assessment Forms
Which risk assessment form do you use in clinical practice?

	Frequency	Percentage
Plymouth Rule Version 2	4	5.5
Plymouth Rule Version 3	5	6.8
GEMNet Risk Factors Score	0	0
L-TRIP Score	0	0
Modified Caprini Score	3	4.1
I don't Know	13	17.8
All of the above	1	1.4
None of the above	39	53.4
Other	8	11
Total	73	100

In Table 4.25 there are six subgroups of respondents based on "How often are any or all of the previously mentioned guidelines or risk assessment forms used in your department?" The majority of respondents 20.5% (n=15) belonged to the "sometime" group, followed by 19.2% (n=14) belonged to the "rarely" group, followed by 16.4% (n=12) to the "no guidelines in the department" group, followed by 15.1% (n=11) to "always" and "usually", while only 13.7% (n=10) belonged to the "never" group.

Table 4.25: How Often Are Risk Assessment Forms Used?
How often are any or all of the previously mentioned guidelines or risk assessment forms used in your department?

	Frequency	Percentage
Always	11	15.1
Usually	11	15.1
Sometimes	15	20.5
Rarely	14	19.2
Never	10	13.7
No guidelines in the department	12	16.4
Total	73	100

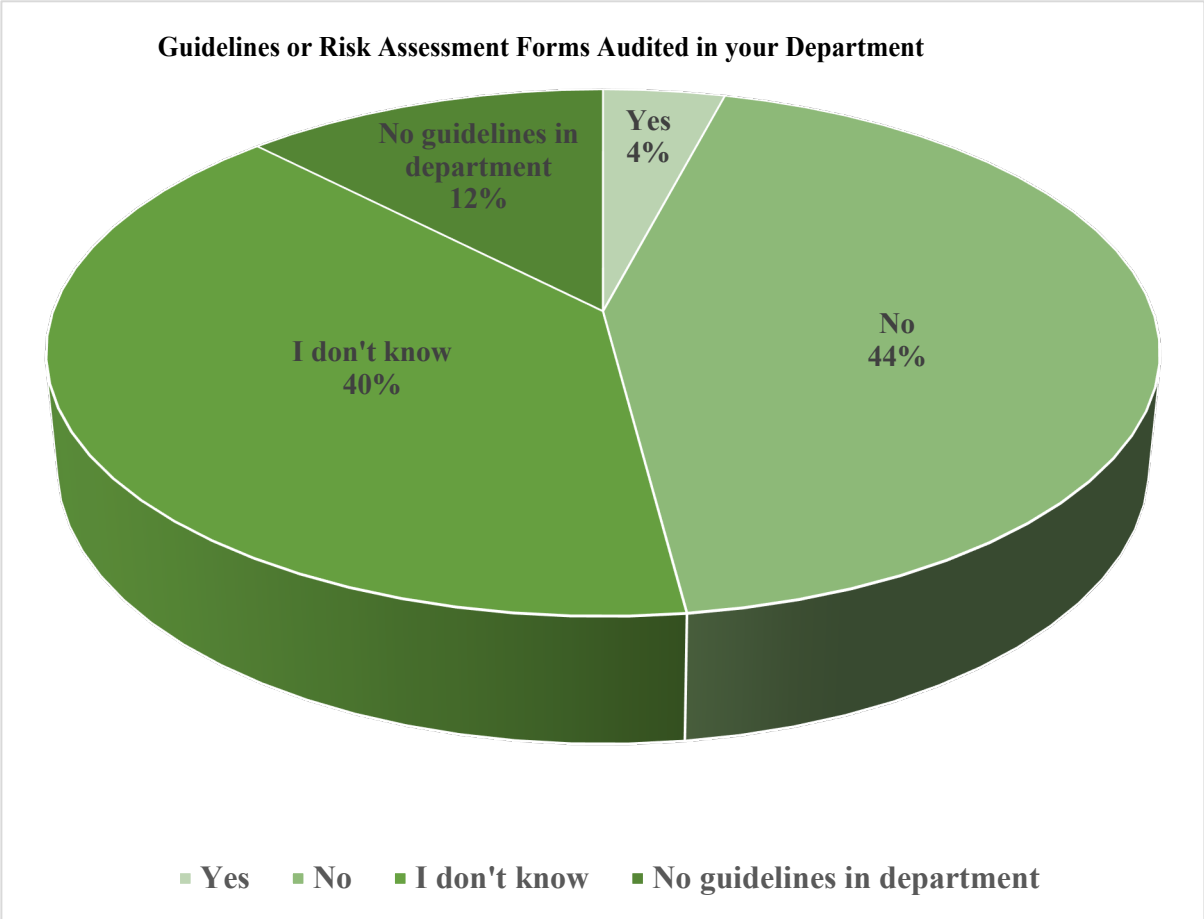
In Table 4.26 there are four subgroups of respondents based on "Have any of the previously mentioned guidelines or risk assessment forms ever been audited in your department?" The majority of respondents 43.9% (n=32) belonged to the "no" group, followed by 39.7% (n=29) to the "I don't know" group, followed by 12.3% (n=9) to the "no guidelines in the department" group, while only 4.1% (n=3) belonged to the "yes" group (Figure 4.7)

Table 4.26: Audit of VTE Guidelines and Risk Assessment Form
Have any of the previously mentioned guidelines or risk assessment forms ever been audited in your department?

	Frequency	Percentage
Yes	3	4.1
No	32	43.9
I don't know	29	39.7
No guidelines in the department	9	12.3
Total	73	100

Only 4.1% (n=3) had previously audited guidelines used within their hospitals.

Figure 4.7: Guidelines or Risk Assessment Forms Audited in your Department



4.7 Clinical Practice

The next stage of analysis was to see how the ANP's current knowledge and the clinical guidelines of their hospital affect their clinical practice daily when it comes to patients with lower limb immobilisation and their potential risk of developing a VTE.

There are four subgroups of respondents in Table 4.27, asking "Are you aware of any patients who have returned to your department with a complication associated with a lower limb immobilisation while commenced on a prophylaxis?" The majority of respondents 72.6% (n=53) belonged to the "no" group, followed by 13.7% (n=10) to "I don't know", followed by 12.3% (n=9) to "yes", while only 1.4% (n=1) belonged to "other". The one respondent who wrote other stated that it was 'not applicable'.

Table 4.27: Returned Patients on Prophylaxis with Lower Limb Immobilisation
Are you aware of any patients who have returned to your department with a complication associated with a lower limb immobilisation while commenced on a prophylaxis?

	Frequency	Percentage
Yes	9	12.3
No	53	72.6
I don't know	10	13.7
Other	1	1.4
Total	73	100

Table 4.28 asked four questions to determine the relation between "are you aware of any patients who have returned to your department with a complication associated with a lower limb immobilisation while commenced on a prophylaxis?" and varied clinical decision making statements.

In regards to varied clinical decision-making statements, a standard deviation was (SD = 1.52) and total mean = 2.99. The question means were ranged between (2.51 – 3.47). The lowest mean belonged to question two which stated: "How often do you complete a VTE risk assessment on your patients with lower limb immobilisation?" (M=2.51) (Figure 4.8 & Table 4.29), followed by question four "I usually base clinical decisions concerning VTE on one or more guidelines" (M=2.90) then question one "I use my clinical judgment instead of a recognised assessment tool (M=3.10)" then followed by question three "If you assess patients with lower limb immobilisation for VTE do you document this?" (M=3.47) (Table 4.30).

Table 4.28: Chi-Square Clinical Decision Making
Your clinical decision making Chi-Square

	Mean	SD	X2	df	P
I use my clinical judgment instead of a recognised assessment tool.	3.10	1.335	7.572	12	.818
How often do you complete a VTE risk assessment on your patients with lower limb immobilisation?	2.51	1.520	11.031	12	.526
If you assess patients with lower limb immobilisation for VTE do you document this?	3.47	1.667	9.805	12	.633
I usually base clinical decisions concerning VTE on one or more guidelines.	2.90	1.565	7.809	12	.800
Total	2.99	1.52			

Note: SD=Standard Deviation. X2=Chi-Square. df=Degree of Freedom. P=Significance level

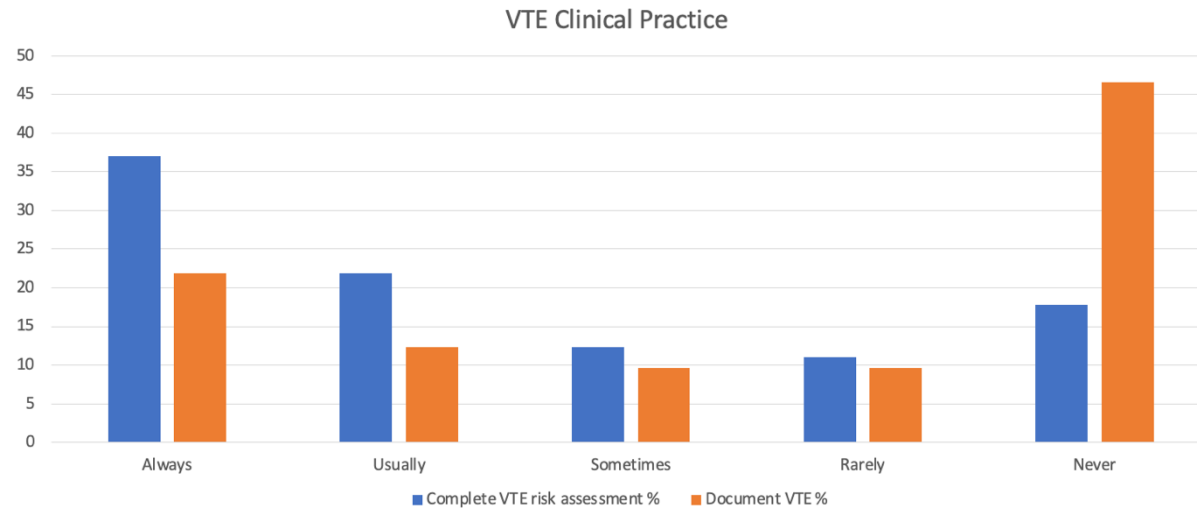
Table 4.29: How often is VTE risk assessment completed?

How often do you complete a VTE risk assessment on your patients with lower limb immobilization?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Always	27	37.0	37.0	37.0
	Usually	16	21.9	21.9	58.9
	Sometimes	9	12.3	12.3	71.2
	Rarely	8	11.0	11.0	82.2
	Never	13	17.8	17.8	100
	Total	73	100.0	100.0	

Table 4.30: Document VTE risk assessment

If you assess patients with lower limb immobilization for VTE, do you document this?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Always	16	21.9	21.9	21.9
	Usually	9	12.3	12.3	34.2
	Sometimes	7	9.6	9.6	43.8
	Rarely	7	9.6	9.6	53.4
	Never	34	46.6	46.6	100
	Total	73	100.0	100.0	

Figure 4.8: How often do you complete a risk assessment for VTE



The opinion that "There is a significant relation between ANP knowledge of patients returned to their department with a complication associated with a lower limb immobilisation while commenced on a prophylaxis?" and "clinical decision-making statements" None of these statements in table 4.28 were statistically significant therefore there is evidence to fail to reject

the null hypothsis "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* . (Table 4.28). Table 4.31 highlights three subgroups of respondents based on "Do you routinely prescribe VTE prophylaxis for patients with lower limb immobilisation?" The majority of respondents 90.4% (n=66) belonged to the "no" group, followed by 8.2% (n=6) belonging to the "yes" group, only 1.4% (n=1) belonged to the "I don't know" group.

Table 4.31: ANP Routinely Prescribe Prophylaxis
Do you routinely prescribe VTE prophylaxis for patients with lower limb immobilisation?

	Frequency	Percentage
Yes	6	8.2
No	66	90.4
I don't know	1	1.4
Total	73	100

In Table 4.32 there are eight subgroups of respondents based on "What do you routinely prescribe for VTE prophylaxis for patients with lower limb immobilisation?". The majority of respondents 46.6% (n=34) belonged to the "None of the above" group, followed by 23.2% (n=17) that belonged to the "LMWH" group, followed by 13.7% (n=10) to the "I don't know" group, followed by 6.8% (n=5) to the "anti-embolic stockings" groups, followed by 4.1% (n=3) to the "NOAC" group, 2.7% (n=2) to the "Asprin" group, followed by the "Rivaroxiban" group and "Warfarin" group with 1.4% (n=1) in each group. There were no 'other' comments noted with this question, however, 'anti-embolic stockings' at 6.8% (n=5) prescribing this to a patient with a limb injury needs further discussion in Chapter 7.

Table 4.32: Types of Prophylaxis Prescribed by ANP
What do you routinely prescribe for VTE prophylaxis for patients with lower limb immobilisation?

	Frequency	Percentage
LMWH	17	23.2
NOAC	3	4.1
Rivaroxiban	1	1.4
Warfarin	1	1.4
Asprin	2	2.7
Anti-embolic stockings	5	8.2
All of the above	0	0
None of the above	34	46.6
I don't know	10	13.7
Other	0	0
Total	73	100

However, as seen in Table 4.32, 32.85% (n=24) ANPs listed that they prescribe a variety of different prophylaxis even though only 8.2% (n=6) stated 'yes' as seen in Table 4.31.

Table 4.33 There are five subgroups of respondents based on "How much do patient's preferences influence your decision?" It is reassuring that ANPs are confident in their practice when the majority of respondents 42.4% (n=31) said that patient preferences "Never" influence their decision. This was followed by the "Sometimes" group with 23.3% (n=17) each, then the "rarely" group were 15% (n=11) and both "Occasionally" and "frequently" groups were 9.6% (n=7) each.

Table 4.33: Patient's Preference Influence Decision Making
How often do patient's preferences influence your decision?

	Frequency	Percentage
Frequently	7	9.6
Occasionally	7	9.6
Sometimes	17	23.3
Rarely	11	15
Never	31	42.4
Total	73	98.6

In regards of VTE risk assessment of patients with lower limb immobilization, a standard deviation (SD = 1.56) and total Mean = 2.45. The lowest mean belonged to question four which stated: "Do you measure the height of the patient?" (mean=1.90, five which stated: "Do you calculate the patient's BMI? (M=2.27)", then question one which stated: "Do you complete a VTE risk assessment form for patients with lower limb immobilisation?" (M=2.29) followed by question eight which stated: "Do you give patients written information about VTE prophylaxis?" (M=2.37), then question two "Do you complete the VTE risk assessment form in conjunction with the patient?" (M=2.53) then question seven "Do you give patients written information about VTE risks while in lower limb immobilisation?" (M=2.67), then followed by question six "Do you discuss with the patient risks and benefits of thrombolysis?" (M=2.7) and question three that stated "Do you weigh the patient?" (M=2.88) (Table 4.34).

Table 4.34 explains how the results were significant in terms of the fifth statement, "Do you calculate the patients BMI?", X2 (8, N = 73) 16.570 with $p < 0.05$), also the sixth statement "Do you discuss with the patient risks and benefits of thrombolysis?", X2 (8, N = 73) 21.278 with $p < 0.05$) and the eighth statement "Do you give patients written information about VTE prophylaxis?", X2 (8, N = 73) 16.788 with $p < 0.05$). Since the Chi-square values are greater than the (Critical chi-square value = 15.51) at (df = 8 crossed with p = 0.05). Thus, the

assumption "There is a relation between: Do you routinely prescribe VTE prophylaxis for patients with lower limb immobilisation? and varied VTE risk assessment of patients with lower limb immobilization" The null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge and VTE assessment for patients with lower limb immobilisation.

On the other hand, the other statements in Table 4.34 (statement one, two, three, four, and seven) were not statistically significant. The hypothesis "There is a relation between do you routinely prescribe VTE prophylaxis for patients with lower limb immobilisation?" and VTE risk assessment of patients with lower limb immobilization (statements one, two, three, four, and seven) there is evidence to fail to reject the null hypothesis "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* .

Table 4.34: Chi-Square VTE Risk Assessment of Patients

VTE risk assessment of patients with lower limb immobilization Chi-Square.

		Mean	SD	X2	df	P
1	Do you complete a VTE risk assessment form for patients with lower limb immobilisation?	2.29	1.541	10.922	8	.206
2	Do you complete the VTE risk assessment form in conjunction with the patient?	2.53	1.708	7.306	8	.504
3	Do you weigh the patient?	2.88	1.490	12.399	8	.134
4	Do you measure the height of the patient?	1.90	1.386	13.373	8	.100
5	Do you calculate the patients BMI?	2.27	1.502	16.570	8	.035
6	Do you discuss with the patient risks and benefits of thrombolysis?	2.70	1.613	21.278	8	.006
7	Do you give patients written information about VTE risks while in lower limb immobilisation?	2.67	1.667	10.822	8	.212
8	Do you give patients written information about VTE prophylaxis?	2.37	1.603	16.788	8	.032
Total		2.45	1.56			

Note: SD=Standard Deviation. X2=Chi-Square. df=Degree of Freedom. P=Significance level

4.8 Barriers and Facilitators

As previously mentioned in Table 4.24 only 16.4% (n=12) of ANPs complete recognised VTE risk assessments within their clinical practice for patients with lower limb immobilisation. I needed to establish the reason for this lack of adherence. It emerged that 61.7% (n=45) of ANPs stated that barriers existed within their emergency setting.

Table 4.35 looks at three subgroups of respondents based on "Are there barriers that exist to prevent you from assessing patients with lower limb immobilisation for VTE?" The majority of respondents 61.7% (n=45) belonged to the "yes" group, followed by 26.0% (n=19) belonging to the "no" group, while only 12.3% (n=9) belonged to the "I don't know" group.

Table 4.35: Are There Existing Barriers
Are there barriers that exist to prevent you from assessing patients with lower limb immobilisation for VTE?

	Frequency	Percentage
Yes	45	61.7
No	19	26.0
I don't know	9	12.3
Total	73	100

The barriers that exist were further investigated and broken down into fourteen different statements.

Table 4.36, shows 14 questions which were asked to determine the relation between barriers that exist preventing the ANPs from assessing patients with lower limb immobilisation for VTE and what these varied barriers are that entail the respondents in their own clinical setting preventing them from assessing patients for risk of VTE.

A chi-square test of independence was performed as shown below to examine the relation between "are there barriers that exist to prevent you from assessing patients with lower limb immobilisation for VTE?" and varied barriers in respondents' own clinical setting that prevent them from assessing patients for risk of VTE.

In regards to which of these are barriers in your own clinical setting, that prevent you from assessing patients for risk of VTE, a standard deviation (SD = 0.455) and total mean = 1.56. The lowest mean belonged to question twelve which stated: "No clear guidelines (M=1.22)".

The result was significant in terms of the fourth statement ("No education provided", X2 (2, N = 73) 20.063 with p <0.05), and the ninth statement ("No VTE risk assessment forms available"), X2 (2, N = 73) 8.811 with p <0.05). The speculation that "There is a relationship between are there barriers that exist to prevent you from assessing patients with lower limb immobilisation for VTE? and varied barriers in respondents' own clinical setting that prevent them from assessing patients for risk of VTE" (statements four and nine) The null hypothesis states "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* - there is evidence to reject the null hypothesis proving the lack of knowledge and VTE assessment for patients with lower limb immobilisation due to barriers within their clinical setting.

On the other hand, the other statements in Table 4.36 (statements one, two, three, five, six, seven, eight, ten, eleven, twelve, thirteen and fourteen) were not statistically significant. The hypothesis "Barriers don't exist within the clinical setting that prevent ANPs from assessing patients with lower limb immobilisation for VTE setting" (statements one, two, three, five, six, seven, eight, ten, eleven, twelve, thirteen and fourteen)" there is evidence to fail to reject the null hypothesis "*That within the emergency setting, there is knowledge and VTE risk assessment is performed for all patients with lower leg injuries resulting in immobilisation'* . Statement fourteen will be further discussed in Chapters 5 and 6.

Table 4.36: Which of These Barriers Prevent ANPs From Assessing Patients?
Which of these are barriers in your own clinical setting that prevent you from assessing patients for risk of VTE?

		Mean	SD	X2	df	P
1	Too busy	1.70	.462	1.640	2	.440
2	Forget about completing form	1.78	.417	.011	2	.994
3	No policy in your clinical setting	1.29	.456	4.988	2	.083
4	No education provided	1.26	.444	20.063	2	.000
5	No discharge advice for patients	1.45	.501	1.729	2	.421
6	No height chart for measuring patients	1.55	.501	3.939	2	.140
7	No weighting scales for patients	1.90	.296	.554	2	.758
8	No BMI conversion chart	1.66	.478	2.134	2	.344
9	No VTE risk assessment forms available	1.40	.494	8.811	2	.012
10	Poor staff skill mix	1.64	.482	4.807	2	.090
11	Constant interruptions while with patients	1.66	.478	4.149	2	.126
12	No clear guidelines	1.22	.417	3.538	2	.171
13	No equipment available to give patients	1.59	.495	2.333	2	.311
14	Other	1.73	.450	3.044	2	.218
Total		1.56	0.455			

Note: SD=Standard Deviation. X2=Chi-Square. df=Degree of Freedom. P=Significance level

Table 4.37, shows there are three subgroups of respondents based on "Are there facilitators that you encounter that enable and allow you to prescribe VTE prophylaxis treatment for patients within the ED that have sustained a lower limb fracture?". The majority of respondents 49.3% 9n=36) belonged to the "no" group, followed by 27.4% (n=20) belonging to the "yes" group, while 23.3% (n=17) belonged to the "I don't know" group. The 27.4% (n=20) ANPs that answered yes were further required to comment on these facilitators that exist and this will be further investigated in Chapter 6.

Table 4.37: Enabling Facilitators

Are there facilitators that you encounter that enable and allow you to prescribe VTE prophylaxis treatment for patients within the ED that have sustained a lower limb fracture?

	Frequency	Percentage
Yes	20	27.4
No	36	49.3
I don't know	17	23.3
Other	0	0
Total	73	100

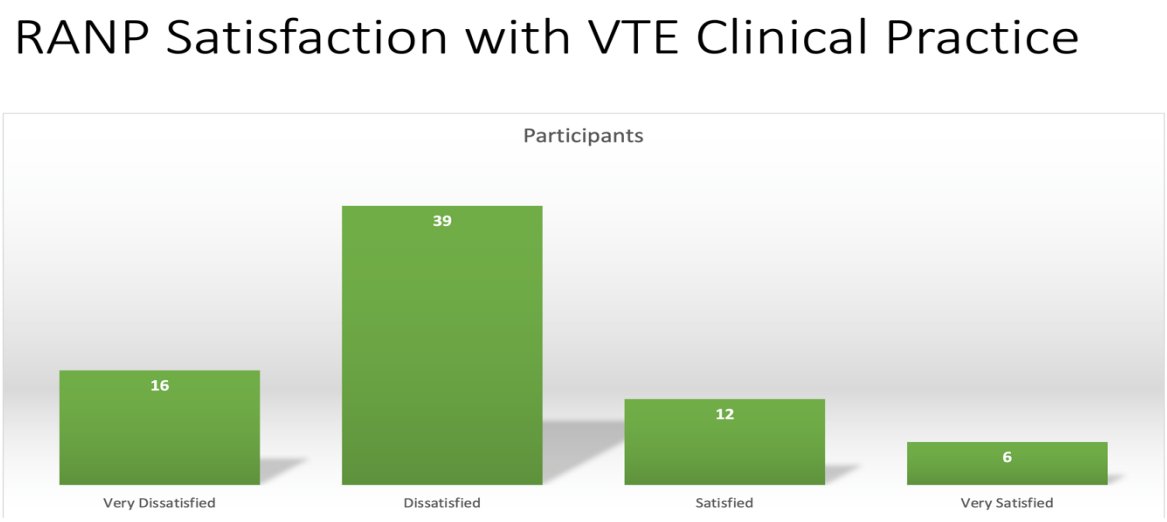
In Table 4.38, there are four subgroups of respondents based on "How satisfied are you with your current practice in relation to VTE risk and prevention for patients within the ED that have sustained a lower limb fracture?" The majority of respondents 53.4% (n=39) belonged to the "dissatisfied" group, followed by 21.9% (n=16) belonged to the "very dissatisfied" group, while 16.4% (n=12) belonged to the "satisfied" group and 8.2% (n=6) belonged to the "very satisfied" group (Figure 4.9).

Table 4.38: ANP Satisfaction with Current VTE Practice

How satisfied are you with your current practice in relation to VTE risk and prevention for patients within the ED that have sustained a lower limb fracture?

	Frequency	Percentage
Very Satisfied	6	8.2
Satisfied	12	16.4
Dissatisfied	39	53.5
Very Dissatisfied	16	21.9
Total	73	100

Figure 4.9 Satisfaction with current practice in relation to VTE risk and prevention



The majority of ANPs (75.4% n=55) currently managing patients with lower limb injuries resulting in immobilisation are not satisfied with their current practice. This highlights the importance of this topic and the possible need for change in the management of these patients.

Table 4.39 shows the frequency and percentage of the respondents according to "Are you aware of any patients who have returned to your department and were diagnosed as having a VTE as a result of a lower limb immobilisation?" The majority of respondents 46.6% (n=34) belonged to the positive response "Yes", followed by 45.2% (n=33) to the "No" group, while 8.2% (n=6) belonged to the "I don't know" group.

Table 4.37 and Table 4.38 reflect that patients are returning with VTE as a result of lower limb immobilisation but the ANPs are not equipped to manage these patients.

Table 4.39: Awareness of Returning Patients Diagnosed with VTE in Immobilisation
Are you aware of any patients who have returned to your department and were diagnosed as having a VTE as a result of a lower limb immobilisation?

	Frequency	Percentage
Yes	34	46.6
No	33	45.2
I don't know	6	8.2
Total	73	100

Table 4.40 shows the frequency and percentage of the respondents according to "Would you like to receive education or training about VTE risk and lower limb immobilisation?": It clarifies that the majority of respondents 94.5% (n=69) belonged to the "Yes" group, while

only 5.5% (n=4) belonged to the "No" group. This is encouraging to see that education and training would be welcomed.

Table 4.40: Acceptance to Received Education
Would you like to receive education or training about VTE risk and lower limb immobilisation?

	Frequency	Percentage
Yes	69	94.5
No	4	5.5
I don't know	0	0
Other	0	0
Total	73	100

Table 4.41 shows the frequency and percentage of the respondents according to "Do you think patients should be informed about the risk of VTE when placed in a lower limb immobilisation?": It clarifies that the majority of respondents 100% (n=73) belonged to the positive "Yes" Group and believe that patients need to be informed of their risks. How ANP can inform them if they do not have the knowledge themselves, will be discussed in Chapter 7.

Table 4.41: Informing Patients in Relation to VTE
Do you think patients should be informed about the risk of VTE when placed in a lower limb immobilisation?

	Frequency	Percentage
Yes	73	100
No	0	0
I don't know	0	0
Total	73	100

Table 4.42 shows the frequency and percentage of the respondents according to "Do you regard this as an important issue?" It clarifies that the majority of respondents 98.6% (n=72) belonged to the "Yes" group, and only 1.4% (n=1) belonged to the "I don't know" group.

Table 4.42: Important Issue
Do you regard this as an important issue?

	Frequency	Percentage
Yes	72	98.6
No	0	0
I don't know	1	1.4
Total	73	100

4.9 Summary of Results

In summary, the participants' responses offered great insight into the issues that arise within their clinical setting concerning fulfilling their complete management of care when it comes to assessing the VTE risk of patients being discharged from the ED setting. These analyses have explored the perceptions of ANPs in relation to VTE risk assessment in patients sustaining a lower limb injury requiring immobilisation. The results obtained have addressed the two quantitative research questions, thus providing an insight into the perceptions of the sample population. Analysis of the data has highlighted several significant results. The data that has emerged through this chapter has assisted in answering the overarching research question "How do Emergency ANP evaluate VTE risk in patients with lower limb injuries in their clinical practice?"

The two specific quantitative research questions that were asked in Chapter 3 and analysed in Chapter 4 will be discussed.

What is the current knowledge that emergency advanced nurse practitioners have regarding VTE risk assessment and prophylaxis in patients with lower limb immobilisation?

and

How do emergency advanced nurse practitioners identify patients who are most at risk of developing a VTE as a result of lower limb immobilisation?

The overall level of knowledge of the participants in this study was insufficient. 61.7% (n=45) of the ANPs rated their knowledge as poor or fair. This study highlighted that the majority of the participants 69.9% (n=51) had never attended a course or in-service programme in relation to VTE risk. Of those that had attended a course only 16.4% (n=12) regarded the quality of the course as very good or excellent. When asked about their knowledge regarding clinical guidelines and risk assessment tools this highlights a clear deficit in knowledge. Only 47.9% (n=35) of ANP were familiar with the recognised general evidence-based VTE risk assessment guidelines while 13.6% (n=10) were familiar with the relevant risk assessment tools available. It was surprising to discover in this study, that the participants who are on a daily basis diagnosing and treating patients who require lower limb immobilisation do not have the required knowledge to prevent VTE from occurring resulting in further risk and mortality to

their patients. When asked about the risk factors that exist for patients with lower limb immobilisation only three risk factors from the possible nineteen were deemed relevant as a significant risk, these included patients who previously had a history of deep vein thrombosis or a pulmonary embolism as well as patients who recently had pelvic surgery. The participants did not regard any of the other statements as a potential risk factor.

Concerning guidelines, it was discovered that only 49.3% (n=36) of ANPs working in hospitals in the country are using VTE guidelines. 42.5% (n=31) stated that their hospital did not have any guidelines and a further 8.2% (n=6) were not aware and did not know if they had these guidelines in their hospital setting.

With further questions, it transpired that out of the 49.3% (n=36) ANPs that stated that their hospital had guidelines, 21.9% (n=16) did not know which guidelines the hospital used. There appears to be a lack of knowledge when it comes to the VTE risk assessment and DVT diagnosis Wells Score tool. The 13.6% (n=10) that stated 'other' claimed they use the Wells Score which as mentioned is not a VTE risk assessment tool. This highlights a lack of knowledge as this guideline is used for suspected DVT diagnosis and not VTE prevention. Only 32.8% (n=24) stated that their hospital uses appropriate internationally recognised evidence-based VTE risk assessment guidelines relevant to the cohort of patients in this study. Concerning appropriate risk assessment tools used by ANPs, 13.7% (n=10) of the participants in this study stated that their hospital uses risk assessment, however when they were asked if they individually use risk assessment tools in their clinical practice 16.4% (n=12). Are ANPs using their own guidelines and risk assessment tools in practice that have not been approved by the hospital? All guidelines and risk assessment tools must be audited to ensure they capture and are appropriate for the cohort they are being used on. From this study, only 4.1% (n=3) of the clinical guidelines and risk assessment tools had ever been audited within the clinical setting.

One of the ANP roles within the ED setting is prescribing medication relevant to their patients, however, it transpired that only 8.2% (n=6) of ANP routinely prescribe VTE prophylaxis if necessary to high-risk patients with lower limb immobilisation. As ANP are autonomous in their practice and also have nurse prescribing qualifications only 8.2% (n=6) would prescribe if a patient is at risk of developing VTE. Are they going to their medical colleagues to get prophylaxis prescribed or are the patients being discharged without any prophylaxis?

It was reassuring that 42.4% (n=31) never and 15% (n=11) rarely allowed patients to influence their decision making concerning VTE prophylaxis and the management of the patient. ANPs as senior decision makers should be confident in their clinical decision making. Table 4.35 highlighted that there was a significant relationship between the ANPs who discussed with the patient the risks and benefits of thrombolysis, X2 (8, N = 73) 21.278 with p <0.05), calculated the patient BMI, X2 (8, N = 73) 16.570 with p <0.05) as well as providing patients written information about VTE prophylaxis, X2 (8, N = 73) 16.788 with p <0.05) and those who prescribe thromboprophylaxis for these patients.

I appreciate that several barriers prevent and hinder the ANPs from assessing the risk of patients with lower limb immobilisation. Lack of education was considered the biggest barrier in preventing ANP from the management of VTE risk within the clinical setting, with the second largest barrier being due to the lack of availability of relevant VTE risk assessment forms. 46.6% (n=34) of ANP are aware of patients within their department who have had unplanned returns to their department and were diagnosed with a DVT as a result of lower limb immobilisation. Therefore, it is not surprising that 75.3% (n=55) of ANP are either dissatisfied or very dissatisfied with their current practice in relation to VTE risk assessment and prevention for patients within the ED setting who have sustained a lower limb injury. The majority of ANP (98.6% n=72) in this study regard this topic as an important issue in their clinical practice and 100% (n=73) agree that patients should be informed about the risks of developing VTE as a result of lower limb immobilisation. It is encouraging to see that 94.5% (n=69) of ANP in this study would like to receive education and training about VTE risk and lower limb immobilisation.

These results have highlighted the specific lack of knowledge and adherence to guidelines and completion of risk assessment tools within everyday clinical practice. As a DVT can remain hidden under a brace or plaster cast it is vitally important that high-risk patients are identified prior to application of the lower limb immobilisation.

Chapter Five: Presentation of Qualitative Findings

5.1 Introduction

This chapter will provide an overview of the thematic analysis stages used and report the results from the participants answering a combination of comment boxes and open-ended questions as discussed in Chapter 3. From the analysis, four deductive themes were found, knowledge and education, clinical guidelines, clinical practice issues and barriers and facilitators that exist. However, within each theme, various components overlapped with other themes, such as lack of guidelines appearing in guidelines, clinical practice and barriers and facilitators.

As this study is using a parallel results convergent mixed-methods research design approach, the qualitative findings are reported independent of the quantitative analysis however, there will be a synthesis of qualitative and quantitative findings in the next chapter.

5.2 Computer-Assisted Qualitative Data Analysis

NVivo 12.0, a computer-assisted qualitative data analysis software (CAQDAS) package, was used in conjunction with manual data analysis. Welsh (2002) suggested that using a combination of both manual and computer-assisted methods is likely to achieve the best results. The data was downloaded from the JISC Questionnaire platform onto an Excel spreadsheet and then imported into NVivo. NVivo is designed for rich text-based data sets where in-depth analysis is required (QSR International 2020). NVivo enables the researcher to identify trends and allows for the examination of thematic relationships through the process of coding nodes. The dissecting of words and sentences into meaningful codes enables the researcher to link, shape, search and model themes, subthemes and relationships giving rise to a detailed analysis (QSR International 2020). The NVivo software was used to assist in qualitative data management as it allows for systematically organising the data allowing for a comprehensive analysis to be performed. The usefulness of engaging computer-assisted packages such as NVivo in qualitative research data analysis has been debated in the literature. Some qualitative theorists state that the use of computer software may inhibit the researcher to think through the data and draw their own conclusions (Baugh, Hallcom and Harris 2010).

5.3 Phases of Thematic Analysis

Clarke and Braun (2017) state that the hallmark of thematic analysis is its flexibility in addressing research questions, sample size, and data collection methods in both large and small research studies. In their earlier literature, they clearly define the thematic analysis model which lays out the phases necessary to complete before being able to identify the final themes that are generated from the data collected (Braun & Clarke 2006) (Table 5.1). A consistent approach is necessary in conducting a realist, deductive, thematic analysis (Nowell *et al* 2017). In the next section, I discuss how the six-step thematic analysis was applied in this research.

5.3.1 Phase One and Two

In stage one, each question response from the four open questions and the eight open comment boxes questions were entered verbatim and exported from the JISC online platform into a spreadsheet and then into the QSR NVivo version 12 software package. On the JISC online platform, each participant was given an automatically generated code, 471599-471590-46712803 is an example. Not every participant completed the open question or comment boxes. There were 52 out of the 73 participants that completed the questionnaire took part in the open questions and comment boxes. These 52 participants' JISC codes were recoded into a more manageable code such as ANP 1 (Appendix 16).

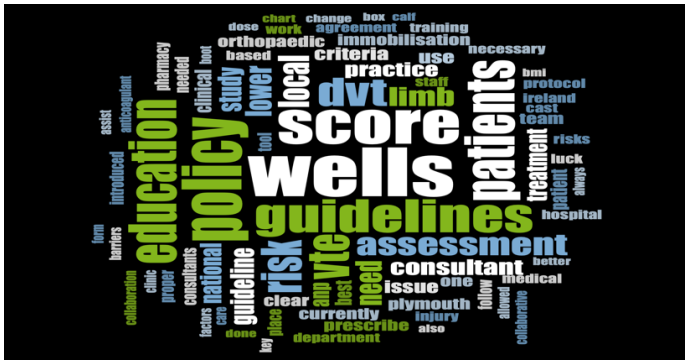
Moving on to phase two, enabled me to become familiar with the data through the process of data entry and therefore identifying some initial codes or themes. Reading and re-reading the data is a lengthy process but is necessary to establish initial codes.

Table 5.1 Six-step thematic analysis (adapted from Braun & Clarke 2006)

Phase		Examples of procedure for each step
1	Familiarising oneself with the data	Transcribing data; reading and re-reading; noting down initial codes
2	Generating initial codes	Coding interesting features of the data systematically across the data set, collating data relevant to each code
3	Searching for the themes	Collating codes into potential themes, gathering all data relevant to each potential theme
4	Involved reviewing the themes	Checking if the themes work in relation to the coded extracts and the entire data set; generate a thematic 'map'
5	Defining and naming themes	Ongoing analysis to refine the specifics of each theme; generation of clear names for each theme
6	Producing the report	Final opportunity for analysis selecting appropriate extracts; discussion of the analysis; relate back to research question or literature; produce report

During phase one of the thematic analysis it was evident that the participants had opinions in relation to the lack of guidelines and policies in their department which was seen in comments throughout the majority of questions (Figure 5.1). Braun and Clarke (2013) state that it is normal for the researcher to identify what is significant to them, therefore it is important as the researcher to take a step back and ensure while reviewing the data that all themes are identified and not just the themes that the researcher feels strongly about. Initial codes were generated by coding the whole data set.

Figure 5.1 Word Cloud from NVivo listing participants' comments

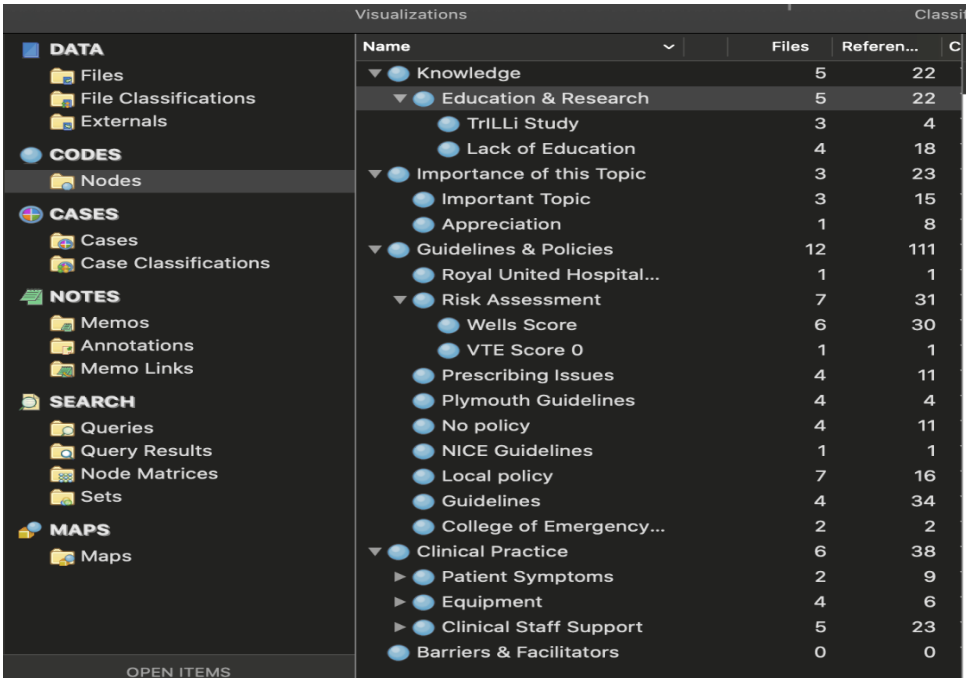


5.3.2 Phase three

The third phase begins when all data have been initially coded and collated, and a list of the different codes is identified across the data set (Nowell *et al* 2017). It is noted in the literature that there can be many levels of coding, however, too many levels can be counterproductive to

the goal of attaining clarity in organizing and interpreting the data (King, 2004). Data can be coded under several different themes as they fit, being uncoded, coded once, or coded as many times as deemed relevant by the researcher (Braun & Clarke, 2006). Hierarchical coding also allows the researcher to analyse texts at a variety of levels of specificity with broad higher-order codes providing an overview and detailed lower-order codes allowing for distinctions to be made within and between cases (King, 2004). Initial codes may begin to form main themes and other codes form subthemes (Nowell *et al* 2017, DeSantis & Ugarriza, 2000). Inductive and deductive codes were created and used to identify and link segments of the data together and to generate overarching themes to establish an accurate and transparent picture of the qualitative data (Braun & Clarke 2006). Inductive analysis is described as being data driven and it is a process of coding the data without trying to fit it into the researcher's pre-existing preconceptions (Nowell *et al* 2017). However, deductive analysis is driven by the researcher's analytic interest and may provide a more detailed analysis of the data (Braun & Clarke, 2006). The researcher must distinguish if they are using an inductive or deductive thematic analysis (Braun & Clarke, 2006). The deductive codes formed main themes such as knowledge, guidelines and policies, clinical practice and barriers and facilitators. However subthemes like equipment, clinical leads etc… were inductively (Figure 5.2). Phrases or single words that related to these themes were coded in the participants' language as they had written online.

Figure 5.2 Screenshot of the coding framework in NVivo



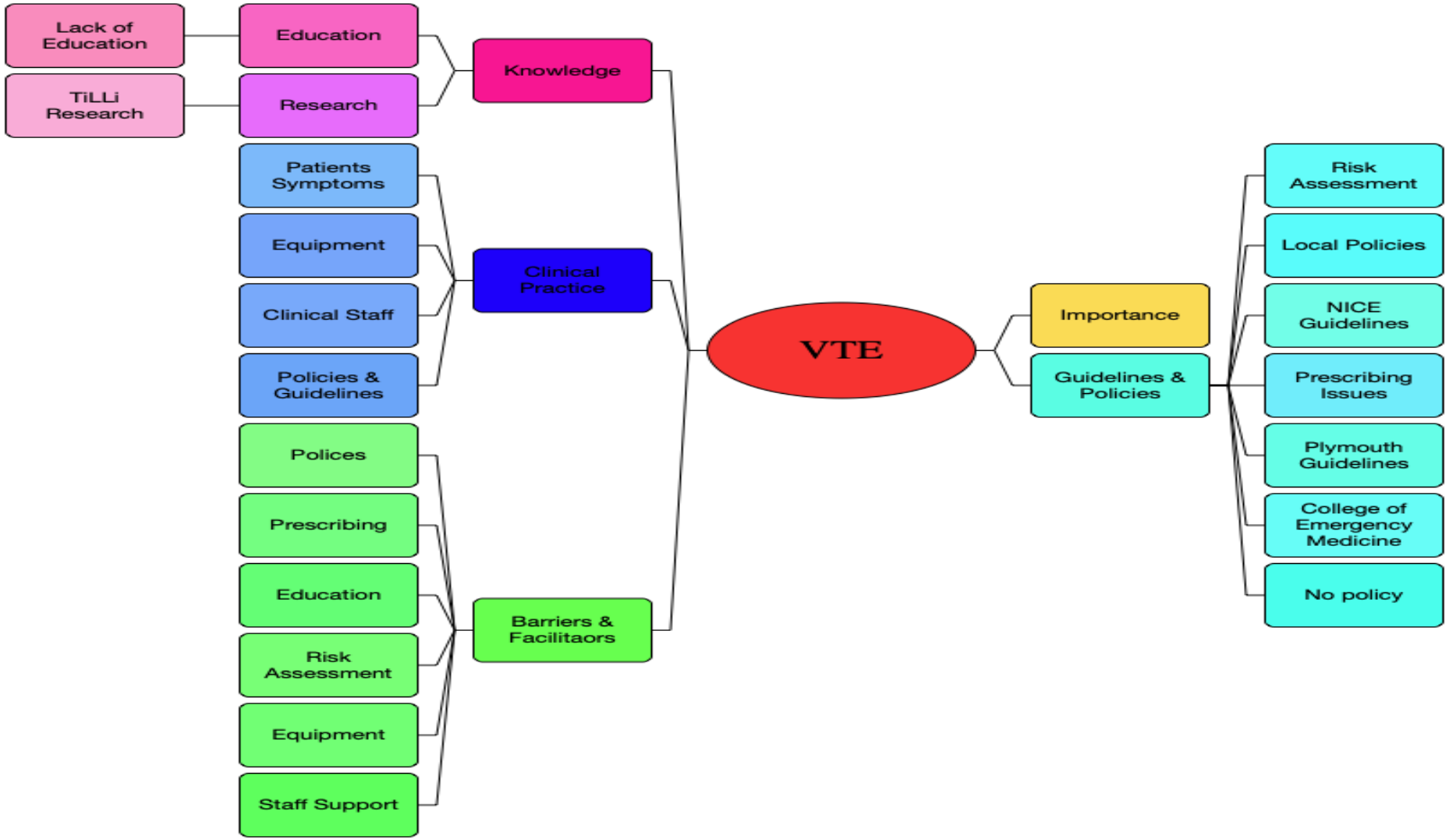
5.3.3 Phase four

The fourth phase begins once the themes have been devised and they require re-examination. I reviewed the data to establish if they appeared to form a consistent pattern. The reliability of the individual themes is reviewed and analysed to determine if the chosen themes accurately reflect the meanings evident in the data set as a whole (Braun & Clarke 2006). Phase four saw all codes being re-examined and determining if their content addressed the research questions being asked. A few codes were joined together as there was a degree of overlap, so *risk assessment* and *guidelines* were joined together under the general umbrella of *guidelines and policies*. This process involved constantly going back and forth, confirming and checking that all data was coded appropriately. The code name *patients' symptoms* contained some data that did not answer the research question and therefore was decoded. The code *no guidelines* and *local guidelines* joined together to form *guidelines and policies*. At this stage, the data was reduced into a more manageable set of significant codes, consisting of five in total. Braun and Clarke (2006) comment that the data within the chosen codes should cohere meaningfully, with a clear and identifiable distinction between each code. This is true in this study except for the code *barriers and facilitators* where there is a degree of overlap with the other codes. For the other four codes knowledge, importance of this topic, guidelines and policies and clinical practice further exploration took place to understand more about what they represent and what they actually say. This led to the fifth phase reviewing potential themes.

5.3.4 Phase five

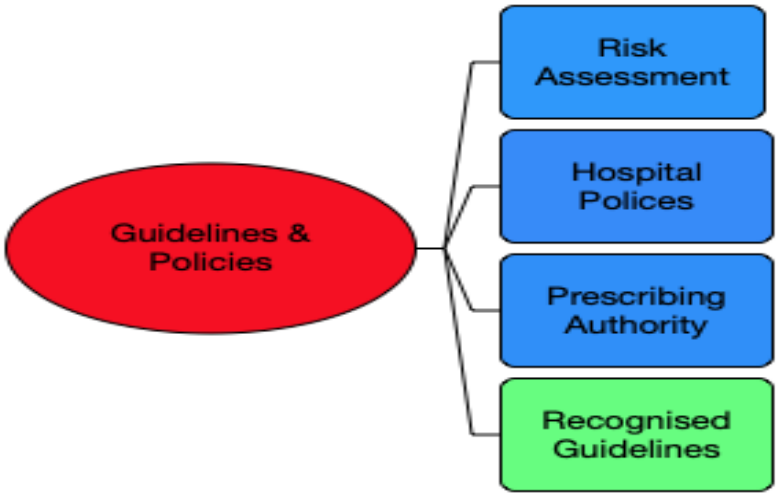
Braun and Clarke (2013) regard this process as an opportunity to assess the quality of the themes being suggested (Figure 5.3). Again, I checked across all themes for similarities and to ensure that the data could not be further refined. All the coded data for each theme was reviewed again to ensure that a clear pattern existed. The meanings of the codes in the dataset were also checked again to ensure they were accurately coded and linked to the theme with the utmost consistency. Meaningful themes were identified and illustrated with the aid of a mind map as in Figure 5.3.

Figure 5.3 NVivo Coding Mind Mapping of VTE Research themes



King (2004) suggests that themes should not be regarded as final until all of the data have been read through and the coding scrutinized at least twice. As a lone researcher, the data was read and re-read along with the coding many more times. Local policy and no policy joined together as hospital policies as the participants were talking about the policies that existed or did not in their hospital. All recognised guidelines in clinical practice were merged at this stage (NICE, Plymouth & College of Emergency Medicine). This resulted in a thematic map for guidelines and policies as illustrated in Figure 5.4. This new map illustrated the main themes which emerged from the qualitative research data.

Figure 5.4 Guidelines and Policies Thematic Map



The recognised guidelines that are highlighted in green, highlight the guidelines such as NICE, College of Emergency Medicine and Plymouth as opposed to the blue boxes which highlight issues that are specific local hospital issues. The changes in this theme had no impact on the other themes highlighted in Figure 5.4.

5.3.5 Phase Six

Braun and Clarke (2006) state that the final phase begins once the researcher has fully established the themes and is ready to begin the final analysis and write-up of the thematic analysis. This write-up should provide a detailed concise, coherent, logical account of the data within and across all the themes (Braun & Clarke 2006).

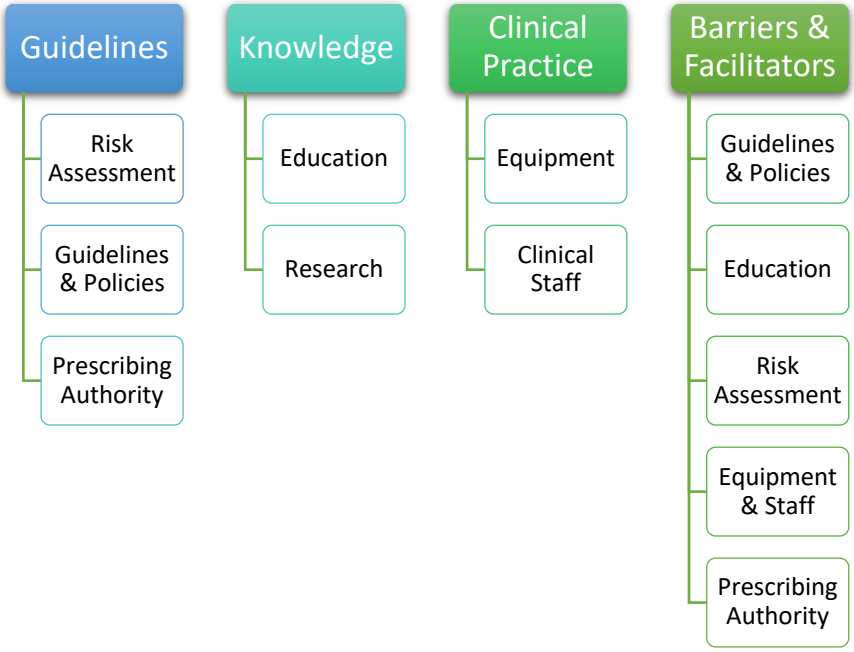
Each theme is defined in Table 5.2. All comments reported both positive and negative were transcribed verbatim in this study.

Table 5.2 Definitions of themes and subthemes

Theme & Subthemes	Definition
Risk Assessment	A *risk assessment* is a careful examination of what could cause harm to people.
Hospital Policies	A written statement that indicates clearly the position and values of the organisation on a given subject (NMBI 2021)
Guidelines	Defined as a principle or criterion that guides or directs action. Guideline development emphasizes using clear evidence from the existing literature, rather than expert opinion alone, as the basis for advisor materials (NMBI 2021)
Prescribing Authority	The registered nurse or midwife prescriber is required to prescribe within their scope of practice (NMBI 2021)
Education	The process of teaching or learning (Cambridge Dictionary 2021)
Research	A detailed study of a subject, especially in order to discover new information or reach a new understanding (Cambridge Dictionary 2021)
Equipment	The set of necessary tools, clothing etc.. for a particular purpose (Cambridge Dictionary 2011)
Clinical Staff	People who work in a hospital or healthcare setting
Knowledge	The cognitive representation of ideas, events or happenings. May be derived from practical or professional experience as well as from formal instruction or study, articulated in terms of description, memory, understanding, thinking, analysis, synthesis, debate and research (NMBI 2021)
Clinical Practice	Delivery of healthcare by healthcare professionals
Barriers	Anything that reduces the chance of something from happening (Cambridge Dictionary 2011)
Facilitators	Anything that helps make something happen (Cambridge Dictionary 2011)

The final themes that emerged from the data are illustrated in a thematic map presented in Figure 5.5. At this final stage, the formal writing of the findings commenced. It was also at this stage that the interpretation and analysis of the data commenced. Each point was made from the interpretation of the themes needed to represent what the data stated. Nieswiadomy and Bailey (2017) state that at this stage careful consideration is needed while extracting the most descriptive pieces of data that will illuminate the analysis of the findings.

Figure 5.5 Final identified themes and subthemes from thematic analysis



5.4 Interpretation of Themes

I was conscious of ensuring my interpretations were originating from the data and not from my clinical experience. The identified themes are now discussed and interpreted. Starks and Trinidad (2007) state that the trustworthiness of the process will be determined by how the researcher uses the data to support the main points. The use of the consolidated criteria for reporting qualitative research (COREQ) reporting guidelines aids the researcher in ensuring that there is transparency in the reporting of findings in qualitative research (Tong *et al* 2007). These criteria were implemented to help concisely consolidate the findings.

Table 5.3 COREQ Reporting Guidelines Domain 3

Reporting		
29	Illustrations of Quotations	Participant quotations reflect the themes/findings? Each quotation is identified under the participant number?
30	Data and findings compatible	Was there compatibility between the data and the findings?
31	Transparency of major themes	Was there transparency in the themes and was this reflected in the findings?
32	Transparency of minor themes	Was there a discussion in relation to the minor themes that emerged?

(Adapted from Starks & Trinidad 2007)

5.5 Guidelines

Clinical practice guidelines are evidence-based recommendations with the potential to improve population health (Vander Schaaf *et al* 2015 pg. 230). They aim to give treating clinicians a concise description of the best scientific evidence-based knowledge to date within a given field. Guidelines and protocols have become a fundamental aspect of emergency care clinical practice (Cone 2007, Agrawal & Kosowsky 2009). This was highlighted during this study by the participating ANP under three main components; risk and risk assessment, policies and guidelines both local and national and finally guidelines surrounding prescribing authority. These three components are illustrated as subthemes of the main theme 'Guidelines'.

5.5.1 Risk and Risk Assessment

Within this first sub-theme, the ANP were asked if they had VTE risk assessment forms in their clinical setting that they used. As mentioned in Chapter 4, several ANPs (15 participants) did not tick the recognised forms listed on the questionnaire but ticked 'other' and went on to state that the risk assessment forms that they use is the Wells Score.

Many ANPs feel that it is an important topic and that it needs researching so that these cohorts of patients are not at risk of developing a VTE as a result of their lower limb injury. This is especially so as there are long delays in fracture clinic appointments and virtual clinics occur where the patient is never seen.

> *I think VTE prophylaxis will be nationally introduced for lower limb immobilization very soon, the risks are really underestimated within emergency care (ANP 35).*
>
> *Very pertinent issue particularly given increasingly raised BMI and other risk factors of our patients (ANP 50).*
>
> *Huge issues with prolonged waiting times for fracture clinic apt 6-7 weeks following ED presentation (ANP 17).*

5.5.2 Guidelines and Policies

In the second sub-theme there was a strong feeling from the ANPs that there is a need for a standardised national guideline in Ireland for the ED setting that has support from both the orthopaedic and emergency teams. This is so that these patients are fully protected from any risk of developing a VTE as a result of their lower limb injury.

Lower limb immobilisation patients are not assessed in ED for risk of VTE as it is not policy (ANP 39).

A national collaborative guideline is needed for ED approved by Orthopaedic Surgeons and EM (ANP 17).

Needs to be standardised national practice in ED for VTE assessment and prophylaxis (ANP 39).

Standard national guideline for Ireland (ANP 17).

Need a national policy/guideline for ED and an information sheet (ANP 9).

If concerned would assess using the DVT pathway (ANP 4)

There were a variety of practices occurring which were unique for each clinician. As there are no guidelines nationally that give clear direction to ED clinicians in the management and treatment of their patients with lower limb injuries, clinicians have many different ideas and methods of treating these patients.

Consultant does not think it is necessary in our unit as the patient attends ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with (ANP 40).

No specific policy of risk assessment for lower limb injury. If concerned would assess using the DVT pathway (ANP 43).

I personally give all patients with lower limb injury thrombosis Ireland VTE alert card, no department policy despite discussions with clinical lead (ANP 5).

5.5.3 Prescribing Authority

The third sub-theme highlighted is the lack of guidelines and policies for ANPs in prescribing prophylaxis. The issue around the prescribing authority of prophylaxis will need to be addressed in the future if and when a national guideline is implemented for patients at risk of developing a VTE as a result of lower limb immobilisation. There appeared to be limitations that if a protocol existed and someone was at risk and required prophylactic anticoagulants then who would be responsible for prescribing it and following up the patient.

Potential barrier to ANP practice is also the inability to prescribe VTE prophylaxis treatment, based on local policy (ANP 12).

As a ANP the protocol is currently to refer the high-risk patients for medical doctor to prescribe anticoagulants.. as drug not licensed at that prophylactic dose. Also orthopaedic doctors do not prescribe prophylactic anticoagulant I and that ultimately are the team that follow patients. (ANP 34).

In my hospital the NOAC used was not licensed at the prophylaxis dose and therefore as an ANP we could not prescribe, SO how could we follow such a protocol? (ANP 18)

5.6 Knowledge

The second theme reported issues around knowledge and the lack of education surrounding VTE risk especially in patients with lower limb immobilisation. Tudor Car *et al* (2019) state that the translation of research evidence into clinical practice can take up to seventeen years before implementation.

5.6.1 Education

Health professionals' education is normally voluntarily and is generally conducted in a classroom-style face-to-face environment, which can be costly and time-consuming. Digital technology platforms have emerged in the last few years and could be utilised in improving education. It would be beneficial to utilise this means for the education of VTE risk in lower limb immobilization patients.

Training and education is lacking particularly in relation to patients being discharged with immobilisation of a lower limb (ANP 26).

Not enough up to date clinical knowledge and awareness of risk factors and prophylaxis measures (ANP 50).

Focused treatment change with software assist tools.. local project... education (ANP 50).

Proper education and equipment for measuring and weighting patients to work out an accurate BMI (ANP 3).

Through collaboration with consultants and education programmes (ANP 26).

If barriers occur, education and skill mix can overcome these barriers (ANP 23).

5.6.2 Research

The TiLLI study is a review that took place in the UK in 2019 (Horner *et al* 2019). They provided a summary of recent evidence by assessing both the clinical and cost-effectiveness of thromboprophylaxis in patients with temporary immobilisation after injury. They also examined the evidence supporting stratified thromboprophylaxis and the validity of widely used risk assessment methods (Horner *et al* 2019). The TiLLI study is being duplicated in two emergency departments in the Republic of Ireland and therefore the ANPs in those departments are more aware of the TiLLI study and the findings that emerge from both the TiLLI study and this study.

> *Very important topic, needs to be researched so that patients are not put at risk (ANP 49).*
> *Current Tilli study ongoing in our department (ANP 42).*
> *Study has commenced in hospital group on DVT risk to patients in lower limb immobilisation (ANP 27).*
> *One of the ED consultants is reviewing this issue at present (ANP 39).*
> *Awaiting report to Trilli study (ANP 22).*
> *The TILIRI study has increased our perception of the issue (ANP 45).*

5.7 Clinical Practice

Clinical practice consists of many different influencing factors that are constantly changing in the healthcare environment. The ANPs were asked about their own clinical practice and how the treatment and management of patients with lower limb injuries who require immobilisation are effected. A major stumbling block for them is the lack of clinical guidelines and local policies that do not exist to aid them in the management of this cohort of patients this issue was previously discussed in 5.5.2 and 5.5.3

5.7.1 Equipment

To accurately complete any of the recognised evidence-based risk assessment forms currently available for the ANP or clinicians they need to establish the patients current BMI to establish if a patient is at risk. To do this the patient needs to be weighed and height measured prior to application of the cast or walking boot. Therefore it is a necessity to have accurate calibrated

weighting scales and height measurements. It was highlighted in this study that access to this inexpensive equipment is lacking in some emergency settings.

> *Proper education and equipment for measuring and weighting patients to work out an accurate BMI (ANP 3).*
> *The necessary equipment to measure and weigh patients in ED (ANP 28).*

5.7.2 Clinical Staff

I used the sub-theme clinical staff as an umbrella term to address both support staff and clinical supervision staff as highlighted by the participants in this study.

5.7.2.1 Clinical Supervision

Clinical supervision is not to be confused with supervised clinical practice, they both have very different meanings (NCNM 2008(d), pg.2). Concerning this study the ANP were looking for support in clinical supervision which is a process of professional support clinically. This involves experienced and knowledgeable clinicians and colleagues meeting regularly to assist in the development of clinical practice by assisting in developing guidelines, education or by putting policies in place. The ANPs in this study mentioned on numerous occasions that they felt that this was lacking and therefore impeding the management of patients at risk from VTE as a result of lower leg immobilisation.

It was noted by seven participants in this study that this issue has been addressed at a local level but without the support of the ED consultants and clinical leads and any collaboration from a multidisciplinary point of view.

> *No department policy despite discussions with clinical lead (ANP 5).*
> *Need proper guidelines preferably same nationally… and ED and Ortho need to agree on guidelines (ANP 34).*
> *No straight advice from emergency consultants and orthopaedic consultants (ANP 22).*
> *A national collaborative guideline is needed for ED approved by orthopaedic surgeons and EM (ANP 17).*
> *Consultant does not think it is necessary for our unit as the patient attends ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with (ANP 40).*

5.7.2.2 Support Team

The participants in this study highlighted that additional support from other disciplines is pertinent in the management patients that attend the ED setting. The disciplines that emerged were orthopaedics, pharmacy, nursing, management as well as ED consultant as mentioned above.

> *Collaboration and input from key stakeholders (ANP 24).*
> *Haematologist, pharmacist and EM Consultant input (ANP 25).*
> *Multidisciplinary guidelines and training (ANP 28).*
> *Better leadership from management (ANP 4).*
> *No orthopaedic team on site (ANP 17).*

There seems to be an issue regarding this problem as to who's remit this falls under, is it ED or orthopaedic.

> *A national collaborative guideline is needed for ED approved by orthopaedic surgeons and EM (ANP 17).*
> *No straight advice from emergency consultants and orthopaedic consultants (ANP 22).*
> *Consultant does not think it is necessary in our unit as the patient attends ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with (ANP 40).*

A few participants in this study highlighted the need for better staffing to facilitate the appropriate management of patients with lower limb immobilisation.

> *Better staffing and education (ANP 10).*
> *If there is an educated staff nurse working with ANP this is a facilitator as they can assist with weighing patient, assessment tools and education (ANP 13).*
> *Education and skill mix can overcome these barriers. Staff being able to prioritise work (ANP 23).*

5.8 Barriers and Facilitators

5.8.1 Barriers

In addition to the closed barrier questions, the participants were asked if other barriers existed in their clinical practice. Twelve respondents answered this question many of these have previously been discussed earlier in this chapter (Appendix 17 contains all 12 transcribed comments).

Following on from that question the participants were allowed to suggest how these barriers could be overcome. In this question, 31 respondents answered this question again the majority of these answers had been previously discussed earlier in this chapter (Appendix 17 contains all 31 comments).

5.8.2 Facilitators

Having answered about the barriers that exist in their clinical placement the participants were further asked if any facilitators exist in their clinical setting to enable them to complete a VTE risk assessment on patients that result in a lower leg being immobilised. In this question, 21 participants out of the 73 ANPs that completed the questionnaire answered this question, again the majority of these answers have been previously discussed earlier in this chapter. (Appendix 17 contains all 21 positive and negative comments).

5.9 Quality of Qualitative Data

A foundational aspect of 'good research is to utilize procedures to ensure the validity of the data, results, and their interpretation' (Creswell & Plano Clark 2017 pg. 210). Creswell and Creswell (2018) denote that the idea of validity and reliability as used in quantitative research greatly differs in qualitative research. Measuring the reliability of qualitative research is challenging and limits the meaning of qualitative research. This is mainly because human nature consists of personal opinions and different behaviours which are not static or consistent. Reliability in qualitative research was referred to by Creswell and Creswell (2018) as the stability of responses to multiple codes of the data sets. However, the criteria for determining the trustworthiness of qualitative research were introduced by Lincoln and Guba in the 1980s when they replaced terminology for achieving rigor, reliability, validity, and generalizability with transferability, dependability, credibility, confirmability and reflexivity (Morse 2015).

They also introduced the strategies for introducing trustworthiness (Table 5.4). To illustrate the quality of the qualitative data, I examined the interpretation of the findings within this chapter for their trustworthiness under these five headings based on Lincoln and Guba (1986).

Table 5.4 Trustworthiness based on Lincoln & Guba (1965)

Credibility	The confidence that can be placed in the truth of the research findings. Credibility establishes whether the research findings represent plausible information drawn from the participants' original data and is a correct interpretation of the participants' original views
Transferability	The degree to which the results of qualitative research can be transferred to other contexts or settings with other respondents. The researcher facilitates the transferability judgment by a potential user through thick description.
Dependability	The stability of findings over time. Dependability involves participants' evaluation of the findings, interpretation and recommendations of the study such that all are supported by the data as received from participants of the study.
Confirmability	The degree to which the findings of the research study could be confirmed by other researchers. Confirmability is concerned with establishing that data and interpretations of the findings are not figments of the inquirer's imagination, but clearly derived from the data.
Reflexivity	The process of critical self-reflection about oneself as researcher (own biases, preferences, preconceptions), and the research relationship (relationship to the respondent, and how the relationship affects participant's answers to questions).

5.9.1 Credibility

Credibility is the equivalent of internal validity in quantitative research and is concerned with the aspect of the truth value (Lincoln & Guba 1985). Strategies to ensure credibility are prolonged engagement, persistent observation, triangulation and member check (Korstjens & Moser 2018).

5.9.1.1. Prolonged engagement - As a ANP within the ED setting I had sufficient time and knowledge to become familiar with the context of this study. The study was available online for four months and therefore allowed the participants ample opportunity to complete this questionnaire. The online platform only saved fully completed questionnaires and ensured that the participants were ANP from an ED setting. Participants were allowed to support their opinions by completing the open-ended questions. This data was reviewed from the raw material and went through extensive thematic analysis until themes emerged.

5.9.1.2 Persistent observation – Having completed a detailed literature review into the risk of VTE in lower limb immobilisation certain elements were identified and emerged as the most relevant to the problem being studied. It was these elements that were focused in detail on in the study. This was further enhanced during the coding process as developing the codes and the concepts helped examine the characteristics of the data. The data and coding were read and re-read ensuring that themes provided the intended depth of insight from the participants.

5.9.1.3 Triangulation – Triangulation aims to enhance the process of research by using multiple approaches. Triangulation was achieved by examining the consistency of different data sources from within the same method, and by comparing the ANP participants' different views (Patton 2014). Data triangulation refers to multiple data sources. This was achieved by the participants coming from across the country so all worked in different departments therefore all had different opinions and views based on their work placement. Method triangulation refers to using multiple methods of data collection. As this was a mixed-method study the findings from the qualitative analysis were triangulated by convergence with those from the quantitative approach increasing its credibility (Creswell and Creswell 2018).

5.9.1.4 Member Check –confirming the interpretations and conclusions of participants from whom the data was originally obtained (Korstjens & Moser 2018).

5.9.2 Transferability

Transferability concerns the aspect of applicability (Lincoln & Guba 1985). Korstjens and Moser (2018) state that the responsibility of the researcher is to provide a 'thick description' of the participants and the research process therefore enabling the reader to assess whether your research scenario and findings are transferable to their clinical setting. The best way to achieve transferability is to paint as full a picture as possible of the context and findings of the study (Lincoln & Guba 1985). Another aid to transferability is the careful selection of the study sample so that the research findings are transferable to the participants' own settings. As this study was a national study within the emergency setting, it should be possible to replicate this study in another country and hopefully similar findings would emerge.

5.9.3 Dependability

Dependability includes the aspect of consistency (Lincoln & Guba 1985). This study was developed through a systematic search of the existing literature regarding VTE risk assessment. All drafts and changes have been recorded for traceability purposes. The use of a codebook helped with maintaining consistency throughout the analysis. However, this codebook was revised and updated during the coding cycle. The utilisation of the mind-mapping process in Figure 4 helped to verify consistency and allowed to determine how precise the participants' original information was preserved in the coding (Whiting & Sines 2012).

5.9.4 Confirmability

Confirmability concerns the aspect of neutrality (Lincoln & Guba 1985). The focus is on the interpretation process embedded in the process of analysis (Korstjens & Moser 2018). At this stage, I would have welcomed the opinion of another researcher to independently code the data and measure inter-rater reliability to determine the level of consistency in the coding process. However, due to the nature of a doctoral study, this is not possible. I was fortunate to have had the continuous support of my two supervisors who throughout the process shared their opinions and could confirm the reliability of the findings. During this study, there was a complete set of notes on decisions made during the research process therefore highlighting the transparency throughout the research path.

5.9.5 Reflexivity

Reflexivity is the process of critical self-reflection about oneself as a researcher including any biases or preconceptions they may have as well as the researcher's relationship with the participants (Lincoln & Guba 1985). I maintained a journal over the course of the research process. This gave me the platform to self-examine and reflect on my ideas and how these would impact the study. As the research was an online platform I had no involvement with the actual participants, there was no relationship between myself and the participants and therefore no pressure on the participants to answer the questions.

5.10 Summary of Findings

In summary, the participants' responses to this study offered insight into the issues that arise within the clinical setting that prevent them from fulfilling their complete management of care when it comes to assessing the VTE risk of patients being discharged from the ED setting. Four deductive themes emerged from the data and each had subthemes (Figure 5.6).

In the first theme was 'Guidelines', three main factors were found to be related to the guidelines theme. The first sub-theme was risk assessment, it was evident from the comments that the ANPs felt that this topic needed to be addressed. The introduction of a risk assessment form that was nationally used would aid the ANP in the management of these patients. There was some confusion noted as several ANP stated that they used Wells Score, however, this tool is unacceptable as it is used and only effective for patients who are symptomatic with calf pain and of no use to patients who may be at risk of developing a VTE. This potential confusion stemmed from the lack of appropriate guidelines and education regarding this subject. There appear to be little or no guidelines in the ED setting throughout the country. The ANP stated that they would like to have standardised guidelines that they can use in their clinical setting and that they would all be on the same page when it comes to the management of these patients. A guideline regarding risk assessment of patients in lower limb injuries must be developed at a national level with all relevant stakeholders on board so that there is no confusion and that the care is seamless. The Wells Score criteria was also mentioned 30 times here as a guideline that they use for VTE risk assessment, again this highlights the lack of knowledge that exists. The final sub-theme that emerged was an unexpected issue that had not been anticipated but the ANPs highlighted the difficulty regarding the prescribing authority and ensuring that their collaborative practice agreement in their clinical setting allows them to prescribe prophylaxis if a patient has a positive risk assessment score.

The second theme was knowledge and this had two subthemes: education and research. In the first sub-theme of education, the majority of ANPs felt they lacked the knowledge and competency to deal with these patients completely and as lower limb injuries are a large proportion of their patients they feel that education and training are necessary for their clinical practice. The second sub-theme was research and this was two-pronged. Firstly, the TiLLI study was mentioned as a current study in their department, this study is taking part in two ED departments throughout the country and it is observational. Only 5 ANPs out of the 73 mentioned this study. The findings of this study have not been published yet, however the TiLLI study done in the UK has been published by Horner *et al* (2020).

The third theme was clinical practice this had two main subthemes; equipment and clinical staff. It emerged that some ED settings do not have basic equipment such as weighing scales and height charts, preventing patients' BMI from being assessed. BMI is necessary to establish, as patients with a high BMI greater than 30 are at the greatest risk of developing a VTE using the Plymouth Risk Assessment Version 3 (Keenan *et al* 2021). Within the clinical setting, everyone must be on the same page, however, there seem to be issues surrounding who these patients fall under: emergency or orthopaedics. There is a need for the emergency team to take ownership of these patients. Ownership of these patients within the ED setting would ensure that the VTE guidelines and risk assessment form were completed by the ED staff prior to the patients attending the fracture clinic where they may be waiting weeks for an appointment, resulting in the patient being susceptible to developing a VTE while at home. A few of the ANP mentioned that they seek support and leadership from their consultants and hospital managers to help put guidelines and systems in place to facilitate them in their day-to-day management of patients. Implementation in practice will be discussed in Chapter 7, Section 7.8.

The last deductive theme was the barriers and facilitators that exist in either hindering or helping aid the ANP in their professional practice in the management and treatment of patients with lower limb injuries and the risk involved. This theme intertwined with the previously mentioned themes and emphasised the lack of guidelines and risk assessments as a barrier, resulting in the ANPs practising on clinical judgement alone and not on evidence-based guidelines. The fact that even if the ANP had guidelines to help guide them, they were unable to prescribe prophylaxis if required due to the lack of prescriptive authority from their local drugs and therapeutic committee. 34 ANPs answered 'yes' to using guidelines, however, only 12 ANP always prescribe prophylaxis anticoagulants to their patients. Prophylaxis medication would need to be added to the ANP collaborative practice agreement so that the ANP could prescribe if the patient was deemed a risk of developing a VTE. The lack of education and knowledge surrounding this emerged as a significant barrier for the ANPs and one that they would like to overcome through education sessions and further research. The support of staff and extra equipment in the ED setting is needed for accurately carrying out the risk assessment forms.

Chapter Six: Integration of Quantitative Results and Qualitative Findings

6.1 Introduction

Mixed-method data analysis comprises logical techniques applied to both the quantitative and qualitative data as well the blending of both data sets (Creswell and Plano Clark 2017 pg. 212). This study, as previously mentioned, used a parallel results convergent mixed-methods research design, where both quantitative and qualitative data were analysed separately and reviewed before progressing onto the integration of both sets of results (Onwuegbuzie & Teddlie 2004). The mixed-method interpretation required me to look across the quantitative results and qualitative findings, assessing the information and in turn gathering the answers to the research questions. Teddlie and Tashakkori (2009) call this interpretation as drawing 'inferences' (Teddlie & Tashakkori 2009 pg. 300).

6.2 Integrated Data Analysis

The rationale for this mixed-methods approach was to understand the knowledge and clinical practice that exists in the ED setting from ANP concerning VTE risk assessment and lower limb immobilisation. The data from the qualitative findings was used to confirm the quantitative results. Tables 6.1, 6.2, 6.3 and 6.4 represent the merging of quantitative results and qualitative findings to provide a clear understanding of the outcomes.

To integrate the findings firstly, the qualitative findings were examined to establish if they confirmed the quantitative results. This was done by considering the results of the quantitative analysis under the key concepts of knowledge, clinical guidelines, clinical practice, barriers and facilitators. Then the four main qualitative themes were reviewed and how their sub-themes married with the quantitative results was established.

For example, as demonstrated in Table 6.1, in the theme 'guidelines' the quantitative results reported 42.5% (n=31) of participants saying that their hospital did not have guidelines to aid in the management of VTE in patients with lower limb immobilisation and a further 8.2% (n=6) stated that they did not know if any existed. When the 49.3 % (n=36) that stated 'yes' that their hospital had guidelines, were asked which guidelines the hospital had 21.9% (n=16) stated that they did not know which guidelines the hospital used.
13.6 % (n=10) of the participants stated the hospital used 'other' guidelines to the recognised VTE guidelines listed and in the comment box attached they wrote 'Wells Score', this is not a

VTE risk assessment guideline or tool it is a diagnostic risk form for a positive DVT. It also emerged that that 5.5% (n=4) used more than one guideline which is not good clinical practice.

Not using recognised risk assessment tools or using multiple assessment tools highlights the lack of knowledge that exists about this subject. Both these findings were then entered into the joint display. Creswell and Plano Clark (2017) describe a joint display as a 'table in which the researcher arrays both quantitative and qualitative data so that the two sources of data can be directly compared' (Creswell and Plano Clark 2017 pg. 226). This process continued for all of the quantitative results and qualitative findings. The remaining qualitative findings offering new information regarding prescribing authority will be further discussed in Chapter 7.

6.3 Interpretation of Integrated Results and Findings

The information in this chapter and displayed in the following tables contribute to answering mixed-method research questions aiming to examine if the quantitative results and qualitative findings confirm each other or not hence confirming the integrity of the data, as well as expanding the understanding of ANPs' practice from the quantitative phase. The evidence confirmed the quantitative results in relation to knowledge, guidelines, clinical practice, barriers and facilitators. This chapter will now report if the factors that were highlighted in the quantitative analysis correspond to those found in the qualitative findings. As evidence, in Tables 6.1, 6.2, 6.3 and 6.4 results from both methodological approaches were congruent in addressing the ANP practice when evaluating VTE risk due to lower limb injuries within the ED setting.

6.3.1 Knowledge – Table 6.1 presents the integrated data analysis that resulted in three main headings: education, knowledge and research. The lack of education and knowledge was evident throughout the research as a whole. 69.9% (n=51) of ANP had never attended a course or in-service in relation to VTE risk assessment. As a result, 61.7% (n=45) of ANPs rated their overall knowledge as 'Poor' or 'Fair'. 94.5% (n=69) ANP stated that they would like to receive more education in relation to VTE risk assessment in the future.

6.3.2 Clinical Guidelines - Table 6.2 presents the integrated data analysis that resulted in two main headings: risk assessment and guidelines and policies. The obvious lack of clinical guidelines and risk assessment in ED settings is highlighted in this study as only 45.2% (n=33) of ANPs are aware of the recognised international VTE guidelines that exist to aid their clinical

practice (Table 4.20). However, the ANP state the need for national standardised guidelines and risk assessment forms so that they can utilise them in their clinical practice.

6.3.3 Clinical Practice - Table 6.3 presents the integrated data analysis that resulted in three main headings: clinical decision, prescribing and clinical practice. 75.4% (n= 55) ANP stated that they are dissatisfied or very dissatisfied with their clinical practice concerning the management of these patients this is as a result of several issues. Some of the main ones were due to a lack of guidelines and risk assessment forms and others were the lack of the education and equipment necessary in the management of these patients.

6.3.4 Barriers and Facilitators - Table 6.4 presents the integrated data analysis that resulted in two main headings barriers and facilitators. No education and no risk assessment forms appeared to be the largest barriers for ANP in the management of patients. Within the ANP clinical setting, only 27.4% (n=20) stated that if they had access to somebody or something, this would facilitate their assessing and prescribing of VTE prophylaxis for this cohort of patient.

Table 6.5 presents the integrated data analysis that resulted in the formation of new knowledge relating to factors that impede the preceptive authority of the ANP within their clinical setting. This new knowledge was not presented in the quantitative results, instead it was found in the qualitative findings. This new knowledge highlights the fact that the ANP within their local protocols are impeded from prescribing VTE prophylaxis even if they do recognise a patient is at risk of developing a VTE as a result of lower limb immobilisation.

The last noteworthy piece of new knowledge that emerged in the qualitative findings but was not presented in the quantitative results, proposed that many ANPs feel that they lack clinical support from their consultants or the main stakeholders within their clinical setting. Consultants from both the emergency and the orthopaedic settings must come together with national stakeholders and policy makers to decide on guidelines that promote best practices for the safety of patients and that can be implemented and utilised by all within the clinical setting.

Finally, from the comparison of the integrated findings, both sets of results and findings were synthesised, there were no incidences from either the quantitative results or qualitative findings that either disconfirmed or disagreed with each other.

Table 6.1 Joint Display of Integrated Data Analysis for Knowledge

Key Topic	Quantitative Findings	Qualitative Findings	Mixed-Method Comparison
Education	69.9% (n=51) ANP had not attended a course or in-service program that provided information on venous thromboembolism (VTE) risk assessment and prevention (p=0.001) 61.7% (n=45) ANP rated their overall knowledge as 'Poor' or 'Fair'. 94.5% (n=69) ANP stated that they would like to receive education.	*Training and education is lacking particularly in relation to patients being discharged with immobilisation of a lower limb (ANP 26).* *More education. Agreement on assessment tool to use. Standardized treatment pathways (ANP 19).* All from sub-theme- Education	The lack of education is acknowledge and ANP accept that they have poor or fair knowledge of this issue and would welcome training and education to enable them to provide better care.
Knowledge	In regards to knowledge comments, there was a total Mean of 1.54, and a standard deviation (SD = 1.46) as to how would you rate your overall knowledge of VTE risk assessment comments. The results between these variables were significant in terms of rating overall knowledge and 'Patients with a lower limb immobilisation are not at risk of developing a VTE" there is evidence to reject the null hypothesis proving the lack of knowledge that exists, X2 (6, N = 73) 17.586 with p <0.05.	*Not enough up-to-date clinical knowledge and awareness of risk factors and prophylaxis measures... (ANP 50).* *Not picking up patients for treatment until further education (ANP 1).* All from sub-theme- Education	The ANP recognise that they lack the knowledge when it comes to dealing with VTE risk in patients. They do have the knowledge to recognise that patients with a lower limb immobilisation are at risk of developing a VTE.
Research	The ANPs were asked if they regarded this topic as an important issue. 98.6% (n=72) ANPs stated 'Yes', and only 1.4% (n=1) stated that 'I don't know'.	*Very important topic, needs to be researched so that patients are not put at risk (ANP 49).* *I look forward to reading the research (ANP 33).* All from sub-theme- Research	The majority of the ANPs who took part in this study regard this as an important topic and one that further research needs to be done.

Table 6.2 Joint Display of Integrated Data Analysis for Guidelines

Key Topic	Quantitative Findings	Qualitative Findings	Mixed-Method Comparison
Risk Assessment	45.2% (n=33) of ANP not familiar with the mentioned risk assessment forms. 76.7% (n=56) stated either none of the above, I don't know or other. ANPs were asked to rate their overall knowledge of the potential risk of developing a VTE. The results between the twenty different variables were statiscally significant in three statements. Recent pelvic surgery, X^2 (9, n = 73) 22.719 with p <0.05. Patients with history of PE are a potential risk (PE), X^2 (6, n = 73) 15.706 with p <0.05 Patients with history of DVT, X^2 (9, n = 73) 23.312 with p <0.05. There is evidence to reject the null hypothesis proving the lack of knowledge that exists in relation to the potential risk factors of developing a VTE. Which risk assessment forms do you use in clinical practice 83.6% (n=61) answered I don't know, none of the above, other. Only 4.1% (n=3) of the guidelines or risk assessment forms ever been audited.	*Very pertinent issue particularly given the increasingly raised BMI and other risk factors of our patients (ANP 50).* *Well done this is an excellent study, I think vte prophylaxis will be nationally introduced for lower limb immobilization very soon, the risks are really underestimated within emergency care (ANP 35).* *Concordance is vital in patient care- patient aware of health risks, signs and treatment of risks. How to prevent them is key (ANP 23).* *Huge issues with prolonged waiting times for fracture clinic apt 6-7 weeks following ED presentation...(ANP 17).* <u>All from sub-theme- Risk Assessment</u>	With 76.7% (n= 56) of ANP not familiar with the internationally recognised risk assessment forms. 83.6% (n=61) ANP did not know if any international risk assessment forms were in clinical practice. This highlights the lack of education and knowledge and the risk that exists for a patient who attends the ED setting and has their lower limb immobilised. However, the ANP recognised that this is a 'huge issue'. There is a significant relationship between how ANP rated overall knowledge of VTE risk assessment and potential risk of developing a VTE as a "Recent pelvic surgery, PE, or DVT.

Guidelines & Policies	49.3% (n=36) ANPs stated their hospital have guidelines. When asked what guidelines were used 45.1% (n=33) answered none of the above or other. 21.9% (n=16) of the ANP hospitals used NICE 2012 guidelines which was the most widely used guideline in this study. 67% (n=49) stated either none of the above, I don't know or other. When asked did the ANP as an individual use these guidelines only 13.7% (n=10) answered 'yes'. However, 5.5% (n=4) stated NICE 2012 which was mentioned previously, 9.6% (n=7) stated that they didn't know. 8.2% (n=6) stated other but in the comment box wrote 'Wells Score' and one ANP put 'policy based on Plymouth guidelines'. Wells Score is not a guideline used for risk of VTE.	*Proper guidelines are necessary, standardisation is needed, we all need to be on the same page (ANP 18).* *Currently no clear policy of VTE prophylaxis in Ireland (ANP 22).* *Need proper guidelines preferably same nationally (ANP 34).* *Guidelines no risk form in chart just use clinical judgement we always use teds and low molecular heparin prophylaxis (ANP 14).* *Introduction of a policy for vte prophylaxis in the ED (ANP 35).* *No specific policy of risk assessment for lower limb injury. If concerned would assess using the DVT pathway (ANP 43).* *Lower limb immobilisation patients are not assessed in ED for risk of VTE as it is not policy (ANP 39).* *Wells Score* <u>All from sub-theme- Guidelines & Policies</u>	Guidelines proved to be a big issue in the ANP clinical setting. The most well-known VTE risk assessment guideline was the NICE 2012 where 49.3% (n=36) ANP stated that they were familiar with it. However, when asked if their hospital used any guidelines 49.3% (n=36) ANP stated 'yes' out of these 36 ANPs answered yes, 67% (n=49) answered none of the above, I don't know or other. In the other comments, all except one ANP had written 'Wells Score' which is not a recognised guideline in this cohort of patients. This highlights the voice of the ANPs when they state that clear guidelines and policies are necessary along with standardisation of these guidelines nationally.

Table 6.3 Joint Display of Integrated Data Analysis for Clinical Practice

Key Topic	Quantitative Findings	Qualitative Findings	Mixed-Method Comparison
Clinical Decision	ANPs when asked if they used their clinical judgment instead of a recognised assessment tool, (X2 (12, N = 73) 7.572 with p= 0.818), how often ANPs complete a VTE risk assessment on patients with lower limb immobilisation?, (X2 (12, N = 73) 11.572031 with p =0.526) and if ANPs usually base their clinical decisions concerning VTE on one or more guidelines, (X2 (12, N = 73) 7.809 with p = 0.800) - none of these statements were statistically significant therefore there is evidence to fail to reject the null hypothsis. How often is VTE risk assessment form completed? 37% (n=27) always, 21.9% (n=16) usually and 12.3% (n=9) sometimes complete risk assessment form, while 17.8% (n=13) never or 11% (n=8) rarely. There was statistical significance when asked Do you calculate the patients: BMI?", X2 (8, N = 73) 16.570 with p <0.05, discuss with the patient risks and benefits of thrombolysis?", X2 (8, N = 73) 21.278 with p <0.05, or give patients written information about VTE prophylaxis?", X2 (8, N = 73) 16.788 with p <0.05, giving evidence to reject the null hypothesis proving the lack of knowledge and VTE assessment for patients with lower limb immobilisation.	*Guidelines no risk form in chart just use clinical judgement we always use teds and low molecular heparin prophylaxis (ANP 14).* *I personally give all patients with lower limb injury thrombosis Ireland VTE alert card, no department policy despite discussions with clinical lead (ANP 5).* *Proper education and equipment for measuring and weighting patients to work out an accurate BMI (ANP 3).* *Need a national policy/guideline for ED and an information sheet (ANP 9).* Sub-theme- Guidelines & Policies *The necessary equipment to measure and weigh patients in ED (ANP 28).* Sub-theme- Equipment If there is an educated staff nurse working with ANP this is a facilitator as they can assist with weighing patient, assessment tool and education *(ANP 13).* Sub-theme- Support Team	The result was not significant in terms of all statements. ANP clinical decision appears to be disjointed, with some ANP giving VTE alert cards, while others want staff nurses to weigh their patients. It is obvious that due to the lack of education and guidelines the ANPs have nothing to base their decision making on.

Prescribing	Only 8.2% (n=6) routinely prescribe VTE prophylaxis for patients with lower leg immobilisation while 90.4% (n=66) do not prescribe. 42.4% (n=31) claimed that patients' preferences "Never" influence their decision. Only 4.1% (n=3) ANP stated that they were aware of patients returning with a complication while on prophylaxis.	*Potential barrier to ANP practice is also the inability to prescribe VTE prophylaxis treatment, based on local policy (ANP 12).* *Nurse not allowed to prescribe anticoagulant. Medical doctors are the only one allowed to prescribe (ANP 32).* *In my hospital the NOAC used was not licensed at the prophylaxis dose and therefore as an ANP we could not prescribe, SO how could we follow such a protocol? (ANP 18)* <u>All from sub-theme- Prescribing Authority</u>	It was noted that 42.4% (n=31) ANP are confident in their clinical decision making not to allow patients to influence their decision when it comes to prescribing VTE prophylaxis. However it appears that only 8.2% (n=6) prescribe prophylaxis for patients who require it. It appears that the majority of ANP are not allowed to prescribe prophylaxis.
Clinical Practice	100% ANP stated that patients should be informed about the risk of VTE when placed in a lower limb immobilisation. 46.6% (n=34) ANP are aware of patients returning with a VTE as a result of lower limb immobilisation. 75.4% (n=55) ANP are either dissatisfied or very dissatisfied with their current practice in relation the VTE risk and prevention for patients in lower limb immobilisation.	*Try to see patients and discuss risk assessment in a quiet room (ANP 51).* <u>Sub-theme- Barrier</u> *Consultant does not think it is necessary in our unit as the patient attends ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with (ANP 40).* *No department policy despite discussions with clinical lead (ANP 5).* <u>Sub-theme- Clinical Supervision</u>	All ANP feel that patients should be informed regarding the risk and 46.6% (n=34) ANPs are aware of patients who have returned with a VTE as a result of lower leg immobilisation however some Consultants aren't proactive in addressing this issue and feel that the problem is for orthopaedics to deal with.

Table 6.4 Joint Display of Integrated Data Analysis for Barriers & Facilitators

Key Topic	Quantitative Findings	Qualitative Findings	Mixed-Method Comparison
Barriers	61.7% (n=45) ANP state that barriers exist in their clinical setting, 12.3% (n=9) stated they did not know and 26% (n=19) said that no barriers exist. The ANPs were asked which barriers exist in their own clinical setting? The result was significant in terms of "no education provided", X2 (2, N = 73) 20.063 with p <0.05 and "No VTE risk assessment forms available", X2 (2, N = 73) 8.811 with p <0.05 - there is evidence to reject the null hypothesis proving the lack of knowledge and VTE assessment for patients with lower limb immobilisation due to barriers within their clinical setting.	*If barriers occur, education and skill mix can overcome these barriers (ANP 23).* *Introduction of new guidelines. Collaboration and input from key stakeholders. Education and necessary clinical supervision (ANP 24).* *Need proper guidelines preferably same nationally.. and ED and ortho need to agree on guidelines (ANP 34).* *Education and necessary clinical supervision (ANP 24).* *More education. development of a guideline. introducing a VTE risk assessment tool (ANP 21).* All from sub-theme- Barriers	Education appeared to be the main theme running through the barriers questions. Only 26% (n=19) stated that no barriers existed in their clinical setting. The main barriers that were significant were the lack of VTE risk assessment forms and lack of education. The ANPs feel they need proper education, guidelines, risk assessment tools, clinical supervision and collaboration from key stakeholders.
Facilitators	49.3% (n=36) stated that there are no facilitators and 23.3% (n=17) stated they did not know if there were any facilitators that enable them to prescribe VTE prophylaxis to patients at risk of developing a VTE due to lower limb immobilisation.	*If there is an educated staff nurse working with ANP this is a facilitator as they can assist with weighing patient, assessment tool and education (ANP 13).* *We have VTE assessment document in our ED chart (ANP 38).* All from sub-theme- Facilitators	27.4% (n=20) ANP stated that they had something or somebody in their clinical setting that facilitates them to prescribe VTE prophylaxis to their patients in the ED setting.

Table 6.5 Joint Display of integrated data analysis for new knowledge emerged from Qualitative Findings

Key Topic	Quantitative Findings	Qualitative Findings	Mixed-Method Comparison
Prescriptive Authority	ANP stated some barriers existed in the prevention of assessing patients with lower limb immobilisation for VTE Sample population (n = 73) (M = 1.51, SD = 0.710)	*Potential barrier to ANP practice is also the inability to prescribe VTE prophylaxis treatment, based on local policy (ANP 12).* *Nurse not allowed to prescribe anticoagulant. Medical doctors are the only ones allowed to prescribe (ANP 32).* All from sub-theme- Prescribing Authority	The ANP have stated that they felt that they are unable to prescribe VTE prophylaxis to the patients they identify as high-risk due to the lack of policies and that their collaborative practice agreement does not include prophylaxis medication.
Clinical Support	ANP stated some barriers existed in the prevention of assessing patients with lower limb immobilisation for VTE Sample population (n = 73) (M = 1.51, SD = 0.710)	*No department policy despite discussions with clinical lead (ANP 5).* *No straight advice from emergency consultants and orthopaedic consultants (ANP 22).* *Consultant does not think it is necessary in our unit as the patient attends ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with (ANP 40).* All from sub-theme- Clinical Supervision	The ANPs have stated that the lack of clinical support and clinical supervision is impeding their management of patients who are at risk of developing a VTE as a result of lower limb injury.

Chapter Seven: Discussion

7.1 Introduction

In this chapter, the research findings will be summarized. The results of this research are fully discussed in detail concerning the wider research and the inception of new knowledge, in relation to the following five research questions:

The overall question was:

1. How do emergency advanced nurse practitioners' evaluate VTE risk in patients with lower limb injuries in their clinical practice?

Specific approach-related research questions were devised as:

Quantitative Questions;

2. What is the current knowledge that emergency advanced nurse practitioners have regarding VTE risk assessment and prophylaxis in patients with lower limb immobilisation?

3. How do emergency advanced nurse practitioners identify patients who are most at risk of developing a VTE as a result of lower limb immobilisation?

Qualitative Question;

4. What barriers or facilitators exist to prevent the risk of VTE in patients with lower limb immobilisation?

Hybrid Question (Mixed-Method);

5. Have the qualitative findings helped explain the results from the quantitative phase of the study?

The use of the critical realist perspective in this research helped me accept the distinction between the empirical and the actual, while discovering the reality of ANP clinical practice in relation to VTE assessments in patients with lower limb injuries. The chapter will follow with a critique of the quality of this research study. Recommendations are made following the

discoveries from this research concerning education, clinical practice and policy as well as the possibility of future research.

7.2 Summary and Key Findings

This study explored, ANP knowledge, clinical practice and the barriers and facilitators that affect the compliance and adherence to the implementation of clinical guidelines for the management of risk assessment in patients with lower limb injuries requiring immobilisation.
The current education takes a minimum of 7 years before being registered as an ANP, the minimum age of an ANP in Ireland is approximately 29 explaining why there was only one participant in this study who was under the age of 30 (Figure 4.1). The majority of ANP that took part in this research recognise that VTE risk in lower limb injuries is an important topic and one that requires further research. The ANP agree that there is a lack of knowledge surrounding this topic and have indicated that they would welcome future training and education so they can provide better care to their patients.
A large proportion of the ANPs in this study were not familiar with internationally recognised risk assessment tools. There was also a lack of knowledge surrounding individual risk factors associated with developing a VTE. The ANPs had difficulties distinguishing appropriate guidelines and risk assessment, they were not aware of the guidelines for the prevention of VTE but on numerous occasions mentioned the Wells score. These comments clearly indicated the general lack of knowledge that exists amongst ANPs in the ED setting.
The ANPs within their ED setting found difficulties around clinical decision making concerning VTE risk assessment in patients with lower leg injuries. The lack of appropriate equipment, lack of support from clinical leads and stakeholders as well as the lack of policies and guidelines were all factors that the ANPs claimed impeded their clinical decision making. They also stated that ED consultants and orthopaedic consultants need to collaborate to address this issue. Some ED consultants state that it is the remit of orthopaedics to VTE risk assess patients when they get to a fracture clinic, which is not appropriate patient management especially since COVID 19 when the inception of virtual fracture clinics commenced, resulting in some cases where the orthopaedic team never physically seeing the patient.
Education was the main barrier that was highlighted amongst the ANP with the lack of guidelines and risk assessment tools another issue.
Finally, a surprising discovery and one that will be discussed in the next section was the lack of prescriptive authority of the ANPs within the ED setting for this cohort of patients.

7.3 Emergence of New Knowledge

This study provided invaluable insights into the current practice of ANPs when evaluating VTE risk due to lower limb injury within the ED setting. New knowledge has emerged from this study surrounding several topics. The issue surrounding prescribing and prescriptive authority was highlighted by the ANPs and how they are prevented from having prescriptive authority for prophylaxis. Some ANPs stated that there were barriers that existed in prescribing thromboprophylaxis treatment if a patient was deemed high risk and that doctors were the only clinicians allowed to prescribe anticoagulants. The registered nurses, midwives or ANP who are registered prescribers are required to prescribe within their scope of practice and maintain their competency within their role (NMBI 2016). Prescribing practice involves 'a number of complex skills including comprehensive consultation, diagnosis, information giving and accurate documentation' (NMBI 2019 pg. 8). Naughton *et al* (2013) claim that the two key components in good prescribing practice are minimising risk and maximising effectiveness. ANPs are in a prime position to fulfil the role of the care provider for this cohort of patients if they are authorised to prescribe thromboprophylaxis. ANPs are autonomous practitioners who within their scope complete a comprehensive health history, confirm an accurate diagnosis, complete the necessary documentation involved and provide the patient with advice. Yet they are prevented from prescribing the necessary prophylaxis to minimise the risk of developing a VTE and maximising the effectiveness of the ANP in their role in preventing a VTE from occurring in patients with lower limb injuries requiring temporary immobilisation. Fox *et al* (2019) divulge that healthcare organisations need to exercise caution when it comes to applying excessive restrictions on a nurse practitioner service, or individual nurse practitioners. If the ANP envisages that their scope of practice is either enabled or restricted this can lead to role dissatisfaction and depreciation of the ANP service. This in turn can result in a reduction in patient satisfaction (Casey *et al* 2015, Hoodless & Bourke 2009). ANP service restrictions including local policies which permit the ANP to manage only low acuity patients (Mc Connell *et* al 2013, Lowe *et al* 2013) and subsequently prevent them from fulfilling their full scope of practice, education and expertise were seen in this research. Several ANPs were prevented from prescribing thromboprophylaxis for their patients that they had diagnosed as high risk of developing a VTE. Drennan *et al* (2009) state that nurses are willing to embrace prescriptive authority as an aspect of role expansion. As this is a competency within the advanced practice role, this should enable ANPs to prescribe prophylaxis to their patients. This demoralises the ANP role restricting them to work to capacity rather than capability (Fox *et al* 2019, Fealy *et al* 2018). It was also encouraging to unfold that several findings (poor knowledge, lack of

clinical guideline adherence, lack of familiarity with VTE risk assessment tools, lack of knowledge and education as a barrier) aligned with findings that emerged from the broadened scoping review as discussed in Chapter 2.

7.4 Discussion of the Findings

7.4.1 Knowledge

As ANPs are diagnosing, treating and discharging patients with lower limb injuries it was necessary to establish the level of knowledge that existed and the willingness to avail of VTE education sessions to improve their overall knowledge. This study highlighted several topics relating to knowledge, initially the overall knowledge or lack of knowledge that exists, second was the issue surrounding education concerning VTE risk in patients with lower limb injuries and finally was about the importance of research on this topic. As per the previous studies carried out by da Silva *et al* 2020, Oh *et al* 2017, Tang *et al* 2015, Lee *et al* 2014 and Mc Farland *et al* 2014, this research findings also uncovered the fact that knowledge of relevant VTE risk assessment and guidelines are insufficient. The majority of the respondents in this study rated their overall knowledge concerning VTE as poor or fair. When it came to knowledge surrounding guidelines and risk assessment the majority of the respondents were not familiar with the clinically recognised VTE risk assessment tools. As mentioned previously a large proportion of the respondents had mentioned that they were familiar with the 'Wells Score'. This is a similar finding to Oh *et al*'s 2017 study which highlighted the fact that in their study their participants were knowledgeable about detection of a DVT but lacked knowledge about prevention. When the ANPs were asked regarding the different risk factors that may result in a patient potentially developing a VTE they only highlighted three risk factors out of a possible twenty. The three risk factors that they highlighted were most commonly 'patients with a history of deep vein thrombosis', patients post 'recent pelvic surgery' and also patients 'history of pulmonary embolism'. The other risk factors such as patients, over 60 years old or patients with high BMI > 30Kg/m^2' were not considered by the ANPs as being a relevant risk factor in developing a VTE from a lower limb injury. This is similar to Mc Farland *et al's* 2014 study where they found that there were low levels of knowledge of VTE risk and prevention amongst their respondents. All ANPs in this study stated that it was important that all patients are aware and informed of the risks associated with lower limb immobilisations but this is not possible if the ANP do not possess this knowledge themselves. As highlighted by Mc Farland *et al* (2014) there is clearly a need to improve ANP's 'understanding without which

there will remain an inability to pass on vital information to patients' (Mc Farland *et al* 2014 pg. 4). The majority of respondents had never attended a course or in-service concerning VTE. An overwhelming 94.5% (n=69) of ANP stated that they would welcome education about VTE risk and lower limb injuries. One ANP stated that '*Training and education is lacking particularly in relation to patients being discharged with immobilisation of a lower limb'* (ANP 26). There is an obvious lack of education in this area and equally an obvious willingness from ANPs to avail of any education. This is mirrored in the literature where it appears to be a common trend that in-service education sessions regarding VTE risk assessment and prevention are not often offered for staff working within acute settings. Oh *et al* (2017) found that only 9.3% of their respondents had ever received in-service training on the topic of VTE. While Lee *et al* (2014) found that only 7% of respondents had previously attended education on VTE care. This study has identified the impacting effect that this knowledge gap has on patients who present to the ED setting. One ANP stated that *'Very important topic, needs to be researched so that patients are not put at risk'* (ANP 49). This was unanimously the opinion of the ANPs in this study as 98.6% (n=72) claimed this was an important topic and needed to be researched.

7.4.2 Guidelines and Risk Assessment Tools

A Cochrane Review in 2017 suggested that without thromboprophylaxis, approximately 1 in every 50 patients will suffer a symptomatic VTE event following temporary immobilisation after an injury (Zee *et al* 2017). Lack of adherence to clinical guidelines within the emergency setting is well documented in the literature (Ebben *et al* 2013). Adherence to clinical guidelines is deemed important to reduce variations within clinical practice and to ensure that patients receive the recommended treatment therefore improving quality of care and health outcomes (Janssen *et al* 2011). I discovered that there was a lack of adherence to and knowledge of the guidelines available for this cohort of patients. The most well-known guideline within the ANP was the NICE guidelines where 67.1% (n=49) ANP stated that they were familiar with it. However, when asked if their hospital used any guidelines 49.3% (n=36) ANP stated 'yes' from these 36 ANPs 21.9% (n=16) answered 'I don't know' which guideline the hospital uses. In the 'other' comments section the only unanimous 'guideline' written was 'Wells Score' which is not a recognised guideline in this cohort of patients. The Wells Score is used in the diagnosing of patients who are suspected of having a DVT rather than establishing the risk of developing a VTE. This study also established that 86.3% (n= 63) of ANPs were not familiar

with internationally recognised risk assessment tools. 82.2% (n=60) ANPs did not know if any international risk assessment forms were in clinical practice. This highlights the lack of education and knowledge and the potential risk that exists for patients who attend the ED resulting in a lower limb being immobilised. One ANP stated that '*Concordance is vital in patient care-patient aware of health risks, signs and treatment of risks and how to prevent them is key'* (ANP 23). There is a need for standardised guidelines and risk assessment tools as voiced by the ANPs: *'clear guidelines and policies are necessary along with standardisation of these guidelines nationally'* and that *'lower limb immobilisation patients are not assessed in ED for risk of VTE as it is not policy'*. It was revealed that some ANPs when they are assessing patients for VTE are using more than one guideline. This is not good practice and poses a risk to the patient. The patients who are not assessed, are at risk of falling between the cracks between ED and orthopaedics and unfortunately, the next time some of these patients will be seen is when they have developed a DVT as a result of their lower limb immobilisation.

7.4.3 Clinical Practice

The importance of integrating clinical guidelines into clinical practice is to improve patient safety and reduce the VTE burden from being established (Wang *et al* 2020). Improving the quality of patient care is important for bridging the gap between patients at risk of developing a VTE and the implementation of clinical guidelines (Lockwood *et al* 2018). ANPs are on the frontline of health service delivery and therefore play a central role in translating clinical guidelines into practice (Collins *et al* 2010). Patient numbers within the ED setting is increasing year on year. It is estimated that activity in EDs will increase by between 16% and 26% up to 2030 (Wren et al. 2017). This increased demand can present a number of challenges within the ED setting including the issue of crowding, pressure on the infrastructure, as well as ensuring that there is a well-resourced workforce to provide high quality emergency care (DoH 2022). The recommendations for ANP staff numbers in the emergency setting was developed back in 2013 following a survey which gathered data regarding ED new patient attendance and ANP service activity and capability. In EDs with excess of 37,500 new patients were to provide a seven-days-a-week, 12-hours-a-day ANP service with two ANPs on duty, while the EDs with less than 37,500 new patient attendances are to provide a seven-days-a-week, 12-hours-a-day ANP service with one ANP on duty (EMP 2019). However, at the time of data collection iin this study there was a major shortfall in ANPs throughout the ED service with 85 ANPs in post as opposed to 150 ANPs required as per the EMP (Table 7.1). Workforce planning to

standardise safe staffing levels, in conjunction with he use of appropriate patient acuity and dependency measurement tools will support ANPs provide high quality patient care by implementing accurate and efficient decision making within the unpredictable ED environment (Gibbons and Stoddart 2018).

Table 7.1: Workforce planning projected requirements for 150 Registered ANP's across Emergency Departments, Injury Units, Paediatric Emergency Departments (EMP 2019).

Projected requirements based on service needs analysis			
24/7 ED with patient Attendance > 37,500	24/7 ED with patient Attendance< 37,500	Injury Unit	Paediatric EDs
2 ANPs on duty per 12hr/7days (6WTE)	1 ANP on duty per 12hr/7days (3WTE)	1 ANP on duty per hour of opening (3WTE)	1 ANP on duty 12hr/7days (3WTE)
60	**48**	**33**	**9**
Total 150			

All ANPs stated that every patient should be informed about the risk of developing a VTE when placed in a lower limb immobilisation. A high proportion 46.6% (n=34) of the ANP were aware of patients who had returned at some stage as a result of developing a VTE from being in a lower limb immobilisation as a result of an injury. The majority of ANPs 75.3% (n=55) were dissatisfied with their current practice in relation to the management of VTE risk and prevention for patients in lower limb immobilisation. It was obvious that ANP wanted to change their practice so that they are satisfied and comfortable addressing this problem within their clinical practice however, a few issues arose that resulted in the dissatisfaction. One issue that was highlighted was the lack of stakeholders and clinical lead (Consultant) support concerning this topic. Some consultants are not proactive in addressing this issue and feel that the problem is an orthopaedics issue that they can address. One ANP stated that the '*Consultant does not think it is necessary in our unit as the patient attends ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with'* (ANP 40). This gives rise to another issue that was unveiled in this study, the prescriptive authority of ANPs to prescribe prophylaxis if warranted. It was noted that only 8.2% (n=6) of ANPs prescribe prophylaxis for patients who require it. It transpired that a large proportion of the ANPs are not allowed to prescribe prophylaxis at a local level due to the lack of guidelines and protocol as well as the support from stakeholders in their clinical setting. A ANP stated that a *'potential barrier to ANP practice is also the inability to prescribe VTE prophylaxis treatment, based on local policy' (ANP 12).* ANPs have tried to overcome and address this issue locally but nothing

has materialised. One ANP stated that in their clinical practice '*No department policy despite discussions with clinical lead' (ANP 5).* ANP are forced to practice based on their own clinical decision making rather than clear guidance from guidelines or protocols, this is resulting in a disjointed service where some ANP are giving VTE alert cards and prescribing while others are not providing any information or risk assessment to their patients. To standardise clinical practice in all ED settings national guidelines must be addressed and implemented successfully.

7.4.4 Barriers and Facilitators

The majority of ANP stated that barriers existed in their clinical setting preventing them from completing risk assessments on patients with lower limb injuries. The main barriers that were significant were the lack of VTE risk assessment tools available within the clinical setting as well as the lack of education available to ANP in relation to VTE in lower limb injuries.

It is well documented that the lack of knowledge is a common barrier to compliance and adherence to VTE prevention and treatment, the literature suggests that improved education and training can overcome these difficulties and therefore improve patient outcomes. Da Silva *et al's* study 'suggests that education programs on VTE risk, prevention and treatment, if frequently preformed and associated with attractive teaching strategies may be positive' (da Silva *et al* 2020 pg. 7). In Mc Farland *et al*'s (2014) study it highlighted the importance of continuous training in educating all staff to take ownership in preventing VTE by effectively completing the risk assessment and not just completing a tick box exercise. Other barriers that were highlighted were the previously mentioned lack of clinical support from stakeholders and consultants as well as the lack of prescriptive authority in relation thromboprophylaxis for high-risk patients. The ANPs feel they need proper education, guidelines, risk assessment tools, clinical supervision and collaboration from key stakeholders. As Elliott *et al* (2013) stated ANP can 'demonstrate clinical leadership by identifying educational needs within their own area of specialties' (Elliott *et al* 2013 pg. 1041). ANPs must be in the driving seat in relation to implementing VTE Policy, clinical guidelines and educational training at a national or international level.

7.5 Strengths of the Research Study

This study was the first of its kind to explore the ANPs' clinical practice and knowledge concerning VTE in lower limb injuries. This is also the only research conducted investigating the knowledge and current practice of VTE in lower limb injuries in the ED setting in relation to any member of the multidisciplinary team. It was a national study in the Republic of Ireland

investigating a whole population of ANP. The assistance from the three professional bodies (IAANMP, EMP and the IAEM) was beneficial as they supported my access to the participants. A mixed-method design allowed for a deeper understanding of the research problem by using both quantitative and qualitative questions. The use of three previously validated questionnaires facilitated the development of the questionnaire used in this research. The parallel results, convergent design enabled the collection of quantitative and qualitative data at the same time. The JISC online survey allowed the participants to complete the survey at a time that suited them. As the survey questionnaire could only be done in one sitting as it prevented any contamination of the data and findings as participants could not look up the answers to the questions. The survey response was high at 85.8% (n=73/85) which ensured that participants who completed the questionnaire were representative of the total ANPs in ED in Ireland. Their answers and comments allowed me to identify the gap that exists in knowledge regarding VTE risk assessment as well as make recommendations for the implementation into clinical practice and policy in the future.

7.6 Limitations of the Research Study

The parallel results convergent design involved the collection of all data at the same time. This can be seen as a limitation as the researcher is unaware of what will emerge from the quantitative analysis, therefore preventing the researcher from the ability to adjust the qualitative approach to ensure a greater understanding of the quantitative results (Hong *et al* 2017). A flexible sequential quantitative and then qualitative approach may have allowed the researcher the scope to engage in a deeper exploration.

The questionnaire consisted of closed and open-ended questions as well as comment boxes, the open-ended questions and the comment boxes required the participant to write their response and comments which form the qualitative data. This can be viewed as a restrictive way of collecting qualitative data as it produced short descriptive comments that did not allow me to explore more in-depth. If the qualitative data was collected by a method such as a semi-structured interview this would have allowed the researcher to investigate further into the ANPs' views. Another limitation that occurred was the use of thematic analysis, although this method of qualitative analysis promotes flexibility, this flexibility can result in the lack of consistency when developing themes acquired from the collected data. A further limitation is the fact that there was only one researcher who works as a ANP conducting this study. During the scoping review, I was the only researcher searching and abstracting the literature, this would have been more beneficial to have at least another one or two researchers for their

opinion, however as this forms part of a doctoral thesis this was not possible. This would also have benefited the thematic analysis as it would have further ensured the quality and trustworthiness of the findings.

7.7 Potential for Bias

Research bias exists in all 'study designs, and although researchers should attempt to minimise bias, outlining potential sources of bias enables greater critical evaluation of the research findings and conclusion' (Smith & Noble 2014 pg. 100). An element of bias that could be that the researcher of this study is a neophyte researcher, who happens to be familiar with the topic being investigated. My own clinical background identified and highlighted the research problem and subsequently influenced me to perform this study. Through extensive reading and performing a detailed literature search, I increased my own knowledge from a research evidence basis and not just from my personal experience. It also highlighted the key issues that needed researching. I contacted the professional organisations before commencing this study to establish if they would act as gatekeepers in the study. These professional bodies sent out the questionnaire link via their email database therefore removing the need for me to contact the potential participants and then the participants feeling coerced into completing the online questionnaire. The study design was initiated by me to explore the issues pertaining to my area of clinical practice, but this could be interpreted as design bias. The participants in the study were all ANPs working in the same field as myself however as the response rate was 85.8% and involved a national collection of ANP from all ED settings, I felt that all efforts to overcome selection bias was controlled. I attempted all efforts to overcome data collection and measurement bias by assessing for validity and reliability as well as trustworthiness which were discussed in-depth in Chapter 3 and Chapter 5. By implementing a mixed-method approach I attempted to alleviate analysis bias by allowing the quantitative data to be statistically analysed and the qualitative data by thematic analysis then synthesising them to establish integration of both results and findings.

I opted to set the online questionnaire in such a way that the ANP could only complete the survey in one sitting preventing them from looking up the certain answers they may deem correct. This allowed me to capture a true level of current knowledge and practice and not a biased one. I was mindful of bias throughout the research process and tried to prevent all potential biases from occurring. Keeping a research journal enabled me to reflect on my own decisions and research questions prior to the review and therefore establish during data interpretation that no prejudices or prior knowledge was resulting in bias. Engward and Davis

(2015) state that constant reflection throughout all stages of the research improves the quality of the research study.

7.8 Recommendations for Education

The term 'knowledge translation' has been utilised for strategies that aim to go beyond just dissemination of the knowledge but including how to emphasise its application into everyday clinical practice (Straus *et al* 2009). During the early days of research, knowledge was disseminated by diffusion of innovations which is a theory that aims at explaining the how, why and what (Rogers 1983). Implementation science emerged as a result of the introduction of evidence-based research. Implementation is described by Nilsen as a continuum consisting of diffusion, dissemination and implementation (Nilsen, 2015). Diffusion is the unplanned spread of new practices without any interventions occurring. Dissemination is actively spread and informing individuals about new clinical guidelines. Implementation is the 'making it happen' process of integration of new guidelines and interventions within a service (Nilsen 2015 & Greenhalgh *et al*, 2004). Healthcare organisations should provide the necessary support and sanction the ANP requisites to work to the full scope of their role (Kilpatrick 2013). The main way this can be achieved is by education and research. This knowledge needs to include risk assessment tools as well as evidence-based guidelines. The most effective way to disseminate new knowledge concerning VTE guidelines and risk assessment tools is through education for the clinical staff involved. There is a lot of debate in the literature regarding the best types of education for clinical guidelines, such as traditional face-to-face education sessions or online digital training. In the current COVID-19 seesaw climate where face-to-face is limited, online would benefit the education of staff. McFarland *et al* (2014) highlighted the importance of continuous training in educating all staff to take ownership in preventing VTE. This needs to be addressed at a national level to put in place an appropriate accessible training programme for all staff, especially ANP, can avail of and therefore in turn improve the service that they provide their patients within the ED setting. The HSE have an online education platform for all staff and a variety of different modules are available, an educational package could be developed and uploaded onto HSEland and an email sent to all ANP with a unique code for them to enter therefore ensuring that all ANP complete the course. Nemeth *et al* (2020) assessed the use of TRIP(cast) score tool application for smartphones for use by physicians to accurately assess at-risk patients. This could be implemented into further education for ANPs.

7.9 Recommendations for Clinical Practice

Clinical practice guidelines have the potential to improve many clinicians' and patients' healthcare decisions by enhancing the quality of service and healthcare outcomes. Guidelines help to standardize the healthcare provided by reducing variations in clinical practice from clinician to clinician. They also help to improve the quality and consistency of care provided by clinicians. If a precise VTE risk assessment is carried out it facilitates determining the risk-to-benefit ratio of thromboprophylaxis, in guiding clinical prevention in patients and therefore ensuring a better outcome overall for patients (Wang *et al* 2020).

There is a need for appropriate guidelines to be implemented in the ED setting for patients with a lower limb injury requiring immobilisation who are being discharged home for fracture clinic follow up. Hospitals also need to establish and implement appropriate guidelines as this study revealed that some ANPs when they are assessing patients for VTE are using more than one guideline. Guidelines are needed to aid ANP in their clinical decision making in clinical practice in the ED setting. When guidelines are implemented in the future, the prescribing authority for ANP will also need to be addressed to allow them to fulfil their scope of practice within their clinical setting. Consultants need to address this issue and support their ANP in the management of this cohort of patients.

7.10 Implications and Implementation for Clinical Practice

Apart from providing direct patient care, ANP deploy their considerable knowledge and experience in coordinating and directing other members of the multidisciplinary team (Bradway *et al* 2012). Although the literature indicates that expanding the scope of practice through advancing the ANP role has both clinical and practitioner benefits (Begley *et al* 2014, Drennan *et al* 2009), there is also evidence that there are many barriers to overcome and challenges that exist in the implementing new practices (Begley *et al* 2014, Drennan *et al* 2009, Heale & Rieck-Buckley 2015, Fealy *et al* 2015). It is evident from the research that VTE guidelines are not being implemented within practice a combination of lack of education and change in practice is responsible. Hopefully, education for ANPs as mentioned will overcome this barrier however, ANPS must be motivated and encouraged to change their practice so that VTE guidelines become implemented into everyday clinical practice. Within the healthcare organisation and especially the ED setting it is important to establish that the ANPs have the capability to implement the VTE guidelines and risk assessment tools available. The stakeholders and clinical leads need to provide the opportunity and encouragement for ANP to

implement the VTE guidelines and motivate the ANP to utilise the risk assessment tools. This can be effectively done by implementing a behavioural change model such as the COM-B system. The COM-B system states that behaviour occurs as an interaction between three necessary conditions, capability, motivation and opportunity (Michie *et al* 2011) (Figure 7.1)(Table 7.2).

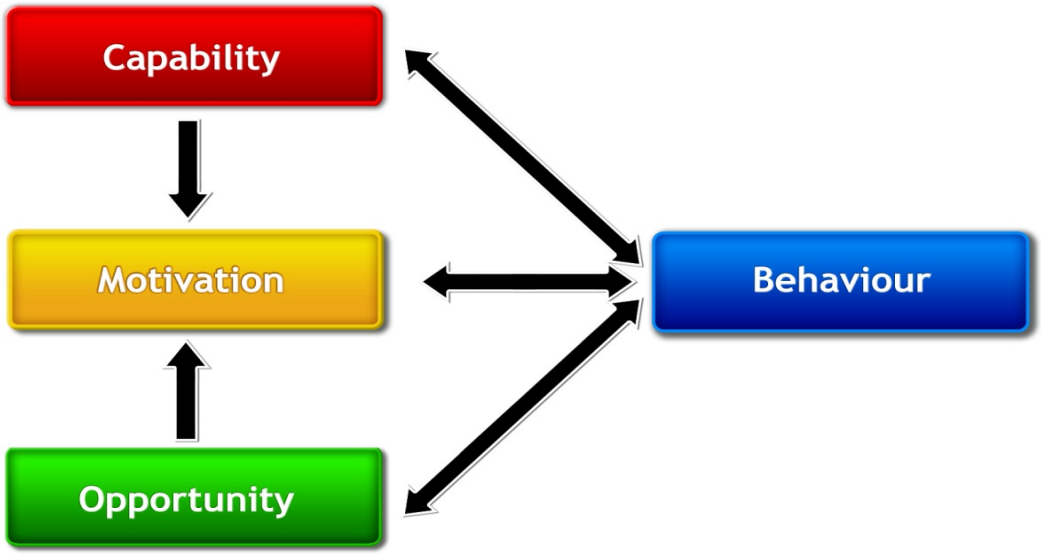


Figure 7.1: The COM-B system

(Michie *et al* 2011)

Capability

This involves the individuals' psychological or physical ability to make a behavioural change. Michie *et al* (2011) state that influencing capability consists of four main components, knowledge, skill, strength and stamina. The individual needs to be educated regarding ways to embrace the desired behaviour and avoid the undesired one. They need to be trained to have the cognitive, physical and social skill set. They also need to be educated to have the strength and stamina to resist old habits. Therefore, education and training the individual to have the skill to perform the desired intervention is a key component. Most educational theories on adult learning focus on new practice methods especially when problems exist within practice (Grol *et al* 2013).

Motivation

West (2006) states that motivation is both 'reflective and automatic'. Reflective is what the individual deems as right and wrong, their conscious intentions, decisions and plans. However, automatic is the individual's desire and their emotional impulses and responses. Michie *et al* (2011) build on this by stating that influencing motivation consists of five main components, plans, evaluations, motives, impulses/inhibitions and responses. It is important to develop action plans, educate and evaluate the NICE guideline, instill the desired motive for best practice for the patient, to overcome inhibitions and old practice impulses and develop positive responses towards change. Grol *et al* (2013) discuss that it is the 'attitude, perception and intention' of the individual motivation that enables for a successful change (Grol *et al* 2013 pg. 22). It is also important to determine the individual's readiness and intention to change. It is important to remember that the individual's readiness to change is very different to their readiness or willingness to accept the intervention.

Opportunity

Michie *et al* (2011) state that influencing opportunity consists of three main components, time, resources and cues/prompts. It is important that the individual is given the time to embrace this new change in practice and that it does not demand more time than previous practice resulting in a relapse of behaviour. The environment may need to be restructured to allow for the availability of the resources required for the intervention to be successful.

This complex intervention and environment have provided me with knowledge and insight into the importance of choosing the most appropriate model, framework and theory to use to help drive improvements through the implementation process and therefore maintain sustainability for years to come.

Table 7.2 COM-B implementation for VTE Guidelines

Barriers highlighted during the research	Relate to COM-B System	Changes made to overcome barriers
Ownership	Capability – Skill & Education	Treating ANP will take ownership as they are treating and prescribing. Consultants to develop a common protocol
Lack of Education	Capability - Education	National workshops and e module on HSE land will be available for all staff.
ANP skill set	Capability – ANP Scope of practice	Utilising the ANPs, Consultants and key stakeholders imparting knowledge to other staff.
Education of ANP	Motivation - Education	Education sessions and online module available on HSE land
Time Constraints	Opportunity - Time	Get patient to complete VTE Risk form while the backslab is being applied if possible.
Prescribing	Opportunity - Resource	Ensure prescriptive authority is granted for ANP to prescribe thromboprophylaxis
VTE Risk Forms	Opportunity - Resource	Ensure downloadable form available for all ED settings
Forget about VTE	Opportunity – Cues/prompts	Online prompt when patient registers in ED

7.11 Recommendations for Policy

It is important to remember that change does not just happen overnight. NICE states "that clinical guidelines can take up to 3 years before they are fully implemented into clinical practice" (NICE 2007(b) pg. 4). ANPs are recognized as contributing high-quality care to patients availing of Irish healthcare (Begley *et al* 2014). ANPs play a vital role in addressing

the challenges of sustaining a global health workforce, and conquering the inequalities of healthcare while improving health outcomes (Elliott *et al* 2016, Global Health Workforce Alliance, 2015, Bryant-Lukosius *et al* 2017). ANP both in Ireland and globally are recognised as leaders as they aid in the progression of services and diversity in roles in healthcare delivery and prevention of ill-health. Thus, ANPs must be seen as the driving force in the implementation of VTE guidelines and risk assessment tools as policy throughout the healthcare ensuring that all organisations are meeting standards. The development of a logic model highlighting the relevant inputs, outputs and outcomes will be allowed for an in-depth critical thinking process towards the relevant interventions and implementations required (Figure 7.2).

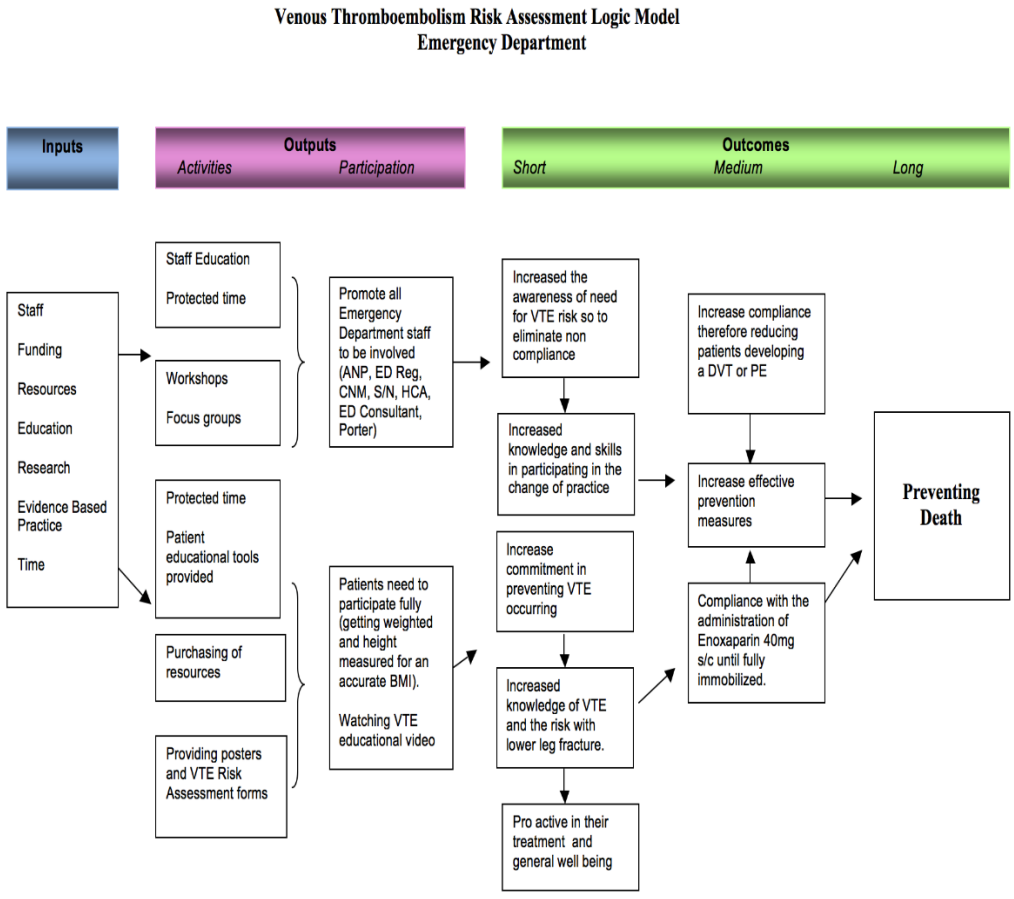


Figure 7.2 – Logic Model for VTE Risk Assessment Policy

Like all good policies being implemented a theoretical framework is required. The most fitting theoretical framework that assists to underpin the development of this complex intervention and one that is a specific tool in aiding the implementation process and evaluation is the RE-AIM framework. Frameworks in implementation science are described as having "descriptive factors that influence implementation outcomes" (Nilsen 2015 pg. 3). The RE-AIM framework

consists of several components or factors that influence the outcome of the VTE implementation. The RE-AIM framework is widely used in research to bridge the gap between research and clinical practice and how the interventions overcome barriers (www.re-aim.org). RE-AIM is an acronym for the outcomes that are measured by this framework. Outcomes are evaluated under the following headings, reach, efficacy, adoption, implementation and maintenance (Farris *et al*. 2007).

R – Reach - This is the number of ANPs that start utilising the VTE guidelines and risk assessment tools, as well as the number of patients that benefit from the VTE risk assessment being performed on them prior to discharge.

E – Effectiveness – This investigates the effect the interventions have on the outcome. A reduction in returns of patients to ED with lower limb immobilisation with suspected or confirmed diagnosis of VTE. Reduction in healthcare costs in the treatment of VTE and the loss of income of the patient.

A- Adoption – This is the number of ANPs who are willing to get involved in the implementation of the VTE guidelines and risk assessment tools within the ED setting.

I – Implementation – How well the interventions have been utilised and brought into action therefore reducing the gap between evidence-based NICE guidelines and clinical practice within the emergency setting. That the implementation will become embedded in the ANPs' daily clinical practice.

M – Maintenance – It is important to set regular periods to review and monitor the utilisation of this implementation within the ED setting. This is important to prevent relapse from occurring and to maintain long-term sustainability.

Sustainability is of utmost importance, as we as researchers hope that our hard work continues to flourish. The literature recognizes without the sustainability of the interventions that the implementation is worthless. Rabin *et al* (2008) argue that implementation is the initial process of establishing the interventions, but sustainability is what is responsible for extending those interventions over a long period within the healthcare setting. The Government, stakeholders, clinical leads and ANPs need to concentrate on maintaining the practice, once the practice has been implemented (Stirman *et al* 2012, Scheirer & Dearing 2011). This study has highlighted the fact that guidelines and risk assessment tools exist in clinical practice but the knowledge surrounding these and the adherence to applying them to patients with lower limb immobilisation is very low. This needs to change, and this change can only be successful if it

is a department of health initiative and the appropriate education is provided to all clinical staff.

7.12 Recommendations for Future Research

This study was the first of its kind to look at the clinical practice and knowledge of ANPs in relation to VTE in lower limb injuries in the Republic of Ireland. This is the only research to be conducted investigating the knowledge and current practice of VTE in lower limb injuries in an ED setting. There are plenty of further research opportunities in the future in this field. The reproduction of this study in other countries is encouraged given that all populations are susceptible to developing VTE as a result of lower limb immobilisation. This study only investigated ANPs as they are the main diagnosing and treating clinician for this cohort of patients, however if there is no ANP on duty then the ED doctor diagnoses and treats the patient. A future study could look at the doctors' clinical practice and knowledge, with this information collected a comparison could be made between the ANP and the ED doctors. The need for research in this area was also highlighted and welcomed by the participants in this study.

Finally, guideline development specifically for VTE risk in patients with lower limb immobilisation needs to be developed both nationally and internationally so that they are standardised throughout all healthcare settings.

7.13 Conclusion

The delivery of high-quality, cost-effective healthcare prompted the development of nurse practitioner services internationally (Jennings *et al* 2009, Lee & Fitzgerald 2008). The literature recognises that ANP contribute to improving the quality of care and health outcomes (Swan *et al* 2015, Martin-Misener *et al* 2015). The study provides important insights into current practice and knowledge of ANP within the ED setting. Knowledge of VTE risks and current guidelines among ANP are deficient which may be as a result of the lack of standardised protocols in the ED setting. Although controversy still exists in the literature about whether cast immobilisation results in patients developing VTE, assessment of patients to identify high-risk patients is essential. All patients need to be carefully assessed for risk of developing a VTE prior to the application of immobilisation so if warranted an appropriate thromboprophylaxis can be prescribed. The literature recognises that ANP seek to expand their role by gaining competencies in additional skills and developing services to meet patients' needs. Bovero *et al* (2018), recognise that ANPs are a key healthcare discipline that is capable of being responsive

to evolving healthcare needs. ANPS must be involved in the development and implementation of national evidence-based clinical practice guidelines ensuring the improvement of VTE management. This guideline development will secure nationally standardised guidelines and risk assessment tools and ensure that the ANP along with other essential stakeholders facilitate the development and uptake of these guidelines and encourage behavioural change. As highlighted in this study there are obvious gaps in clinical practice concerning this topic, these gaps could be addressed in future research. However in the interim, as suggested by Nadaf (2018), advanced practice is in a great position to address increasing global healthcare demands such as VTE risk in lower limb injuries while providing better healthcare services for these patients and enhancing improved patient care by increasing knowledge, adhering to guidelines and assessing patients for risk.

7.14 Take Home Message

Patients have the right to receive the finest care, this needs to include up-to-date evidence-based guidelines and protocols. It is our role as ANPs to implement these standards ensuring compliance and adherence to recognised clinical practice guidelines are obtained guaranteeing high-quality care is being provided. I believe we have the duty and the potential to improve this process.

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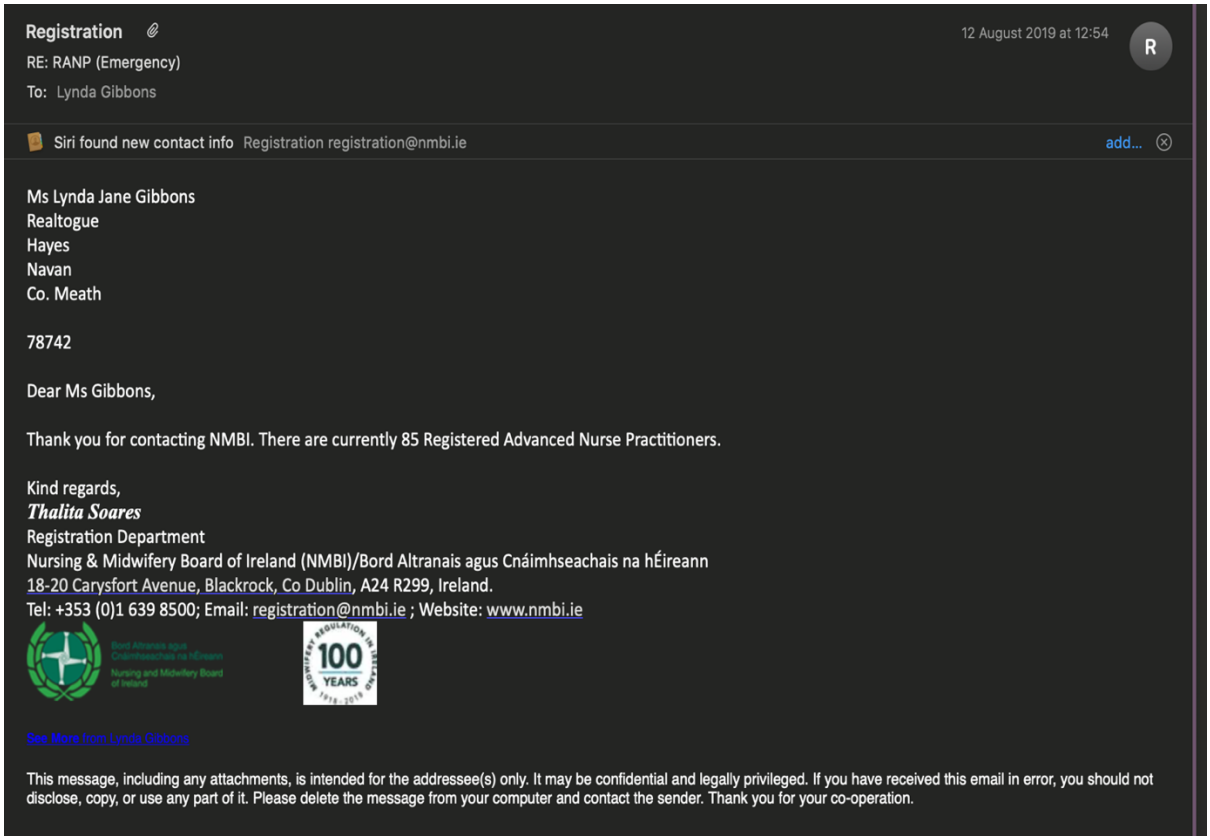
Appendicies:

Appendix 1: Email from NMBI



Registration 12 August 2019 at 12:54

RE: RANP (Emergency)

To: Lynda Gibbons

Siri found new contact info Registration registration@nmbi.ie add...

Ms Lynda Jane Gibbons
Realtogue
Hayes
Navan
Co. Meath

78742

Dear Ms Gibbons,

Thank you for contacting NMBI. There are currently 85 Registered Advanced Nurse Practitioners.

Kind regards,
Thalita Soares
Registration Department
Nursing & Midwifery Board of Ireland (NMBI)/Bord Altranais agus Cnáimhseachais na hÉireann
18-20 Carysfort Avenue, Blackrock, Co Dublin, A24 R299, Ireland.
Tel: +353 (0)1 639 8500; Email: registration@nmbi.ie ; Website: www.nmbi.ie

Bord Altranais agus Cnáimhseachais na hÉireann
Nursing and Midwifery Board of Ireland

100 YEARS

See More from Lynda Gibbons

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Appendix 2: Literature Search MeSH and Keywords

Concept 1: Emergency Setting
Medline: (MH "Evidence-Based Emergency Medicine") OR (MH "Emergency Service, Hospital+") OR (MH "Emergency Nursing") OR (MH "Emergency Medicine")
CINAHL: (MH "Emergency Service") OR (MH "Emergency Nursing")
EMBASE: 'emergency ward'/exp OR 'hospital emergency service'/exp
ASSIA: Accident and Emergency Departments
Web of Science: Emergency AND Department
Global Health Library: "Emergency" AND "Department"

Keywords: "accident and emergency" OR "accident & emergency" OR "emergency department*" OR "emergency room*" OR "emergency unit*" OR "emergency service" OR A&E OR "A and E" OR "emergency ward*"
EMBASE KEYWORDS: accident and emergency OR accident & emergency OR emergency department* OR emergency room* OR emergency unit* OR emergency service* OR A&E OR A and E OR emergency ward*

Concept 2: Knowledge
Medline: (MH "Knowledge") OR (MH " Health Knowledge") OR (MH "Health Knowledge, Attitudes, Practice")
CINAHL: (MH "Nursing Knowledge") OR (MH "Knowledge+") OR (MH "Health Knowledge") OR (MH "Professional Knowledge")
EMBASE: 'Knowledge'/exp OR 'Knowledge base' OR 'Learning'
ASSIA: Knowledge
Web of Science: Knowledge
Global Health Library: "Knowledge"

Keywords: "Knowledge*" OR "Health Knowledge, Attitudes, Practice" OR " Health Knowledge" OR "Knowledge" OR "Professional Knowledge"
EMBASE KEYWORDS: Knowledge OR Knowledge base OR Learning

Concept 3: Clinical Practice

Medline: (MH "Practice Patterns")
CINAHL: (MH "Practice Patterns")
EMBASE: Current AND 'Practice' OR 'Clinical Practice'
ASSIA: Clinical Practice
Web of Science: Clinical AND Practice
Global Health Library: "Clinical" AND "Picture"

Keywords: "Practice Patterns" OR "Clinical Practice" OR "Current Practice"
EMBASE KEYWORDS: "Clinical Practice" OR "Practice Patterns"

Concept 4: Risk Assessment
Medline: (MH "Risk Assessment") (MH "Risk Factors")
CINAHL: (MH "Risk Assessment")
EMBASE: 'Risk Assessment ' OR 'Risk Algorithm'
ASSIA: Risk Assessment and Quantitative Risk Assessment
Web of Science: Risk AND Assessment
Global Health Library: "Risk Assessment"

Keywords: “Assessment, Benefit-Risk” OR “ Assessment, Health Risk” OR “ Assessment, Risk” OR “Risks and Benefits”
EMBASE KEYWORDS: “Risk Assessment” OR Assessment, Health Risk”

Concept 5: Lower Limb Immobilisation
Medline: (MH “Immobilisation”) OR (MH “Immobilization”) OR (MH “ Casts, Surgical”) OR (MH “Fracture Fixation”)
CINAHL: (MH “Lower Extremity+”)
EMBASE: ‘Lower AND Extremity AND Immobilisation’ OR ‘Lower AND Limb AND Immobilisation’
ASSIA: Lower Limbs
Web of Science: Lower AND Limb AND Immobilisation
Global Health Library: : “Limb” AND “Injury” AND “Immobilisation”

Keywords: “Immobili#ation” OR “Cast, Plaster” OR “Cast, Plastic” OR “Cast Fiberglass” OR “ Fracture Fixation” OR “Lower Extremity+” OR “Lower Leg Immobili#ation.mp”
EMBASE KEYWORDS:” Lower Leg immobilisation” OR “Lower Extremity Immobilsation” OR Limb Immobilisation”

Concept 6: Lower Limb Injuries
Medline: : (MH “Leg Injuries”) OR (MH “Leg Injuries”) OR (MH “Lower Extremity”)
CINAHL: (MH “Lower Extremity+”)
EMBASE: ‘Lower AND extremity AND Injury’ OR ‘Lower AND Limb AND Injury’
ASSIA: Lower Limbs
Web of Science: Lower AND Limb AND Injury’
Global Health Library: “Limb” AND “Injury”

Keywords: “Injuries Leg” OR Leg Injury” OR “Lower Extremity” OR “Extremities, Lower” OR Limb Lower” OR “Lower Extremity+” OR “Lower Limb Injury.mp”
EMBASE KEYWORDS: “Lower Leg Injury” OR Lower Extremity Injury” OR Lower Limb Injury”

Concept 7: Venous Thromboembolism
Medline: (MH “Venous Thromboembolism”) OR (MH “Pulmonary Embolism”) OR (MH “Venous Thrombosis”)
CINAHL: (MH "Venous Thromboembolism/DI/ED/NU/RF") OR (MH "Venous Thrombosis+/DI/EC/ED/NU/RF”)
EMBASE: ‘Venous Thromboembolism’ OR ‘Vein Thrombosis’ ‘Embolism’
ASSIA: Venous Thrombosis
Web of Science: Venous AND Thromboembolism
Global Health Library: ‘Venous Thromboembolism’ OR ‘Venous Thrombosis’

Keywords: “Venous Thromboembolism” OR “Thromboembolism Venous” OR “Thromboembolism” OR “Pulmonary Embolism” OR “Pulmonary Thromboembolism” OR “Deep-vein Thrombos#s” OR “Deep Vein Thrombos#s” OR “Venous Thrombos#s, Deep”
EMBASE KEYWORDS: Venous Thromboembolism” OR “Thromboembolism Venous” OR “Thromboembolism” OR “Pulmonary Embolism” OR “Pulmonary Thromboembolism” OR “Deep Vein Thrombosis” OR “Embolism”

Concept 8: Advanced Nurse Practitioners
Medline: (MH "Nurse Practitioners") OR (MH "Nurse Practitioner") OR (MH "Practitioner, Nurse")
CINAHL: (MH "Emergency Nurse Practitioners") OR (MH "Adult Nurse Practitioners") OR (MH "Advanced Practice Nurses+/ED")
EMBASE: 'Nurse Practitioner'
ASSIA: Advanced Nurse Practitioner, Emergency Nurse Practitioners, Nurse Practitioners
Web of Science: Nurse AND Practitioner'
Global Health Library: "Nursing" AND "Practitioner"
Keywords: "Nurse Practitioners.mp" OR "Nurse Practitioner.mp" OR " Practitioners, Nurse.mp"
EMBASE KEYWORDS: "Nurse Practitioners"

Concept 9: Clinical Practice Guidelines
Medline: (MH "Clinical Practice Guideline") OR (MH "Practice Guideline")
CINAHL: (MH " Practice Guidelines") OR (MH "Guideline Adherence/AM/ED/UT") OR (MH "Clinical Governance+/ED/AM/UT")
EMBASE: 'Clinical Guidelines' OR 'Practice Guidelines'
ASSIA: Clinical Guidelines
Web of Science: Clinical AND Guidelines
Global Health Library: "Clinical" AND "Guidelines"
Keywords: "Clinical Practice Guideline" OR "Practice Guideline"
EMBASE KEYWORDS: "Practice Guideline" OR "Clinical Guidelines"
"venous thromboembolism" OR "venous thrombosis"

Concept 10: Barriers & Facilitators
Medline: (MH "Barriers") OR/AND (MH "Facilitators")
CINAHL: (MH "Barriers") OR/AND (MH "Facilitators")
EMBASE: 'Barriers' OR/AND 'Facilitators'
ASSIA: "Barriers" OR/AND "Facilitators"
Web of Science: "Barriers" OR/AND "Facilitators"
Global Health Library: "Barriers" OR/AND "Facilitators"
Keywords: "Barriers" OR/AND "Facilitators" "Barriers AND Facilitators"
EMBASE KEYWORDS: "Barriers" OR/AND "Facilitators.mp"

Appendix 3: Downs and Black Criteria for Literature in this Study

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Quality
Batra *et al*	1	1	1	1	1	2	2	2	0	0	1	1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	1	22
Iqbal *et al*	1	1	1	1	1	2	0	2	0	0	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	17
Oh *et al*	1	1	1	1	1	2	2	2	2	2	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	1	28
Wallace *et al*	1	1	1	1	1	2	2	2	0	2	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	0	24
Lee *et al*	1	1	1	1	1	2	2	2	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	1	25
Tang *et al*	1	1	1	1	1	2	2	2	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	23
Da Silva *et al*	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	26
Mc Farland *et al*	1	1	1	1	1	2	2	2	2	0	1	1	1	1	1	0	1	0	1	1	1	1	0	0	1	1	0	25
																							Max Total					**32**

Key:
Reporting: "Yes=1," "No=0"

1. Is the hypothesis /aim /objective of the study clearly described?
2. Are the main outcomes to be measured clearly described in the Introduction or Methods section?
3. Are the characteristics of the patients / samples included in the study clearly described?
4. Are the interventions of interest clearly described?
5. Are the distributions of principal confounders in each group of subjects to be compared clearly described?

"Yes=2," "Partially=1," "No=0"

6. Are the main findings of the study clearly described?
7. Does the study provide estimates of the random variability in the data for the main outcomes?
8. Have all important adverse events that may be a consequence of the intervention been reported?

9. Have the characteristics of patients lost to follow-up been described?
10. Have actual probability values been reported (e.g., 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?

External validity: "Yes=1," "No=0," "Unable to determine=0"
11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?
12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?
13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?

Internal validity - bias: "Yes=1," "No=0," "Unable to determine=0"
14. Was an attempt made to blind study subjects to the intervention they have received?
15. Was an attempt made to blind those measuring the main outcomes of the intervention?
16. If any of the results of the study were based on "data dredging" was this made clear?
17. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?
18. Were the statistical tests used to assess the main outcomes appropriate?
19. Was compliance with the intervention/s reliable?
20.Were the main outcome measures used accurate (valid and reliable)?

Internal validity - confounding (selection bias): "Yes=1," "No=0," "Unable to determine=0"
21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?
22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?
23.Were study subjects randomized to intervention groups?
24.Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?
25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?
26. Were losses of patients to follow-up taken into account?
27. Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?

Adapted from Downs & Black 1998

Appendix 4: University of Stirling Ethics Approval

FH/MM

11 January 2019

Lynda Gibbons
Faculty of Health Sciences and Sport

UNIVERSITY of STIRLING

NHS, Invasive or Clinical Research (NICR) Committee

Room G10
Pathfoot Building
University of Stirling
Stirling FK9 4LA

Tel: +44 (0) 1786 467390
Email: nicr@stir.ac.uk

Dear Lynda

Clinician's practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting.
NICR (18/19) Paper 007; Chair's Action No. 008

Thank you for your email of 10 January 2019 which included the following attachments:

- Cover Letter Ethics Revision Version 3
- Participant Information Sheet – Jan 19
- IRAS Jan 19 Version 3
- NICR Jan 19 V2
- Questionnaire Jan 19

I am pleased to advise that your study has been granted approval, and wish you and your team all the best. The only issue outstanding is that you need to remove any reference to the Data Protection Act as this has been superseded by GDPR legislation. However, we do not need to see your documents again.

May I remind you of the need to inform NICR (nicr@stir.ac.uk) prior to making any amendments to this protocol, or any changes to the duration of the project and provide notification of study completion. A site file of all documents related to the research should be maintained throughout the life of the project, and kept up to date at all times. The site file template can be found on the NICR webpage at:
http://www.stir.ac.uk/research/integritygovernanceethics/researchethics/formsandguidance/

Please bear in mind that your study could be audited for adherence to research governance and research ethics protocols.

NICR 17/18 – Paper No. 007; Chair's Action No. 008
Please quote this number on all correspondence

Yours sincerely

J. Harris

Dr Josie Evans
(Depute Chair)

Appendix 5: University of Stirling Ethics Approval for Amendment

UNIVERSITY of STIRLING

NHS, Invasive or Clinical Research (NICR) Committee

Research and Innovation Services
3B1 Cottrell Building
University of Stirling
Stirling FK9 4LA

Tel: +44 (0) 1786 466233
Email: nicr@stir.ac.uk

Lynda Gibbons
Faculty of Health Sciences & Sport
University of Stirling
FK9 4LA

29 August 2019

Dear Lynda,

Clinician's practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting. NICR 18/19 - 007

Thank you for your recent submission of amendments, which were received on 27 August 2019.

I am pleased to advise that your study has been granted re-approval, and wish you and your team all the best.

May I remind you of the need to inform NICR (nicr@stir.ac.uk) prior to making any further amendments to this protocol, or any changes to the duration of the project and provide notification of study completion.

Please bear in mind that your study could be audited for adherence to research governance and research ethics protocols.

NICR 18/19 - 007
Please quote this number on all correspondence

Yours sincerely
Pp.

Katie Hamilton

Dr Josie Evans
(Depute Chair)

Appendix 6: HSE North East Area Research Ethics Committee

Ms Lynda Gibbons
Realtoge
Navan
Co Meath

29/3/19

Re/ Research Study Proposal:
"Practitioners' practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting"
REC Ref: REC/19/014

Dear Ms Gibbons

I refer to your email correspondence of the 28/3/19 in response to issues raised by the HSE North East Research Ethics Committee (REC) in connection with the above study. I wish to advise that I have had an opportunity to review same.

I can confirm that you have met all the conditions of the Committee.

Approval is now given to commence the above Study.

If during the course of the research project, amendments or alterations to the proposed research are required, approval must again be sought from this Committee.

Please note a copy of the completed study should be forwarded to the Research Ethics Committee office on completion of same.

This approval will be formally noted at the next REC meeting.

Yours sincerely,

_____
Dr Kevin McKenna
Chair, HSE North East Area
Research Ethics Committee

Copied to/ Mary Daly, Group CEO, IEHG, Mater Misericordiae University Hospital, Eccles Street, Dublin 7

HSE North East Area Research Ethics Committee
HSE Dublin North East, Bective Street, Kells, Co. Meath

List of site/s with favourable opinion/approval

Research Identification

Title of Research: Practitioners' practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting.

Approval to commence the study was given on 29/3/19.

The study approval is extended to each of the site/s listed below.

Applicant	Site
Lynda Gibbons	No site – online questionnaire

Signed: .....
Chair of Committee

Date: **29/3/19**

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Regional Manager Consumer Affairs
HSE Dublin North East

Bective Street, Kells
Co. Meath
A82 NX32

Tel: +353 (0) 46 9251262/263
Fax: +353 (0) 46 9251774

Loughtee Business Park
Drumalee, Cavan
H12 Y329

Tel: +353 (0) 49 4377343
Fax: +353 (0) 49 4377379
Email: consumeraffairs.hsedne@hse.ie

Ms Lynda Gibbons
Realtoge
Navan
Co Meath

30/8/19

Re/ Research Ethics Proposal:
"Clinicians` practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting (CPE-TRoLLIES Study)"
Change Study title to: "Advanced Nurse Practitioner (ANP) practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries with the emergency setting"

Dear Ms Gibbons

I refer to your correspondence of the 20/8/19 regarding changes to the study title.

I wish to advise that I have had an opportunity to review same and approval is given to change study title.

This will be formally noted at the next REC meeting.

Yours sincerely,

Rosalie Smith Lynch
HSE North East Area –
Research Ethics Committee

Copied to/ **Mary Daly, Group CEO, IEHG, Mater Misericordiae University Hospital, Eccles Street, Dublin 7**

Appendix 7: Excerpt of Participant Information Sheet

Participants' Information Sheet

1. **Research Project Title**

   Practitioners' practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting.

2. **Opening text:**

   You are invited to participate in a web-based online survey which is investigating Clinicians' knowledge and current practice on the prevention of VTE in patients who have sustained a lower limb fracture resulting in immobilisation either in the form of a backslab or a walking boot. This survey is part of a research project being conducted by myself, Lynda Gibbons, a Clinical Doctorate research student at the University of Stirling. It should take approximately 10 minutes to complete. You will be given some series of questions where you will be required to tick the appropriate box and also questions based on a scale ranging from "strongly agree" to "strongly disagree". Please read through these terms before agreeing to participate below.

3. **Background, aims of project**

   The aim of this study is to explore clinicians' knowledge and current practice regarding VTE risk assessment and treatment of patients with lower limb injuries within the Emergency setting.

   The evaluation aims to capture the current level of knowledge that ED clinicians have, their current practice and if any barriers or facilitators that exist in the prevention and assessment of VTE in patients who are discharged with a lower limb immobilisation.

4. **Why have I been invited to take part?**

   You have been asked to take part in the study to gather further information regarding the barriers and facilitators towards the adherence and implementation of the use of the VTE risk assessment guidelines.

Appendix 8: Participant Debriefing Sheet

Thank you for participating in this research project

13. Practitioners' practice when evaluating Venous Thromboembolism (VTE) risk due to lower limb injuries within the emergency setting.

14. Background, aims of project

The aim of this study is to explore clinicians' knowledge and current practice regarding VTE risk assessment and treatment of patients with lower limb injuries within the Emergency setting.

The evaluation aims to capture the current level of knowledge that ED clinicians have, their current practice and if any barriers or facilitators that exist in the prevention and assessment of VTE in patients who are discharged with a lower limb immobilisation.

15. What happens to the data I provide?

Your answers will be completely anonymous, and we will use all reasonable endeavours to keep them confidential. Your data will be stored securely on a password protected IT and the document will also be password protected which will be only accessible to the researcher. Your IP address will not be stored. Supervisors and the researcher will only see the data after anonymization.

Research reports and publications will not include any information that may identify you or your organisation. The study data including (questionnaires data) will be stored in a secure place for 10 years as per the University data guidelines. All data will adhere to the GDPR (2018) requirements.

16. Will the research be published?

The research will be published in a peer reviewed journal following completion of the study. It may also be presented at an International Healthcare Conference.

17. Contact Details

If you would like to discuss the research with myself Ms Lynda Gibbons (086) 6067266 or l.j.gibbons1@stir.ac.uk or if you have any concerns you can contact Professor Jayne Donaldson Dean of the Faculty Health Science and Sport in the University of Stirling. Prof Jayne Donaldson– (0044) 1786 466343 or jayne.donaldson@stir.ac.uk

Appendix 9: Certificate of Completion for Participants

Appendix 10: Letter of Support from Professional Body (EMP)

NATIONAL CLINICAL PROGRAMME IN EMERGENCY MEDICINE

@EmergencyProg

National Clinical Programme in Emergency Medicine,
RCSI Clinical Programmes Office,
2, Proud's Lane,
St Stephens Green,
Dublin 2

23rd November 2018

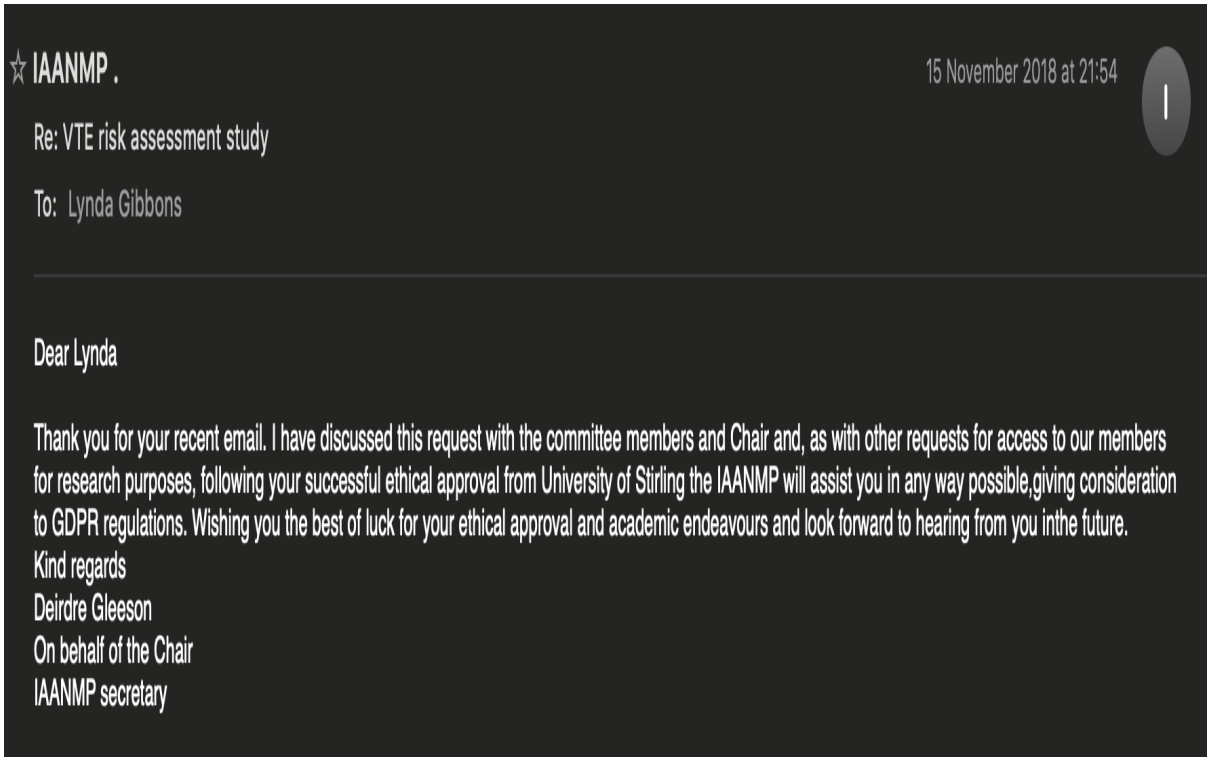
To Whom It May Concern:

As current Chair of the National Clinical Programme in Emergency Medicine, Advanced Nurse Practitioner Forum, I have agreed to facilitate Ms Lynda Gibbons to gain access to the membership of the ANP Forum through the use of an electronically held database and will act as a communication conduit to distribute a link to members for the purposes of Ms Gibbons research titled *Clinicians' practice when evaluating venous thromboembolism risk of lower limb injuries within the emergency setting*.

Yours truly,

Valerie Small RGN, RNT, RP,RANP
MSc, PG Dip CHSE,

Appendix 11: Letter of Support from Professional Body (IAANMP)



☆ IAANMP .

15 November 2018 at 21:54

Re: VTE risk assessment study

To: Lynda Gibbons

Dear Lynda

Thank you for your recent email. I have discussed this request with the committee members and Chair and, as with other requests for access to our members for research purposes, following your successful ethical approval from University of Stirling the IAANMP will assist you in any way possible,giving consideration to GDPR regulations. Wishing you the best of luck for your ethical approval and academic endeavours and look forward to hearing from you inthe future.
Kind regards
Deirdre Gleeson
On behalf of the Chair
IAANMP secretary

Appendix 12: Email correspondence to authors seeking permission to use their questionnaire.

Dr Jung-Ah Lee

Lynda Gibbons 18 April 2018 at 22:31

VTE

To: Lee, Jung-Ah

Dear Dr Lee,

I hope you don't mind me writing to you but I really enjoyed your paper that you and your colleagues published in the Journal of Vascular Nursing in 2014. I am a Clinical Doctorate student in the University of Stirling in Scotland but I'm working and living in Ireland. My research that I'm undertaking is a mixed method approach with a questionnaire followed by semi structured one to one interview to build on the answers of the questionnaire. I am looking at the knowledge and practice habits of Emergency Department Clinicians for patients with lower limb immobilisation following a fracture. I was wondering if there was a possibility to gain access to your cross sectional survey questionnaire. As your study investigated a different cohort of staff it may not be fully relevant but I feel it would be invaluable in the development of a questionnaire for my research. If you permit me access to your questionnaire I ensure that you will be reference and your work acknowledged. I am happy to discuss any questions you may have.

Kindest Regards,

Lynda Gibbons
Advanced Nurse Practitioner
Emergency Department
Our Lady's Hospital,
Navan.
Co. Meath
Ireland

Lee, Jung-Ah 19 April 2018 at 09:33

RE: VTE

To: Lynda Gibbons

Siri found new contact info in this email: Jung-Ah Lee jungahl@uci.edu add to Contacts...

Dear Lynda,
Please find the survey instrument with answer keys.
You may like to revise questions related to risk factors. We found nurses skipped some risk factors if they were not sure for the correct answer.

Let me know if you have any more questions !
I am happy to share the instrument !

Sincerely,
Jung-Ah

JUNG-AH (Anna) LEE, PhD, RN
Associate Professor
Sue and Bill Gross School of Nursing
University of California, Irvine
100A Berk Hall (Building 802)
Irvine, CA 92697-3959
Phone (949) 824-2855
Fax (949) 824-0470
Email: jungahl@uci.edu
http://www.nursing.uci.edu/

See More from Lynda Gibbons

UCI IRB Survey Instru...ey.doc

Lynda Gibbons 20 April 2018 at 00:11

Re: VTE

To: Lee, Jung-Ah

Dear Jung,

Many thanks for you very prompt and encouraging email. I really appreciate your generosity in sharing your survey instrument. It looks like a great tool will look forward going through it in more detail over the coming days.

Kind Regards,

Lynda.

See More from Lee, Jung-Ah

Dr Roy Wallace

Lynda Gibbons 17 April 2018 at 02:40

VTE Research

To: Rory Wallace - SVHM

Dear Dr Wallace,

I hope you don't mind me writing to you but I really enjoyed your paper that you and your colleagues published in the Internal Medicine Journal in 2017. I am a Clinical Doctorate student in the University of Stirling in Scotland but I'm working and living in Ireland. My research that I'm undertaking is a mixed method approach with a questionnaire followed by semi structured one to one interview to build on the answers of the questionnaire. I am looking at the knowledge and practice habits of Emergency Department Clinicians for patients with lower limb immobilisation following a fracture. I was wondering if there was a possibility to gain access to your cross sectional 53 question survey. As your study investigated a different cohort of physicians it may not be fully relevant but I feel it would be invaluable in the development of a questionnaire for my research. If you permit me access to your questionnaire I ensure that you will be reference and your work acknowledged. I am happy to discuss any questions you may have.

Kindest Regards,

Lynda Gibbons
Advanced Nurse Practitioner
Emergency Department
Our Lady's Hospital,
Navan.
Co. Meath
Ireland

Rory Wallace - SVHM 19 April 2018 at 14:14

Re: VTE Research

To: Lynda Gibbons

Hi Lynda,

Thank you for the email. Im glad you found the paper informative.

Your research sounds as though it could have very practical benefits. Im sure approaches to fracture management in Australia are not as well standardised as they could be, although I can't say I personally have that much experience in the area.

I've attached a copy of our questionnaire. The live version was primarily distributed via a survey monkey link.

All the best with your work. Send me a copy of your paper when its done.

Regards,

Rory

Sent from my Samsung Galaxy smartphone.

-------- Original message --------

See More from Lynda Gibbons

This email and any attachments to it (the "Email") is confidential and is for the use only of the intended recipient, and may not be duplicated or used by any other party without the express consent of the sender. If you are not the intended recipient of the Email, please notify the sender immediately by return email, delete the Email, and do not copy, print, retransmit, store or act in reliance on the Email. St Vincent's Health Australia ("SVHA") does not guarantee that the Email is free from errors, viruses or interference. Emails to and from SVHA or its related entities may be scanned and filtered in locations outside Australia.

QuestionnaireVTE_V2 [...D].pdf

Lynda Gibbons 20 April 2018 at 00:13

Re: VTE Research

To: Rory Wallace - SVHM

Dear Rory,

Many thanks for you very prompt and encouraging email. I really appreciate your generosity in sharing your survey instrument. It looks like a great tool and I will look forward going through it in more detail over the coming days. Maybe when I'm finished this piece of research we could do a comparison between Australia and Ireland in a future study.

Kind Regards,

Lynda.

See More from Rory Wallace - SVHM

Dr Melanie Keiffer

Lynda Gibbons 18 April 2018 at 22:48

VTE Research

To: Melanie Keiffer

Dear Dr Keiffer,

I hope you don't mind me writing to you but I really enjoyed your paper that you published in Nursing Clinics of North America in 2015. I am a Clinical Doctorate student in the University of Stirling in Scotland but I'm working and living in Ireland. My research that I'm undertaking is a mixed method approach with a questionnaire followed by semi structured one to one interview to build on the answers of the questionnaire. I am looking at the knowledge and practice habits of Emergency Department Clinicians for patients with lower limb immobilisation following a fracture. I was wondering if there was a possibility to gain access to your cross sectional survey questionnaire. As your study investigated a different cohort of staff it may not be fully relevant but I feel it would be invaluable in the development of a questionnaire for my research especially regarding the barriers towards guideline adherence. If you permit me access to your questionnaire I ensure that you will be reference and your work acknowledged. I am happy to discuss any questions you may have.

Kindest Regards,

Lynda Gibbons
Advanced Nurse Practitioner
Emergency Department
Our Lady's Hospital,
Navan.
Co. Meath
Ireland

Melanie Keiffer 19 April 2018 at 16:24

Re: VTE Research

To: Lynda Gibbons

Hi Lynda,

Good for you. Congrats on your work...let me see if I can find the original questionnaire. Of course you are welcome to use it, all you do it have to cite my article and the one from the CDC which I based my questionnaire on...look in my methods section.

I am speaking at a conference this week but will be back to San Francisco next week and can likely find it then.

Melanie

Melanie Keiffer DNP, ANP-BC
Associate Professor
School of Nursing & Health Professions
University of San Francisco
Cowell Hall-Office 208

See More from Lynda Gibbons

Hi Lynda,

Please see attached. The formatting is off as I copied the survey from qualtrics. Please forgive the long delay, It was a crazy busy spring/summer.

I admire your perseverance in following up and I hope your studies are going well. Let me know if I can be of further assistance.

Melanie Keiffer DNP, APRN, ANP-BC
Assistant Professor & Program Director

Doctor of Nursing Practice/Adult Gerontology Primary Care Nurse Practitioner
& Family Nurse Practitioner Programs
Department of Nursing Practice
College of Nursing
Academic Health Sciences Center
University of Central Florida

12201 Research Parkway
Orlando, FL 32826
Office: 407.823.5463
Fax: 407.823.5675
Email: melanie.keiffer@ucf.edu

See More from Lynda Gibbons

Clinical Practice Guideli...R.docx

Lynda Gibbons 19 April 2018 at 23:52

Re: VTE Research

To: Melanie Keiffer

Hi Melanie,

Hope your conference goes well. I really appreciate your support and encouragement. Many thanks for sharing your questionnaire,
Looking forward to hearing from you in the near future.

Kind Regards,

Lynda

See More from Melanie Keiffer

Appendix 13: VTE Questionnaire

Scan Code for Pdf Version of VTE Questionnaire

Appendix 14: Excerpt from the Relevance Ratings on the Item Scale by Expert Panel

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	Expert 14	Experts in ag	I-CVI
1.a. I understand that I don't have to take part in this study and that I can opt out at any time. I understand that I don't have to give a reason for opting out.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
1.b. I am aware of the potential risks and benefits of this research study.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
1.c. I am satisfied that my information will be kept private and confidential.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
1.d. I have voluntarily agreed to participate in this research study.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
1.e. I am 18 years or older.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
2. I have read the information provided. I give my informed consent to have my data processed as part of this research study.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
3. What is your current position?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
4. What is your specialty?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
5. How many years have you worked in your specialty?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
6. Which settings do you practice?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
7. On average how many patients does your department see a year?	1	1	1	1	1	1	1	1	0	1	1	1	1	1	13	0.93
8. Are you male or female?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
9. What is your age?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
10. What is your highest level of qualifications?	1	1	1	0	1	1	1	1	1	1	1	0	1	1	12	0.86
11. Have you ever attended a course or in service program that provided information on venous thromboembolism (VTE) risk assessment and prevention?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
12. How would you rate your overall knowledge of venous thromboembolism (VTE) risk assessment?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
13. Which of these guidelines for venous thromboembolism management are you familiar with? (You may select more than one)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
14. Which risk assessment forms are you familiar with? (You may select more than one)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
15.1. Patients with a lower limb immobilisation are not at risk of developing a VTE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
15.2. VTE prophylaxis should be prescribed for all patients with lower limb immobilisation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1
15.3. VTE prophylaxis should not be prescribed for patients with lower limb immobilisation	1	1	1	1	1	1	0	1	1	1	0	1	1	1	12	0.86
16. All these patients are a potential risk of developing a VTE (tick the most applicable).	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	1

Appendix 15: Research Funding

Item	Cost €	Comments
Computer paper	€ 250	Stationary Supplies Shop
Memory sticks	€ 30	Stationary Supplies Shop
NVivo software	€ 0	From University of Stirling
SPSS software	€ 0	From University of Stirling
Jisc Online Survey	€ 0	From University of Stirling
Questionnaires	€ 0	Online via Jisc
Letters to professional bodies	€ 0	Emailed
Letters to Authors seeking permission	€ 0	Emailed
General Stationary supplies	€ 60	Stationary Supplies Shop
Statistics	€ 0	Performed by Researcher
Thematic Analysis	€ 0	Performed by Researcher
Travel	€ 0	Performed by Researcher
Total Expenses for Research = € 340		

Appendix 16: Renaming of Participants JISC Codes

JISC Code Name	VTE Research Code Name
471599-471590-46712803	**1**
471599-471590-46718388	**2**
471599-471590-46719562	**3**
471599-471590-46719940	**4**
471599-471590-46721165	**5**
471599-471590-46725780	**6**
471599-471590-46726204	**7**
471599-471590-46726214	**8**
471599-471590-46726522	**9**
471599-471590-46737743	**10**
471599-471590-46766870	**11**
471599-471590-46794874	**12**
471599-471590-46814668	**13**
471599-471590-46900022	**14**
471599-471590-46927581	**15**
471599-471590-46928078	**16**
471599-471590-46936388	**17**
471599-471590-46936571	**18**
471599-471590-46940360	**19**
471599-471590-46940864	**20**
471599-471590-46967932	**21**
471599-471590-46971466	**22**
471599-471590-46976942	**23**
471599-471590-46991799	**24**
471599-471590-46992014	**25**
471599-471590-46993084	**26**
471599-471590-46994926	**27**
471599-471590-47025120	**28**
471599-471590-47032321	**29**
471599-471590-47047056	**30**
471599-471590-47087195	**31**
471599-471590-47130134	**32**
471599-471590-47137485	**33**
471599-471590-47154127	**34**
471599-471590-47163653	**35**
471599-471590-47178633	**36**
471599-471590-47271796	**37**
471599-471590-47294253	**38**
471599-471590-47658606	**39**
471599-471590-47996289	**40**
471599-471590-48008435	**41**
471599-471590-48053939	**42**
471599-471590-48064284	**43**
471599-471590-48094087	**44**
471599-471590-48149342	**45**
471599-471590-48529038	**46**
471599-471590-48707362	**47**
471599-471590-49124447	**48**
471599-471590-49413195	**49**
471599-471590-49654261	**50**
471599-471590-49748866	**51**
471599-471590-47379799	**52**

Appendix 17: Booklet of Transcribed Comments

5.8.1 Barriers

Barriers that exist

Unable to access Doppler ultrasound scans (RANP 1).

VTE guidelines but no policy on prophylaxis for patients going into cast / Boot (RANP 5).

No policy for ED patients usually discussed at 1st opd trauma clinic or if admitted (RANP 9).

Guidelines no risk form in chart just use clinical judgement we always use teds and low molecular heparin prophylaxis (RANP 14).

No orthopaedic team on site (RANP 17).

Could say all of the above but I follow safe practice with VTE risk assessment and always fill one out (RANP 25).

Training and education is lacking particularly in relation to patients being discharge with immobilisation of a lower limb (RANP 26).

As a ANP the protocol is currently to refer the high risk patients for medical doctor to prescribe anticoagulants.. as drug not licensed at that prophylactic dose Also orthopaedic doctors do not prescribe prophylactic anticoagulant I and that ultimately are the team that follow patients (RANP 34).

lower limb immobilisation patients are not assessed in ED for risk of VTE as it is not policy yet but may be introduced soon (RANP 39).

Consultant does not think it is necessary bin our unit as the patient attends Ortho within a few days and consultant feels DVT prophylaxis is orthopaedic problem to deal with (RANP 40).

No specific policy of risk assessment for lower limb injury. If concerned would assess using the DVT pathway (RANP 43).

Not enough up to date clinical knowledge and awareness of risk factors and prophylaxis measures... (RANP 50).

Overcoming Barriers that exist

Local policy currently being reviewed to change this (RANP 1).
Proper education and equipment for measuring and weighting patients to work out an accurate BMI (RANP 3).
Better leadership from management (RANP 4).
Guidelines for prophylaxis (RANP 5).
Need clear guidelines for patients in ED (RANP 9)..
Better staffing and education (RANP 10).
Staff increases and education (RANP 13).
Include form for risk assessment in documentation on admission (RANP 14).
Development of local and national policy and guidelines (RANP 16).
Standard national guideline for Ireland. IAEM exclude need for prophylaxis NOAC for patient treatment. In a back slab. Huge issues with prolonged waiting times for fracture clinic apt 6-7 weeks following ED presentation... (RANP 17).
Proper guidelines are necessary, standardisation is needed, we all need to be on the same page. In my hospital the NOAC used was not licensed at the prophylaxis dose and therefore as an ANP we could not prescribe, SO how could we follow such a protocol???? (RANP 18).
More education. Agreement on assessment tool to use. Standardized treatment pathways (RANP 19).
More education. development of a guideline. introducing a VTE risk assessment tool (RANP 21).
Currently no clear policy of VTE prophylaxis in Ireland. Use RCEM 2012 guideline on high risk patients (RANP 22).
If Barriers occur, education and skill mix can overcome these barriers. Staff being able to prioritise work (RANP 23).
Introduction of new guidelines. Collaboration and input from key stakeholders. Education and necessary clinical supervision (RANP 24)..

Through collaboration with consultants and education programmes (RANP 26).

Consultant pharmacy buy in. Study has commenced in hospital group on DVT risk to Patients in lower limb immobilisation (RANP 27).

Multidisciplinary guidelines and training (RANP 28).

By implementing guidelines and providing education and training (RANP 33).

Need proper guidelines preferably same nationally.. and ED and Ortho need to agree on guideline (RANP 34).

Introduction of a policy for VTE prophylaxis in the ED (RANP 35).

Department policy for all ED clinicians (RANP 39).

Mandatory DVT prophylaxis guidelines (RANP 40).

Specific guideline on lower limb injury assessment and which VTE prophylaxis is most appropriate (RANP 43).

Education and policies being put in place (RANP 45).

Policy (RANP 46).

Education (RANP 48).

Education (RANP 49).

Focused treatment change with software assist tools.. local project.. education..

LEAN adoption...someone to grasp DVT issue on limb immobilisation and address changes needed (RANP 50).

Try to see patients and discuss risk assessment in a quiet room (RANP 51).

5.8.2 Facilitators

Consultant support (RANP 1).

None (RANP 4).

CPE for prescribing includes innohep (RANP 6).

Algorithms, pre prepared packs to dispense to patients with sharps box, educational leaflets (RANP 7).

Clear unambiguous protocols (RANP 11).

Additional education, clear departmental guidelines (RANP 12).

If there is an educated staff nurse working with ANP this is a facilitator as they can assist with weighing patient, assessment tool and education (RANP 13)..

ED consultant (RANP 16).

Collaborative Practice Agreement which would need updating to prescribe prophylaxis (RANP 20).

Pharmacy Pharmacy guidance on-line Vascular ANP Medical Team (RANP 23).

Haematologist, pharmacist and EM Consultant input (RANP 25).

Collaborative practice agreement (RANP 28).

N/A (RANP 36).

We have VTE assessment document in our ED chart (RANP 38).

No (RANP 39).

Education and local guidelines (RANP 41).

Current TiLLI study ongoing in our department (RANP 42).

Senior Staff (RANP 44).

The TiLLI study has increased our perception of the issue (RANP 45).

The team works together (RANP 47).

Home Yellow sharps box pack (RANP 4)

Appendix 18: Professional Indemnity

Sentinel Building
103 Waterloo Street
Glasgow
G2 7BW
t +44 (0)141 248 5070
f +44 (0)141 222 3345

University of Stirling
Finance Department
Stirling
FK9 4LA

27th July 2018

Dear Sirs,

Client Information Letter

We, Aon UK Limited, are insurance brokers acting on your behalf only in accordance with our terms of business agreement. We have agreed to provide this letter to confirm that the contract(s) of insurance described on the attached pages (the '**Insurances**') are in force at the date of this letter.

All of the Insurances are subject to their specific policy terms, conditions and exceptions, not all of which may be summarised on the attachment. Please refer to the actual policies if full terms and conditions are required.

We accept no obligation to inform any other person or entity should any of the Insurances be cancelled, assigned or changed in such manner as to affect the accuracy of this document. Unless we specifically agree otherwise in writing, and to the fullest extent permitted by law, we do not accept any liability to anyone other than you, our client (and any such liability to you will be subject to the limitations contained in our terms of business agreement, and/or any other agreement, with you) for the content of this letter and its attachments.

Yours faithfully,

Mrs Allison Patterson
Scotland Operations Director
For and on Behalf of Aon Ltd

Direct Dial: 0141 222 3338
Email: Allison.patterson@aon.co.uk

Appendix 19: GDPR Certificates


Certificate of Completion

Lynda Gibbons

Understanding & Prioritizing Data Privacy

Updated: 12/2018 • Completed: 03/2019 • 1h 19m

Certificate No: 008A3A551AFB4C198237B31375A80168

Lynda.com FROM LINKEDIN


Certificate of Completion

Lynda Gibbons

Learning GDPR

Updated: 12/2018 • Completed: 03/2019

Certificate No: 6A0DFF9752084E6D96C20EA0889F07C6
CPE Unitss : 0.50 • CPE® Registered Education Provider #4101

Lynda.com FROM LINKEDIN


Certificate of Completion

Lynda Gibbons

Microsoft 365: Achieving GDPR Compliance

Updated: 06/2018 • Completed: 03/2019 • 1h 51m

Certificate No: A898AF31819E4DE083ED7679B5547E54

Lynda.com FROM LINKEDIN


Certificate of Completion

Lynda Gibbons

GDPR for Marketers

Updated: 03/2019 • Completed: 03/2019

Certificate No: 7D2CA359AD1049CE9AA1DEC33BC5EDA3
CPE Unitss : 1.40 • CPE® Registered Education Provider #4101

Lynda.com FROM LINKEDIN


Certificate of Completion

Lynda Gibbons

GDPR Compliance: Essential Training

Updated: 12/2018 • Completed: 03/2019 • 55m 17s

Certificate No: 4E81CF1905F344EAB8DAF0114C68FEB9

Lynda.com FROM LINKEDIN


Certificate of Completion

Lynda Gibbons

Creating a Culture of Privacy

Updated: 12/2018 • Completed: 03/2019 • 57m 23s

Certificate No: 349D066C3B6243A393B3E712C761EFEC

Lynda.com FROM LINKEDIN

Appendix 20: Article: Scoping Review

Venous thromboembolism clinical practices and knowledge of risk assessment tools and guidelines in ambulatory lower limb injury patients: A scoping review

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Post: Registered Advanced Nurse Practitioner (Emergency) Our Lady's Hospital, Navan
Adjunct Lecturer, UCD School of Nursing Midwifery & Health Systems,
Honorary Clinical Associate, Faculty of Nursing and Midwifery, Royal College of Surgeons in Ireland.

Dr Carina HIBBERD
Post: Lecturer, Clinical Doctorate Programme, University of Stirling

Dr Kathleen STODDART
Post: Senior Lecturer, Clinical Doctorate Programme Director, University of Stirling

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Funding Information: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

Background: The primary motivation for this study was fuelled by an interest in advanced nursing practice and the management of patients presenting with injuries to the Emergency Department (ED). The assessment and prophylaxis of the Venous Thromboembolism (VTE) in hospital patients has shown to be both medically and financially beneficial. The completion of a VTE risk assessment for patients sustaining a lower leg injury is evidence that an evaluation has taken place and therefore justifies the clinical decision for the Registered Advanced Nurse Practitioner (ANP) to prescribe prophylaxis or not for the patient.

Objective: The objective of this scoping review was to identify and map the available literature surrounding these three questions**:** 1) What knowledge do Nurse Practitioners, Clinicians and Nurses have of VTE guidelines and risk assessments tools for patients in a Lower Limb immobilization? 2) What practice habits do Nurse

Practitioners, Clinicians and Nurses have in identifying and preventing patients who are most at risk of developing a VTE as a result of Lower Limb immobilization? 3) What barriers and facilitators exist in the managing the prevention of VTE in patients with lower limb immobilisation?

Design: Scoping review using the Arksey & O'Malley's (2005) methodological framework

Methods: Search words '*Venous Thromboembolism*' and '*Risk Assessment'* and '*Knowledge*', were used as search terms in the following databases: Cochrane library, Joanna Briggs Institute (JBI), Web of Science, Ovid, Medline, PubMed, EMBASE, ASSIA, Global Health Library, Clinical Key, CINAHL plus (Via EBSCO Databases) and Guidelines International Network (GIN) without date limits or language restrictions and using combinations of Medical Subject Headings (MeSH) and topic terms. 216 potentially relevant articles were identified. Independent selection, data extraction tabulation of findings and analysis were completed.

Findings: After applying the inclusion and exclusion criteria eight articles were identified. Only studies that reported Clinical staffs' VTE risk assessment knowledge and clinical practice in a hospital setting were included. No studies were identified that included nurse practitioners knowledge and clinical practice of VTE risk and prevention for patients with lower limb immobilization after injury. Due to the lack of literature, the search expanded to include other conditions not only lower limb injuries.

Conclusions: Literature mapping suggests that clinicians lack the knowledge in relation to VTE, VTE guidelines and VTE risk assessment tools that exist in clinical practice.

Tweetable abstract: How is VTE risk evaluated in patients with lower limb injuries in the ED? #Nurse Practitioners #Clinical Practice #Knowledge @RiskVte

Keywords: Venous Thromboembolism, VTE risk, Lower limb injuries, immobilisation, clinical practice, nurse practitioner

1 | INTRODUCTION

People attend hospital with their injury or illness seeking treatment to improve their quality of life. The Irish Medical Times (2021) claimed that being in the hospital is a significant risk factor for the development of venous thromboembolism (VTE). There are approximately 11,000 people affected with roughly 4,000 of these dying in Ireland each year from VTE. In the United States of America (USA) it is estimated that VTE occurs every year in approximately 900,000 people in the USA, resulting in a death toll of 300,000 (Raskob *et al* 2010) and it is the 3rd highest cause of death in the US (Lim *et al* 2012). In 2022 Thrombosis United Kingdom (UK) found that in the western world someone dies from a VTE every 37 seconds. Healthcare organisations trying to change from curative medicine to preventative medicine with the their main aim in preventing the appearance of a disease or illness within a growing population. Healthcare prevention is seen as a key element to improving the overall health of a population and to try to curtail the continuously rising healthcare costs (Grosse *et al* 2016b). The assessment and prophylaxis of VTE in hospital patients has shown to be both medically and financially beneficial (Horner 2020). The National Institute for Health and Clinical Excellence (NICE) guidelines states that all patients should be assessed for risk of VTE and commenced on VTE prophylaxis if required (NICE 2015). VTE is a significant global health burden, with incident events alone costing National Health Service (NHS) Scotland an estimated £14.9 million in 2017/2018 and the USA an estimated $7–10billion each year (Thrombosis UK 2021, Grosse *et al* 2016a, Grosse *et al* 2016b).

The NHS in UK commenced an initiative to provide financial incentive to drive this project, the trust needed to assess 95% of their patients for risk of developing a VTE to avail of a financial award (NHS Commissioning Board 2013). The NHS since implementing this financial award have seen a marked improvement with 96% for NHS acute care providers assessing for VTE risk as reported during the first quarter of 2019/2020 (NHS 2019) compared to a UK study in 2012 showed that 18% of the hospitals involved in the study failed to meet the 90% target for assessing patients at risk of VTE (DoH 2013).

Immobility is considered a major risk factor for VTE in all populations (Nokes & Keenan 2009). As early as 1944, the risk for VTE associated with lower limb fractures requiring immobilisation was established (Batra *et al* 2006). The association between injury and

VTE is well recognized, and the reported incidence of VTE after trauma varies from 7% to 58% depending on patient demographics, kind of injury, method of detection, and type of VTE prophylaxis used (Knudson *et al* 2004). Keenan *et al* (2021) claims that there is a 2% clinically significant risk of developing a VTE following temporary lower limb immobilisation after injury. The Royal College of Emergency Medicine (RCEM) in 2015 carried out an audit throughout the UK examining data about patients (9916) who presented to an Emergency Department (ED) or Local Injury Unit (LIU) (167 centers) and required treatment consisting of either a back-slab or splint to immobilize their lower limb injury (Morris *et al* 2015). Over 90% of these patients were diagnosed with a fracture. However, it emerged from Morris *et al* 2015, that 25.9% of patients discharged from the ED had no VTE risk assessment carried out prior to discharge. Most of the previously published studies investigating VTE risk in lower limb immobilisation in patients, focused on hospital admitted patients where some patients required surgery. There is minimal literature surrounding the patient cohort of nonsurgical ambulatory patients who are at risk of VTE following a lower limb injury. Therefore, a scoping review was conducted to develop an understanding of VTE knowledge surrounding VTE risk assessment tools, guidelines and clinicians compliance and adherence. This review will synthesis the available evidence and map the key concepts as well as the identified gaps.

2 | AIM

The aim of this scoping review was to critique and synthesis the available literature. The purpose was to identify what gaps existed if any in the literature in relation to knowledge and current clinical practice in relation to VTE risk assessment of nurse practitioners, clinicians and nurses. These aims captured in the literature what facilitated the completion of risk assessment tools or what barriers existed to prevent the completion of the risk assessment tools. As well as establishing what the literature documented in relation to VTE guideline adherence.

3 | METHODS

3.1 | Review Design

A scoping review using the Arksey & O'Malley 2005 framework was conducted to map current knowledge in relation to knowledge and clinical practice of VTE risk assessment tools and guidelines through a systematic appraisal. Scoping reviews tend to examine the extent, nature characteristics of the relevant literature while identifying the gaps in existing literature (Munn *et al* 2018, Levac *et al* 2010). Scoping reviews can be conducted as part of an overall research or as a stand-alone summary (Arksey & O'Malley 2005). Researchers use these reviews to investigate broader topics or explore an area that has not been reviewed comprehensively in the literature before (Arksey & O'Malley 2005). As no literature exists regarding Nurse Practitioners' knowledge and current practice in evaluating VTE risk in patients with lower limb immobilisation in the ED, a scoping review was selected. The review will identify the research gaps in relation to knowledge and practice in VTE risk, with the aim of informing future research, guidelines and policies.

Arksey & O'Malley's (2005) six-step framework for interpretive scoping literature reviews was used with the modifications suggested by Levac *et al* (2010) and Daudt *et al* (2013). Arksey & O'Malley's (2005) five-step framework, the sixth being optional that they developed involves, 1) 'identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, 5) collating, summarizing, and reporting the results. In addition there is an optional sixth step, consulting key stakeholders as they can provide further insight. This review included steps 1 – 5.

3.2 | Review Questions

The review questions were:

- What knowledge do Nurse Practitioners, Clinicians and Nurses have of VTE guidelines and risk assessments tools as a result of Lower Limb immobilization?
- What practice habits do Nurse Practitioners, Clinicians and Nurses have in identifying and preventing patients who are most at risk of developing a VTE as a result of Lower Limb immobilization.

- What barriers and facilitators exist to optimal emergency management towards the prevention of VTE in patients with lower limb immobilisation?

3.3 | Eligibility criteria

Inclusion criteria were as follows: primary quantitative, qualitative and mixed method studies conducted worldwide in any of the seven regions of the world that reported on Clinical staffs' VTE risk assessment knowledge and clinical practice in hospital setting. Clinical staff directly involved in patient care (Nurse Practitioners, Physicians, Nurses), VTE in all patients, research studies in all languages were included in this search. Literature published between January 2000 to May 2022 were included in this scoping review. This date range was guided by the emergence of VTE clinical guidelines and risk assessments especially the NICE guidelines in 2010 and the developing a national quality requirement 2014/2015 by the NHS in the UK. Dates prior to 2010 were included the knowledge and practice prior to the NICE published guidelines.
Excluded were editorials, letters, notes, discussion papers, case studies or unpublished thesis. All papers and studies directly relating to treatment and diagnosing VTE were excluded. All thromboprophylaxis research was excluded. Research studies that excluded clinical staff and only involved patients and families were also excluded as this study was looking at clinical staff and preventing VTE from occurring as a result of the knowledge and current practice of the clinical staff.

3.4 | Databases

Based on the review questions, the mnemonic PICoS (Population, Intervention, Comparison, Outcomes, Setting) was used to identify relevant keywords and search terms (Stern *et al* 2014, Robinson *et al* 2011). As no comparator studies exist for the research area of interest the 'C' was omitted (Table 1).

P	I	O	S
Population	**Intervention**	**Outcomes**	**Setting**
Nurse Practitioners, Physicians, Nurses	VTE risk assessment.	Knowledge and practice habits.	Acute hospital setting

Table 1: PICo Framework (Centre for Reviews and Dissemination, 2009)

The following databases were searched: Cochrane library, Joanna Briggs Institute (JBI), Web of Science, Ovid, Medline, PubMed, EMBASE, ASSIA, Global Health Library, Clinical Key, CINAHL plus (Via EBSCO Databases) and Guidelines International Network (GIN). A search strategy was developed which combined key terms using a series of Medical Subject Headings (MeSH) and topic terms (Table 2) for '*Venous Thromboembolism*' AND/OR/NOT/NEAR2 '*Risk Assessment'* AND/OR/NOT/NEAR2 '*Knowledge*',. A combination of truncation and wildcards resulting in the search strategy being more comprehensive and subject focused. The truncation symbol (*) retrieved all articles that contain words beginning with 'thrombo*' plus any additional characters. Wildcards are used for words that have the same meaning but have different spellings due to number of reasons such as 'orthop?edic' and immobili#ation. The use of AND, OR and NOT proved useful by providing a relationship between the words in the search, 'Risk AND Assessment' meant that both words were searched as a phrase rather than separately. The NOT allowed the database to ignore certain results especially in relation to prophylaxis. A proximity search was also performed using the 'NEAR' operators. As Nurse Practitioners are called different titles globally the phase 'Nurse AND Practitioner NEAR2/N2' was used to capture all articles in the proximity.

Concept: Emergency Setting Medline: (MH "Evidence-Based Emergency Medicine") OR (MH "Emergency Service, Hospital+") OR (MH "Emergency Nursing") OR (MH "Emergency Medicine") CINAHL: (MH "Emergency Service") OR (MH "Emergency Nursing") EMBASE: 'emergency ward'/exp OR 'hospital emergency service'/exp ASSIA: Accident and Emergency Departments Web of Science: Emergency AND Department Global Health Library: "Emergency" AND "Department"
Keywords: "accident and emergency" OR "accident & emergency" OR "emergency department*" OR "emergency room*" OR "emergency unit*" OR "emergency service" OR A&E OR "A and E" OR "emergency ward*" EMBASE KEYWORDS: accident and emergency OR accident & emergency OR emergency department* OR emergency room* OR emergency unit* OR emergency service* OR A&E OR A and E OR emergency ward*
Concept: Clinical Practice Guidelines Medline: (MH "Clinical Practice Guideline") OR (MH "Practice Guideline") CINAHL: (MH " Practice Guidelines") OR (MH "Guideline Adherence/AM/ED/UT") OR (MH "Clinical Governance+/ED/AM/UT") EMBASE: 'Clinical Guidelines' OR 'Practice Guidelines' ASSIA: Clinical Guidelines Web of Science: Clinical AND Guidelines Global Health Library: "Clinical" AND "Guidelines"
Keywords: "Clinical Practice Guideline" OR "Practice Guideline" EMBASE KEYWORDS: "Practice Guideline" OR "Clinical Guidelines" "venous thromboembolism" OR "venous thrombosis"

Table 2: Search Template

The PRISMA extension for scoping reviews (PRISMA-ScR) checklist and recommendations were utilised throughout this scoping review (Page *et al* 2021, Tricco *et al* 2018) and shown in Figure 1.

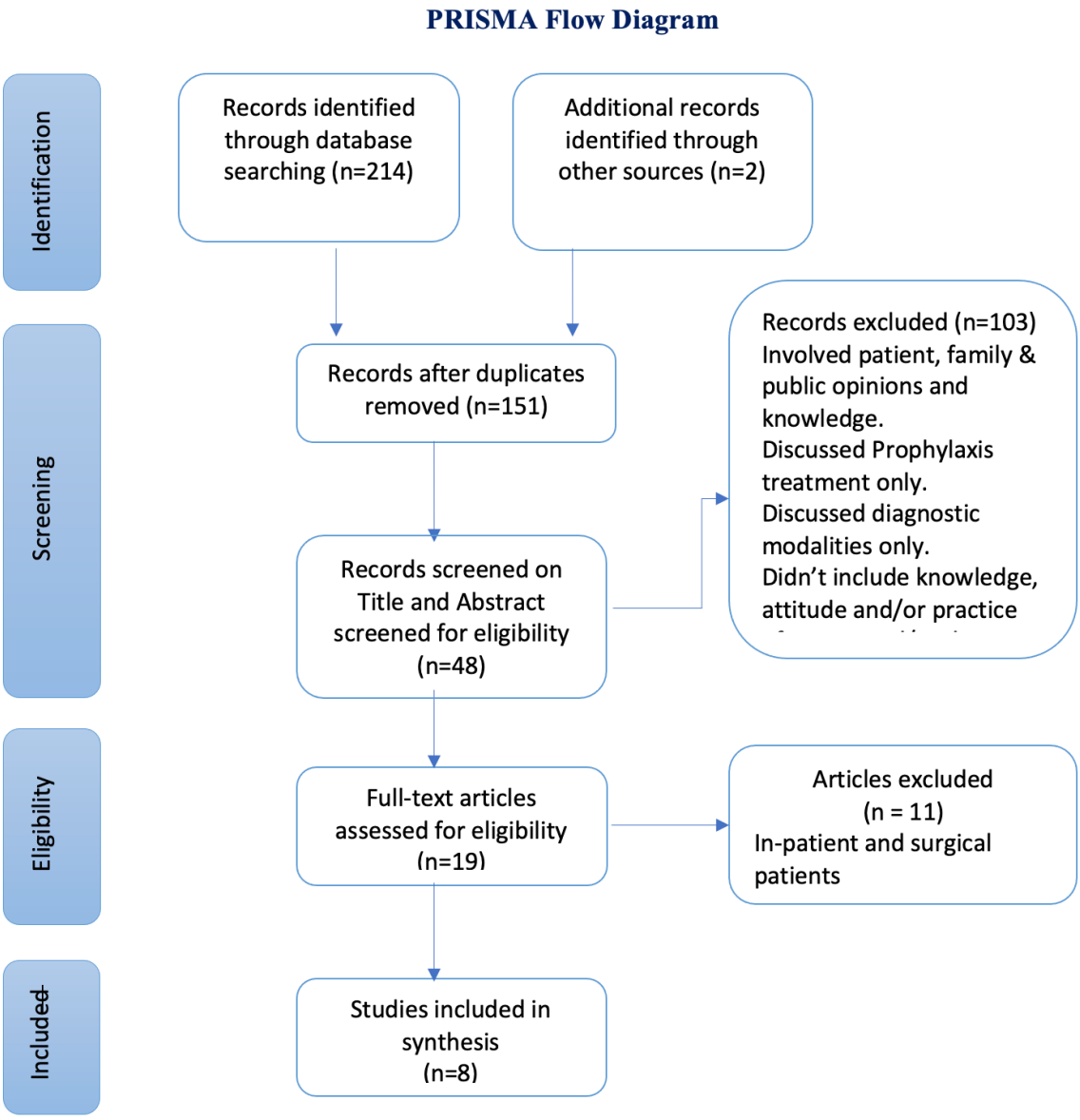

Figure 1: PRISMA Flow Diagram based on Moher *et al* 2009

3.5 | Review process and extraction

An initial search provided 214 articles. Two additional articles were obtained from reference lists via hand searching. Following the removal of the duplicates, relevant publications were identified and screened by titles and abstracts was preformed against the predefined inclusion and exclusion criteria, resulting in 19 eligible full text articles. On further examination of the full text articles with the PICoS selection criteria, a further 11 were excluded for reasons such as surgical patients, leaving a total of eight included in the review. Data synthesis was undertaken in three stages: (1) evidence

extraction and mapping, (2) identification of evidence gaps and (3) a narrative synthesis of selected research areas. A specifically designed data extraction table was used during the literature search to provide a platform to extract and map the data from the included studies. The data extracted included: author, year, country, research aims, study design, data collection methods and study population. Additionally, data were extracted on the following factors: geographic region, setting SORT score. The identified articles were explored using tabulation of findings and narrative synthesis to identify the key concepts (Table 3). The narrative descriptive synthesis was conducted for primary qualitative, quantitative and mixed-methods studies meeting the inclusion and exclusion criteria.

An assessment for study quality formed part of this review process. SORT taxonomy allowed for transparency regarding the strength of the evidence of study and also reduced the potential risk of bias (Barnes *et al* 2016). Each study was analysed for its quality and then rated either Level 1 (good quality patient orientated evidence), Level 2 (limited quality patient orientated evidence) or Level 3 (other evidence) as per SORT criteria (Ebell *et al* 2004). The literature was also reviewed for methodological quality (risk of bias) assessment by utilising the Downs and Black scale, which is one of the mostly widely used and well validated tools for the assessment of both randomised and non-randomised studies (Downs and Black 1998, Richmond *et al* 2013). The Downs and Black scale consisting of 27 questions assessing the quality of the literature, this was completed for each article in this review.

Table 3: The Data Extraction Table of Reviewed Articles

Study No.	First Author, (Year) Country of study	Research Question or Study Aims	Research Design	Data collection including research instruments	Study population Clinical Setting	Summary of findings	SORT Score	Notes
01	Batra *et al* (2006) England, Scotland & Wales, UK	"Investigate the current thromboprophylaxis practice among UK orthopaedic depts for patients immobilised with plaster for lower extremity injuries" pg.813	Quantitative	Telephone Survey Questionnaire Consisting of 4 main questions.	n=70 Doctors consisting of SHO & Registrars 3 refused to take part 70 Orthopaedic departments in UK	Shows inconsistency in orthopaedic depts in the UK. 62% of the departments had no protocols Failure to prescribe prophylaxis in high risk patients Lack of guidelines highlighted as poor clinical practice	Level 1	Current practice Medical Lower Limb Injuries
02	Iqbal *et al* (2012) England, Scotland Wales & Northern Ireland UK	"To assess the current practice across the NHS hospitals in the UK regarding DVT risk assessment and offering the appropriate prophylaxis to non-operative ankle fractures" pg.157	Quantitative	Telephone Survey Questionnaire	n=1 Consultant n= 23 Registrars n= 32 SHOs 56 Orthopaedic departments in UK (44 = England, 6 = Wales, 5 = Scotland, 1 = Northern Ireland)	A large variation existed throughout the UK with poor risk assessment being carried out in patients. Only 5.35% hospitals in the UK had guidelines to preform VTE risk assessment in ankle fracture patients treated with cast immobilisation throughout the outpatients.	Level 1	Current practice Medical Lower Limb Injuries
03	Lee *et al* (2014)	"How do registered nurses perceive their knowledge and practice of VTE risk	Quantitative	Exploratory descriptive study utilizing a web-based,	n= 221 Registered Nurses (bedside) Two acute hospitals	30% of nurses reported that their knowledge was fair or poor.	Level 1	Current practice Nursing

	California USA	assessment and prevention" "What barriers do the nurse perceive in their practices of assessment and prevention for VTE" pg.19		anonymous voluntary survey method	Hospital A = academic hospital with level 1 trauma and 422 beds. Hospital B = large community hospital with level 2 trauma and 407 beds.	31% of nurses reported that they seldom complete VTE risk assessment forms. 7% of nurses had previously attended an in-service education session. Barriers included lack of time, lack of knowledge, lack of standardised protocol.		All patient types.
04	Mc Farland *et al* (2014) UK	"To explore the current practice of VTE prevention in acute trusts" pg.1	Qualitative	Face to Face interview and telephone interviews. Four main themes	n= 17 n= 15 face to face n= 2 telephone 12 separate organisations/trusts	Confusion regarding the responsibility for VTE risk assessment and treatment. Participants showed low level of knowledge and understanding and uncertainty over reduced mobility. Importance of continuous training.	Level 1	Current practice Medical& Nursing
05	Oh *et al* (2017) South Korea	"To examine Korean nurses level of perceived knowledge and practice of VTE risk assessment as well as prevention, self-efficacy and actual knowledge of VTE" pg.427	Quantitative	Cross-sectional descriptive study paper based surveys	n= 452 Registered Nurses. All wards within two university hospitals in Seoul South Korea	Nurses showed very low level of VTE knowledge 80% rated their knowledge as fair or poor. 72.8% of nurses reported that they had seldom completed a VTE risk assessment for their patients. Nurses aware of detection and identification of DVT rather than prevention of VTE.	Level 1	Current practice Nursing All patient types.
06	Da Silva *et al* (2020)	" To compare nurse' self-perceived and objective knowledge	Mixed Methods	Cross-sectional	n= 81 Nurses	The majority of nurses performed risk assessment in only a few patients, mainly due	Level 1	Current practice Nursing

	Sáo Paulo Brazil	of VTE, identify risk assessment practices and perceived barriers and self-efficacy in preventing VTE" pg.1		descriptive study. Interview and paper or online surveys consisting of 21 questions divided in 5 sections	One teaching hospital	to the lack of standardised protocol and the lack of time. Self-efficacy on risk assessment, education and prophylaxis was low.		All patient types.
07	Tang *et al* (2015) North China	"To explore how medical staff of ICUs in China comprehend and practice VTE prophylaxis" pg.1	Quantitative	Cross-sectional descriptive postal surveys consisting of 39 questions divided in 4 sections	n= 1681participants n= 564 physicians n= 1117 nurses 52 ICUs in 23 tertiary hospitals in 7 Chinese province in North China	Knowledge of the guidelines were insufficient. Physicians rarely assessed the risk of VTE in ICU patients. 60% of medical staff were not aware of VTE guidelines in China or abroad.	Level 1	Current practice Medical& Nursing ICU patients
08	Wallace *et al* (2017) Australia	"To identify areas of uncertainty in VTE management and whether self-reported practice is consistent with guidelines" pg.436	Quantitative	Cross-sectional descriptive online surveys consisting of 53 questions	n= 71 haematologists, n= 110 respiratory physicians. Throughout Australia	Considerable variability in VTE management practices across multiple areas. Based decisions on multiple guidelines rather than just one.	Level 1	Current practice Medical Focused more on PE

4 | RESULTS

4.1 | Description of Studies

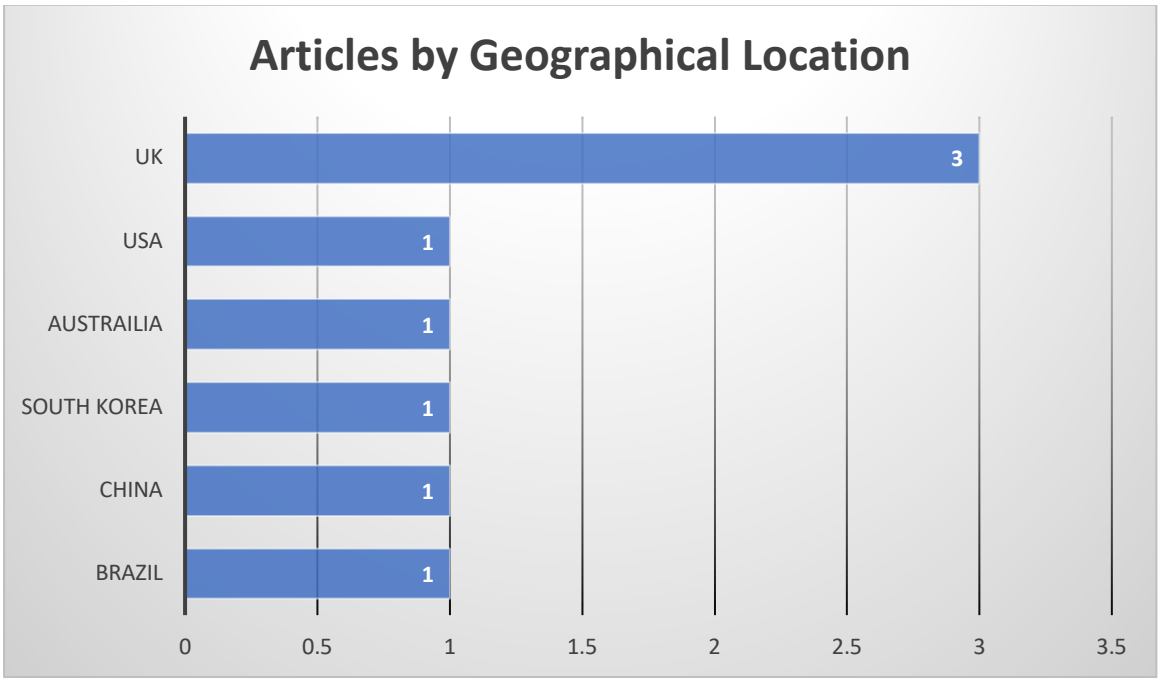

Figure 2: Articles by Geographical Location

The studies in this review (n=8) were conducted globally (Figure 2), United Kingdom (n=3) (Batra *et al* 2006, Iqbal *et al* 2012, Mc Farland *et al* 2014), United States of America (n=1) (Lee *et al* 2014), Australia (n=1) (Wallace *et al* 2017), South Korea (n=1) (Oh *et al* 2017), China (n=1) (Tang *et al* 2015) and finally Brazil (n=1) (da Silva 2020) all met level 1 criteria. From these studies there was one qualitative study (Mc Farland *et al* 2014) and six quantitative studies Batra *et al* 2006, Iqbal *et al* 2012, Lee *et al* 2014, Oh *et al* 2017, Tang *et al* 2015, Wallace *et al* 2017). Only one study used a mixed method approach (da Silva *et al* 2020). No studies included Nurse Practitioners. Three of the studies participants, consisted of doctors (Batra *et al* 2006, Iqbal *et al* 2012, Wallace *et al* 2017), three studies focused on general nursing staff (Lee *et al* 2014, Oh *et al* 2017, da Silva *et al* 2020) and the remaining two studies included both doctors and nurses (Mc Farland *et al* 2014, Tang *et al* 2015). Two of the studies included the assessment of patients sustaining lower limb injuries (Batra *et al* 2006, Iqbal *et al* 2012) while the remaining six included a variety of conditions.

Four main themes were identified:

1) Risk assessment of VTE
2) VTE guidelines
3) Knowledge and education surrounding VTE
4) VTE risk assessment compliance and adherence.

4.2 | Risk Assessment of VTE

Prolonged lower leg immobilization following an injury such as a fracture is associated with an increased risk of VTE however this issue was only discussed in two papers in this review (Batra *et al* 2006, Iqbal *et al* 2012). Iqbal *et al* states that 'all patients with lower limb cast immobilization should at least be risk assessed and thromboprophylaxis to be provided to those having high risk of DVT' (Iqbal *et al* 2012 pg.158). Similarly in Batra *et al* (2006) who advise that patients should be 'carefully assessed for risk of developing DVT before application of plaster and appropriate thromboprophylaxis prescribed accordingly' (Batra *et al* 2006 pg. 816). The remaining six papers discuss the risks that are associated with developing a VTE from a more generic aspect. Oh *et al* (2017) in their study discovered that only 15% of the participants completing a VTE risk assessment this was mirrored in (da Silva *et al* 2020) study where 19.8% of the nurse in the study always completed a VTE risk assessment.

4.3 | VTE Guidelines

Seven out of the eight papers that were reviewed (Table 3) discussed the various issues surrounding VTE guidelines. In da Silva *et al* (2020), study it was reported that the 'lack of a standardised protocol was the main barrier to VTE risk assessment' (65.4%) (da Silva *et* al 2020 pg. 5). Iqbal *et al* (2012) discovered that only 5.35% of hospitals in the UK actually had guidelines in place for preforming VTE risk assessment in ankle fracture patients who have a lower leg immobilization and who are treated in the outpatients. This issue, also came to light in Batra *et al* (2006) study where 98.57% of their respondents were unaware of any existing guidelines and 62% of all departments had no VTE prophylaxis guidelines following cast immobilization for lower limb fractures. A further discovered was that 77% of the respondents based their clinical decisions on more than one guidelines.

4.4 | Knowledge & Education Surrounding VTE

All eight papers investigated and discussed the issue around knowledge and education in relation to VTE prevention. Oh *et al* (2016) highlighted the fact that in their study their participants were knowledgeable in relation to the detection of a Deep Vein Thrombosis (DVT) but lacked the knowledge in relation to prevention. Also in Oh *et al* (2016) study they discovered that 74.3% of the clinicians rated their knowledge as fair. Lee *et al* found in their study that 'greater VTE knowledge was associated with better VTE prevention care' (Lee *et al* 2014, pg. 22). Lee *et al* (2014) in their study also found that 27.8% (58/208) of the nurses self-reported that of their VTE knowledge was fair or poor. Nurses in da Silva *et al* (2020) study perceived that their lack of knowledge was a barrier to completing VTE risk assessments.

4.5 | VTE Risk Assessment Compliance and Adherence

Only five papers (Batra *et al* 2006, Lee *et al* 2014, Mc Farland *et al* 2014, da Silva *et al* 2020, Tang *et al* 2015) investigated the issue surrounding compliance and adherence when it comes to completing a VTE risk assessment on patients. There were a number of issues that fed into the lack of adherence and compliance with the utilisation of the VTE guidelines and the risk assessment models within the clinical setting. As Batra *et al* (2006) highlighted in their study that 62% (n=43) of departments had no VTE protocols insitu and only 11% of departments used risk assessment, making it very difficult to implement and adhere to these guidelines and protocols when they don't exist. da Silva *et al* (2020) identified nurses self-perception of barriers in completing the VTE risk assessment was that, 65.4% was due to the lack of a standardised protocol. Lee *et al* (2014) & da Silva *et al* (2020) claimed that barriers exist in clinical practice, that prevent adherence from occurring.

5 | DISCUSSION

This scoping review undertook to examine the evidence about practice in ED surrounding VTE risk assessment in patients with lower leg immobilisation. Despite this clinical issue, there remains no research guiding the ED management of the risk of VTE in patients with lower limb immobilisation following an injury. There is an abundance

of literature focused on VTE prophylaxis and diagnosing VTE in patients in a wide variety of clinical settings. However, there is little evidence addressing risk assessment knowledge and current practice. As only two studies addressed lower limb immobilization this clearly highlights an under researched topic. The National Institute for Health and Care Excellence (NICE) gives advice regarding the thromboprophylaxis in admitted patients who sustained a lower leg fracture (CG92) however no specific guidelines have been initiated for patients managing their lower leg fracture as an outpatient ambulatory patient (NICE 2019). Batra *et al* (2006) found that in 52.9% of the departments involved in their study, that no VTE prophylaxis was prescribed and the remainder of the departments showed no consistency in the type of VTE prophylaxis used. The range was from aspirin throughout the period of immobilization (15.7% n=11), Low Molecular Weight Heparin (LMWH) throughout the period of immobilization (12.9% n=9) to LMWH while in hospital followed by aspirin throughout the remaining period of immobilization. These findings were replicated in Iqbal *et al* (2012) study which revealed that 50% of the correspondents stated that routine thromboprophylaxis was not required for patients suffering with ankle fractures that were treated with a cast immobilization. There is a number of risk assessment forms that can be used in ambulatory lower limb immobilisation patients, these include Guidelines in Emergency Medicine Network (GEMNet), Plymouth and Leiden Thrombosis Risk in Plaster-cast (L-TRiP-cast) rules, modified caprine score to name a few. All of these have similar risk factors and are applicable for use in the ED setting. The *use* of an internationally recognised risk *assessment tool* designed specifically for this cohort of patients has shown a greater potential for use than the generic tools applicable for admitted medical and surgical patients Iqbal *et al*
(2012. Literature denotes that the introduction of guidelines and risk assessment tools along with education, positively impacts on knowledge (da Silva *et al* 2020). The common theme running through the literature regarding the improvement of staff compliance was education. It is fair to say, that if the nursing and medical staff are lacking in knowledge then they are not equipped in the prevention of VTE for their patients. Oh *et al* (2017) demonstrated that compliance improved following evidence based educational sessions which provided the nurse with knowledge, therefore empowering the nurse to take responsibility for completing the VTE risk assessments.

6 | STRENGTHS AND LIMITATIONS

The main strengths of this review was the systematic approach that was implemented and the adoption of a reproducible method. Unambiguous search MeSH terms, topic terms and keywords were used and were adopted to meet the specific requirements of the twelve databases searched. The risk of bias was minimized by following procedures for selected studies and applying both the the SORT taxonomy and the Downs and Black scale. The quality of the literature was also assessed by implementing the SORT taxonomy and in-turn insured consistency.

The review was limited due to the fact that there was only publications looking at clinician staffs' practice and knowledge in relation to lower limb injuries however this was addressed by including studies from a variety of clinical settings.

7 | CONCLUSION

This scoping review highlighted the lack of empirical evidence for evaluating VTE risk due to lower limb injuries in the ED setting managed by Nurse Practitioners. It demonstrated that there is a fundamental needed for education across all disciplines, to equip clinicians with the knowledge and preparing them to conduct a VTE risk assessment tools for patients with lower limb fractures. This in turn will improve compliance and adherence of VTE guidelines and the completion of risk assessment forms. This scoping review highlighted a substantial variation and inconsistency in the guidelines that are used globally. The risks of omitting a VTE risk assessment and the necessary care for patients with lower limb injury may decrease with the use of international approved clinical guidelines. The lack of knowledge about this topic needs further research and the engagement of relevant stakeholders.

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