

Developing a Clinical Referral Pathway for the Management of Difficult Venous Access for Ward Nurses at North Shore Hospital

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Abstract

Peripheral Intravenous (IV) access is a commonly performed clinical procedure in hospitals, used to obtain blood samples or administer medications and fluids by the IV route. Various circumstances such as patients with difficult veins, staffing issues, staff experience, and workload demands contribute to a difficult venous access situation (DVA). Delays in obtaining IV access can be detrimental to patient care and treatment, threatening the patient's health and increasing morbidity and mortality risks. Specifically, early adequate IV access in unwell patients is vital for life-saving therapies.

Despite nurses being trained in IV cannulation techniques at North Shore Hospital¹, many factors intervene to affect the success of cannulation. Examples of factors are patients with poor venous access, very unwell or dehydrated patients with peripheral venous shutdown or those with physical impediments that prevent easy access to veins. Add to this the experience and confidence levels of nurses undertaking the IV cannulation and the process can be very challenging, particularly when IV access is required for critical treatments. Doctors and other expert clinicians are available during business hours if nurses cannot establish IV access. However, there is reduced support for nurses outside business hours (after hours). A clinical support team is available after hours and they can be contacted through the SmartPage© (Alcidion, 2021; Gill et al., 2013a) system.

Furthermore, if the clinical support team fail to gain IV access, the anaesthetic team can be contacted to perform ultrasound-guided insertion. There is no clinical policy or pathway regarding this, many nurses are unaware of whom to contact in such a situation and what pathway to follow. Navigating these multiple levels of support can cause delays in administering medications and multiple failed attempts to obtain IV access, resulting in

undesirable patient outcomes. A more efficient process is needed for nurses to access rapid support for IV cannulation when patients urgently need it.

This practice project aims to streamline a clinical referral pathway for DVA. A review of the current literature is conducted to provide the background information to support this practice project and research topic. The project is then developed using John Hopkins Nursing Evidence-Based Practice (JHNEBP) model. A six-month sample of SmartPage© referral data is collected to identify the trends and situation of the referral process. The data is then analysed using descriptive statistics and thematic analysis.

The four key themes identified during the data analysis were 'patient clinical condition', 'difficult access', 'staff education and training', and 'urgency for treatment.' These themes, plus the descriptive statistic results, inform improvements to the SmartPage© referral system by streamlining a referral flow chart. The significance of this practice project is that a streamlined clinical referral pathway (flow chart) will lead to a more efficient approach to managing difficult IV access after hours, thereby minimising delays in patient care and treatment and avoiding further complications.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed

Seena Eappen

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Chapter 1 Introduction

Introduction

Establishing intravenous (IV) access for patients is an invasive but necessary intervention in healthcare. Numerous factors can cause this process to be challenging, and therefore skilled staff are required to ensure safe and efficient cannulation (Cooke et al., 2018). In addition, multiple failed attempts at successful cannulation often result in IV catheter failure causing pain, anxiety, and fear in patients (Larsen et al., 2017). Therefore, trained and experienced staff are required to manage DVA requests promptly. Currently, there is no clinical pathway for DVA; having a clinical pathway or guidelines could expedite DVA and, in turn, lead to more positive health outcomes for patients. This chapter will examine the background, aim of the project, and the overview of this project report's structure.

Background

Intravenous cannulation is a critical part of patient care at North Shore hospital. However, variable patient conditions and staff experience may often result in multiple attempts at IV cannulation and delays in commencing appropriate treatment (Sou et al., 2017b). This can be exacerbated after hours when minimal support is available for staff having trouble inserting IV cannula. In addition, non-visible or non-palpable patients' veins may result in multiple attempts (Sabri et al., 2013) and often requires an experienced staff member to perform this clinical procedure to avoid complications. These circumstances produce a DVA. At North Shore hospital, staff can refer patients to the clinical support team using a system called SmartPage© when IV cannulation is challenging.

This practice project aims to create a clinical pathway that improves the DVA referral process for nurses at North Shore hospital,² improving patient outcomes. This project

1. ²According to Waitemata District Health Board Research Consultant (L. Neave, personal communication, August 02, 2021), it is not necessary to de-identify the sources of the practice project for marking. This will be de-identified for publication.

analysed the contents of the SmartPage© referral data for trends in the referral situation and processes. Descriptive statistics and thematic analysis were used to characterise the data and summarise trends.

SmartPage© is a smartphone and web-based messaging system that improves the communication between nurses and doctors (Alcidion, 2021; Gill et al., 2013a). SmartPage© allows two-way closed-loop communication between the health care team and consists of software modules for messaging and task management for clinical, orderly, and emergency staff (Kai Ping Lew, 2018). SmartPage© clinical allows a secure clinical messaging platform between individuals and groups for clinical handovers and task management. SmartPage© is non-clinical is for managing all non-clinical services such as orderlies, food, cleaning, and security.

Each clinical area has a shared login on SmartPage©. All clinical SmartPage© referrals are intended to be of the same format, using an Identify, Situation, Background, Assessment, Recommendation (ISBAR) communication tool. ISBAR is a communication tool developed to improve safety in the transfer of patient clinical information between doctors, nurses and other healthcare teams (Marshall et al., 2009). However, there is no specific format for complex venous access referrals. Consequently, the referrer can omit relevant information, such as the number of attempts or critical clinical details that enable prioritisation of the DVA referral.

My role at NSH is as a clinical support nurse for after hours. The purpose of my role is to provide support for the ward nurses during after-hours when there is not enough senior support available. As highly experienced senior registered nurses, clinical support nurses provide advanced clinical support for in-patient clinical areas (wards). Ward nurses contact the clinical managers through SmartPage© for difficult procedures/support and the clinical managers assign the job to clinical support nurses according to priority. Most of these requests are for DVA, such as inserting IV lines or performing blood tests. Assisting with

DVA is not just the clinical support nurses/clinical managers' role and the workload from DVA referrals has taken their time away from other prime responsibilities.

As a clinical support nurse, I could see that many of these referrals are not just difficult to access but often include other contextual factors. For example, the nurses may be reluctant to attempt IV cannulation because they are not confident. They may fail as they don't have enough experience or believe it is time-consuming when busy with other jobs. If the nurses are confident in performing venous access, they can more readily manage this even in high workload situations. Peripheral IV cannulation is a timely and straightforward procedure once a person has expertise. For these reasons, the nurses need more practice to attempt the venous access by themselves and avoid delays in waiting for someone else to do the venous access for them. Often the clinical support team cannot help with all these requests because of the high volume of other requests we receive from the wards. Through my own clinical experience, I found that it is important that the nurses include all relevant information in the referral so that the clinical managers can accurately prioritise the jobs. This avoids unwanted delays in getting IV access and thus improve patient outcomes (Stolz et al., 2015).

This practice project will analyse information included in referrals for patients at NSH with DVA. This will be achieved by analysis of non-identifiable referral data from SmartPage© will inform the production of a clinical referral pathway for staff to use when faced with a patient who is challenging to cannulate. Currently, there is no clinical policy or pathway to manage difficult IV access. Therefore, streamlining a clinical pathway for managing DVA situations may reduce the number of failed attempts, delays in treatments, reduce trauma and stress for patients, and IV catheter-related infections (Laksonen & Gasiewicz, 2015).

Aim

This practice project aims to develop a Clinical Referral Pathway for the Management of Difficult Venous Access situations (DVA) for Ward Nurses at North Shore Hospital.

Overview of the structure of the project

This practice project consists of six chapters, which follow the different phases of the research process. They are defined as below.

- **Chapter 1** introduces the practice project topic, its aim, background, and structure overview.
- **Chapter 2** reviews the current literature, providing background information supporting this practice project and research topic. It focuses on understanding the existing literature around DVA and its impact on patient care and comfort. Furthermore, this emphasises how nurses learn to advance their clinical practice expertise with DVA. This chapter also focuses on understanding clinical policy or pathway development in healthcare.
- **Chapter 3** explains how this project has been designed by selecting the appropriate project management model. It provides an overview of the John Hopkins Nursing Evidence-Based Practice (JHNEBP) Model and how the practice project is designed by utilising this model. This also provides an overview of the methods and methodologies used to develop this project. This includes the aim of the project, ethical considerations, the research methods, the research approach, the data collection, the sample selection, the type of data analysis, and the pathway development.
- **Chapter 4** presents the findings from the descriptive statistics and thematic analysis of the SmartPage© data. Four main themes emerged through the data analysis; 'patient clinical condition', 'difficult access', 'staff education and training', and 'urgency for treatment.' This guides the development of the clinical pathway.

- **Chapter 5** is the discussion and recommendations for future research following the findings concerning the research. This chapter also evaluates the limitations of the study.

Conclusion

This chapter has introduced the importance of managing difficult IV access situations. It has also provided an insight into the background for developing a streamlined clinical pathway for supporting ward nurses at NSH to manage DVA. This chapter also explained what SmartPage© is and how it made communication easier between health care staff. The next chapter will review the current knowledge and literature about DVA in patients and the theoretical framework to support the methodology and research design of the study.

Chapter 2 Literature Review

Introduction

Performing intravenous (IV) cannulation is a common clinical procedure in hospital settings (Stuckey & Curtis, 2019). This is a straightforward procedure in most cases where the clinician performs the cannulation/venous access using palpation or visualisation of the vein. However, multiple attempts are often required for patients with difficult access before successful placement of IV cannula (Egan et al., 2013). There are many reasons why IV

access is difficult in these patients. This literature review aims to locate and present the existing knowledge and literature related to patients with difficult venous access (DVA) situations (DVA) and its effects on patient care. The review also focuses on how to develop staff expertise and confidence with DVA. The literature review will also determine whether streamlining a clinical pathway for DVA can benefit both clinical staff and patients, thus providing a theoretical framework to support this study's methodology and research design.

Search Strategy

Auckland University of Technology (AUT) and the Waitemata District Health Board (WDHB) library databases were used to research the topic. The databases (CINAHL, SCOPUS, EBSCO, and Google Scholar) were searched for peer-reviewed academic journals in English between the years 2000 to 2020. Keywords used for an initial search included (intravenous access OR difficult IV lines OR venous access OR difficult venous access OR intravenous therapy) AND (referrals management, OR clinical pathway OR clinical policy development) AND (pain AND patient experience), patient experience AND (risk factors OR infection). After reading the abstract, 55 articles were kept for in-depth review. Of these, 36 manuscripts met the inclusion criteria for this literature review.

Inclusion and exclusion criteria:

The inclusion and exclusion criteria, which are essential for obtaining the relevant articles, are shown in **Error! Reference source not found.:**

Table 1

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Published between 2000-2020	The entire content of the articles is not available
Manuscripts that are written in English	Non-peer reviewed literature
Exposure of interest is difficult venous access.	Articles that are not matching with the exposure of interest.
Studies that occurred in acute hospital settings	
Peer-reviewed literature	

Interpretation of literature

Topics explored within this literature review are condensed into categories. They include venous access, DVA, DVA risk factors, DVA effects on patient care and well-being, DVA management tools, and clinical policy or pathway development in health care.

Venous access is a critical part of patient care in hospitals (Cheung et al., 2009). Peripheral venous access is the most common method. It is a method used to access the bloodstream through the veins on the patient's hand or arm and, in some problematic cases, on the patient's foot to administer intravenous (IV) medications, transfusions, or to obtain blood samples for testing (Leidel et al., 2012). The common veins are the antecubital veins (median cubital, median cephalic, and median basilic), the cephalic, the basilic, the metacarpal veins and the dorsal venous network (Dougherty, 2008). The dorsum of the foot and the saphenous vein of the ankle are preferred locations if the lower extremity is used for venous access. Cannulation of the lower extremity is usually avoided due to the risk of complications such as thrombophlebitis and pulmonary embolism (Dougherty, 2008).

Obtaining venous access is a high priority for critically ill patients as a failure in obtaining venous access can cause delays in medical treatment, thus reducing the efficacy of treatment. Failed access can also increase patient morbidity, patient distress, prolonged recovery and hospital bed occupancy (Egan et al., 2013; Fields, Piela, Au, et al., 2014; Goff et al., 2013).

Difficult Venous Access

Nurses and other medical staff commonly experience challenges when placing peripheral IV lines in adults and children (Elkhunovich et al., 2017; Witting, 2012). This situation is described as difficult venous access (DVA), which results in multiple IV attempts (Armenteros-Yeguas et al., 2017). Multiple IV cannulation attempts can cause increased pain and distress to patients (Carr et al., 2010; Fields, Piela, & Ku, 2014). Similarly, multiple attempts can be a frustrating experience for nurses as this disrupts the nurse-patient relationship and delays lifesaving treatments (Kuensting et al., 2009). Furthermore, needle pain can cause patient anxiety, phobia and significantly reduced patient satisfaction with the

health care facility (Carr et al., 2010; Fields, Piela, Au, et al., 2014; Robinson-Reilly et al., 2016). Multiple venepuncture attempts can similarly increase patient suffering and anxiety, delay treatments, and increase healthcare costs (Walsh, 2008). Studies have shown that different solutions for DVA have emerged over the years, such as vein transillumination, ultrasound guidance, central venous access, intraosseous access, peripheral venous cut-down (Larson et al., 2014; Shrestha et al., 2015). Nevertheless, manual peripheral venous cannulation or phlebotomy access remains the most commonly used method among all these techniques (Elkhunovich et al., 2017).

Risk factors of DVA

A study conducted by Fields, Piela, Au, et al. (2014) on adult patients in an emergency department stated that one in every nine to ten patients has DVA. This study identified risk factors associated with DVA, including medical conditions such as diabetes, sickle cell disease, and previous IV drug use. Interestingly, this study excluded age, body mass index, and dialysis as risk factors. Notably, other studies have suggested that IV access is challenging in patients with conditions such as morbid obesity, underweight, chronic illnesses, dehydration, chemotherapy, IV drug use and local adverse conditions (Egan et al., 2013; Pagnutti et al., 2016; Scoppettuolo et al., 2016; Warrington Jr et al., 2012). Chiao et al. (2013) state that patient characteristics such as obesity, race (skin colour), and younger age are associated with DVA. Moreover, Lamperti et al. (2012) suggest that the patient's clinical condition, anatomy, and the skill of the clinician all contribute to successful cannulation.

Effects of DVA on patient care and well being

Although IV cannulation is a widespread clinical procedure at the hospital, it can be excruciating and uncomfortable for many patients. The experience of venous access can be associated with pain, stress, and concern for many patients (Plohal, 2021). Missed attempts and delays in getting IV access can have harmful effects on patient care and well-being, including missed medication doses, significant pain, increased anxiety, and increased risk of

premature device failure (Witting, 2012). Fields, Piela and Ku (2014) identified through a cross-sectional observational study on patients in a hospital that the pain levels are more in patients who had multiple attempts than patients who experienced successful venous access from a single attempt.

The antecubital fossa (ACF) is the most common site used for venepuncture (Carr et al., 2016). The size of the ACF veins and their superficial location makes them easy to access. However, they are not a good choice for cannulation due to various reasons, such as they are close to arteries and veins and are easy to dislodge as they are over an area of joint flexion (Dougherty, 2008). ACF venous access attempts can lead to patient complications such as brachial artery punctures, hematoma formation, brachial nerve injury, severe pain, and catheter malposition (Riley & Garcia, 2012). This results in increased patient anxiety, suffering and length of hospital stay (Riley & Garcia, 2012).

Riley and Garcia (2012) also identified that multiple attempts could result in patient complications such as deep venous thrombosis and an increased rate of blood haemolysis. Patients who have had a previous bad experience may induce anticipatory feelings of increased anxiety and distress (McGowan, 2014). Multiple failed IV attempts increase patient anxiety and discomfort, which causes both physical and mental stress (Sou et al., 2017b).

DVA management tools

McGowan (2014) found that peripheral IV cannulations require specialist knowledge and skill with vein selection and an in-depth understanding of device selection. Staff development could focus on the early identification of patients who have DVA is needed to improve vein and device selection. This will allow time to prepare and ensure support is available to the person inserting the IV to avoid treatment delays and complications of multiple attempts. Education around tools for assessing DVA could also assist. One study conducted by Van Loon et al. (2016) used a DVA scale for adult patients (A-DIVA scale) to identify adult patients with DVA. This study calculated the risk of failure during IV cannulation and thus

created the opportunity to use other techniques such as assistance from more experienced professionals and ultrasound-guided insertion. Van Loon et al. (2016) found that using the A-DVA scale can improve clinical practice and patient's comfort.

Transillumination lights could also assist clinicians in inserting IVs in patients with DVA.

Suppose the usual methods to manage DVA, such as applying a warm compress, adequate patient hydration, using a tourniquet, using gravity, and gently wiping the skin with alcohol swabs, were unsuccessful. In that case, the use of a transillumination light may be helpful to visualise the veins (Cai et al., 2017).

An inspection cohort study conducted by Sou et al. (2017a) found that the use of ultrasound-guided insertion and a clinical pathway for DVA management resulted in a first attempt success rate of 93%. This also resulted in lower recorded pain scores and increased patient comfort. Other studies have also supported this by identifying that ultrasound-guided venous access has a higher success rate and lesser pain levels than other methods (Kumar & Chuan, 2009; Lamperti et al., 2012; Stolz et al., 2015). In addition, the introduction of a pilot IV cannulation team to perform IV cannulation in an Irish hospital increased the number of successful first-time cannulation and reduced missed attempts (Carr et al., 2010). All these measures help to alleviate unnecessary suffering to the patient. Some hospitals used specialised IV therapy teams to manage DVA (Burns & Lamberth, 2010). The need to improve DVA management, especially in patients with complex clinical conditions, resulted in the emergence of intravenous therapy teams (Hornsby et al., 2005; Kokotis, 2005). These teams mainly consist of nurses specialising in IV therapy and management of DVA, and this has improved the outcomes in clinical practice by reducing the risks associated with IV therapy (Armenteros-Yeguas et al., 2017; Burns & Lamberth, 2010).

Another way of managing DVA is using midline or central venous access devices (CVADs). Midline or CVADs are appropriate for patients who require long-term antibiotic therapy (Moureau et al., 2015). Midline catheters are peripheral venous access devices longer than a regular IV line. Insertion should be ultrasound-guided IV by a clinician accredited to insert

these. Midline catheters are used for IV therapy for more than five but fewer than 28 days (Salamonson et al.). CVADs are inserted through a peripheral or proximal central vein (Smith & Nolan, 2013). CVADs such as Peripherally Inserted Central Catheter (PICC or PIC line) are used for long-term therapy and parenteral nutrition (Christensen et al., 2016). However, CVADs are associated with many complications such as infections and are not suitable for all patients (Martincich et al., 2020).

Development of staff confidence and expertise with DVA

Staff confidence and expertise are crucial in managing DVA (Doniger et al., 2009). IV therapy is common practice. Staff working in clinical settings need to expand their knowledge and skills in venepuncture and IV cannulation (Dougherty, 2008). This could be achieved through additional competency and education programmes. Moureau (2019) found that higher insertion success rates and greater patient satisfaction are achieved through specialised training programmes. Wenger (2015) implemented an evidence-based practice project for newly employed and graduate nurses (n=32) to develop confident IV skills. Lack of experience and factors indicating difficult IV access was rated as the most significant concerns in the survey, which was conducted to find out the most “uncomfortable” part of the IV insertion process for graduate and newly employed nurses. Wenger (2015) conducted a course and a simulation practice session for the basic IV insertion techniques. Before this course, the discomfort rate among new nurses with IV insertion skills were 53.4% (Wenger, 2015). Six months after the educational programmes, the discomfort rating of the nurses were decreased to 16.1% (Wenger, 2015)

Clinical policy / Clinical pathway development in health care

Quality improvement initiatives in healthcare, such as medical records and reduction in medication-related adverse events, mainly focus on optimising patient safety and quality in health care. Several quality improvements concepts have been implemented in various healthcare settings to support these quality improvement activities. Some of these

continuous quality improvement concepts in healthcare are Plan-Do-Study-Act (PDSA) cycles, clinical policies and clinical pathways (Lawal et al., 2016).

PDSA is a model widely used in healthcare to help clinicians deliver improvements in patient care through a structured experimental approach to learning and tests of change (Hughes, 2008). It is a four-stage problem-solving model that teams may use to improve a process or make a practice change in a small, testable cycle (Taylor et al., 2014).

Clinical policies are action plans developed by clinicians to solve a particular issue of concern (Collins & Patel, 2009). Manias and Street (2000) found that healthcare professionals use policies and protocols to guide their clinical actions and promote patients' best care. According to Tulloch et al. (2004), a clinical policy or pathway clarifies the management of a specific clinical problem within a particular class of patients. Researchers and clinicians use many tools for developing health care policy or pathways, such as health surveys, electronic and personal health records and hospital registries (Ahmed et al., 2012; Ross et al., 2014). Braverman et al. (2012) explain that one way of developing a healthcare policy or pathway is by using aggregated healthcare data stored in a healthcare database. This method is selected for this project.

Clinical pathways are a common component of quality improvement activities. According to Gurzick and Kesten (2010), clinical pathways must be developed, implemented, and evaluated using best practice guidelines. Clinical pathways are multidisciplinary management tools that use evidence-based clinical practice for a specified group of patients to coordinate and deliver the best care possible (Audimoolam et al., 2005). Clinical pathways employ structured care plans to detail essential steps in caring for a patient with a specific clinical problem by linking evidence to practice (Rotter et al., 2010). Clinical pathways promote improved patient outcomes, increased patient satisfaction, and patient safety by optimising the use of resources (Rotter et al., 2012). In addition, clinical pathways improve patient outcomes and reduce unwanted costs (Cheah, 2000; Gurzick & Kesten, 2010).

Rotter et al. (2012) found that clinical pathways for invasive procedures resulted in reduced length of hospital stay and improved patient outcomes. Simonov et al. (2015) developed an algorithm to help clinicians choose appropriate types of venous access devices, their indication, contra-indications, and appropriateness. Doing so improved the safety of the clinician's practice and patient safety (Simonov et al., 2015). Panella et al. (2003) identified that clinical pathways could positively impact quality health care. Sou et al. (2017b) developed a difficult IV pathway to manage the difficult access for patients by increasing the first attempt success by using ultrasound guidance. A cohort study that included patients referred to the clinical support team for DVA found that using a clinical pathway and ultrasound-guided insertion successful at their organisation. Nine out of every ten IVL inserted had first attempt success with lower pain levels (Sou et al., 2017b).

Conclusion

The purpose of this literature review was to understand the current literature around DVA and its impact on patient care. The review couldn't find enough literature supporting DVA in New Zealand (NZ). This literature review shows that getting IV access quickly without multiple failed attempts is a significant part of hospital patient care. It also asserts that many discussions and studies have been around getting expert help and ultrasound-guided techniques for DVA management. Through the literature, it is evident that patient outcomes can be improved by reducing IV attempts. The literature also addressed the importance of developing staff expertise and confidence with DVA. Considering the importance of venous access in providing efficient patient care, streamlining the DVA pathway is significant. This literature review also addressed the importance of clinical pathway development in health care for quality improvement. The literature shows that clinical pathways reduce the delay in treatments and improve patient outcomes.

Chapter 3 **Project Design**

Introduction

This chapter will discuss the design and development of a difficult venous access (DVA) situation (DVA) pathway based on SmartPage data. The aim of the project, the project management model and the research approach and methods, including sampling, data collection, data analysis, and ethical considerations will be covered in this chapter.

One of the critical issues in hospital care after hours is finding enough support to perform complicated procedures like DVA. Nurses in clinical in-patient settings mainly rely on the Waitemata Central Clinical Support team to undertake difficult procedures such as complex intravenous (IV) access and obtain blood tests. Anecdotally, the number of requests from ward nurses can be overwhelming for the clinical managers who prioritise and perform these tasks. Sometimes, the referrals do not have adequate information, which causes errors in prioritising requests and unnecessary delays in commencing treatments for the patients. When this Practice Project topic was first discussed with the Waitemata Central team, they were very supportive. The Waitemata Central team agreed that developing a clinical pathway to help manage DVA would most likely allow all staff to work more efficiently and improve patient outcomes.

The project management model

This section will discuss the models used to support the project. There are two distinct parts to this practice project. The first part is the analysis of the SmartPage© IV access referral data using descriptive statistics. The SmartPage© IV access referral data includes free text explanations of the situation, although the amount and quality of this information vary widely across entries. This free text data will be analysed in this project using thematic analysis. Analysis of the qualitative alongside the quantitative data will provide insights into the current situation and practices around DVA. The findings from the analysis will be utilised to develop a streamlined clinical pathway to manage DVA.

The process for developing the streamlined DVA referral system includes:

- Detailed review and critique of the literature to see how well the current practice and analysis findings align with literature knowledge and what could be done to improve this.
- Developing a streamlined pathway for improving DVA referrals supported by the literature.

The selection of an appropriate model for clinical pathway development was challenging. Several project management models were reviewed to identify the appropriate model to guide this practice project (Gawlinski & Rutledge, 2008; McCrae, 2012). Two models were further reviewed in-depth from the four models that were selected. They are Rosswurm and Larrabee's Model for Change to Evidence-Based Practice and John Hopkins Nursing Evidence-Based Practice (JHNEBP) Model (Dang & Dearholt, 2017; Rosswurm & Larrabee, 1999). They are both theoretical frameworks guiding nurses and other healthcare professionals to implement organisational change. Rosswurm and Larrabee's model assesses the need for practice change by comparing internal data with external data using a six-step process (Rosswurm & Larrabee, 1999).

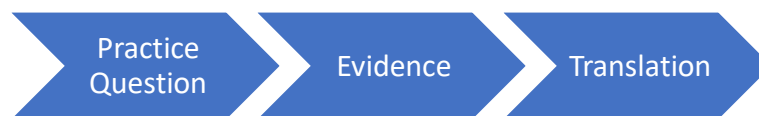
John Hopkin's model is a potent problem-solving approach to clinical decision making, accompanied by user-friendly tools to guide individuals or groups (Dang & Dearholt, 2017). As a clinical support nurse researcher, I noticed that DVA requests could be improved but needed to identify the relevant project management model to implement the change. I was very motivated to find solutions as there was an anecdotal increase in ward nurses' need for assistance with DVA. For this project, the JHNEBP model was more suitable and straightforward to follow as it provides a framework for systematically analysing, designing, developing, and implementing this practice project.

John Hopkins Nursing Evidence-Based Practice (JHNEBP) Model

Evidence-based practice (EBP) integrates the available scientific knowledge with the best available experiential evidence to solve a healthcare organisation problem (Dang & Dearholt, 2017). However, nurses have many barriers to implementing EBP in their everyday work, including the demand for patient care, limiting their time to implement these practices. With the JHNEBP approach, the JHNEBP model is explicitly designed to meet the practice nurse's needs using a three-step PET process: practice question, evidence, and translation (Newhouse et al., 2007). With this approach, the EBP process is simplified and easy to understand. This is vital for this practice project because it helps to improve patient outcomes based on the best available evidence.

Figure 1

John Hopkins Nursing Evidence-Based (JHNEBP) Model



The first phase of JHNEBP is to identify the practice question (Dearholt, 2012). This will be achieved via the PICO (Patient/Population, Intervention/Issue, Comparison, Outcome (Considine et al., 2017)) framework to identify the problem in the form of a real question. The Evidence phase involves literature search, team appraisal and recommendations (Dang & Dearholt, 2017). Research is conducted and critiqued to determine the strengths and weaknesses of articles before committing to a practice. Finally, in the Translation phase, the team decides whether and how to implement changes, evaluate implementation, and communicate the findings. The goal of the JHNEBP model is to ensure that the latest research findings and best practices are quickly and appropriately incorporated into patient care.

Developing a Practice Question

In this phase, stakeholders from Waitemata central operations manager, clinical managers and fellow clinical support nurses formed an advisory group to review and formulate the practice question. In addition, regular meetings were held with nursing team leaders, clinical managers, and clinical support nurses to garner their support while keeping them informed of progress and collecting their feedback throughout the design of this project. The steps used to develop the practice question and the application of the PICO format are shown in Tables 2 and 3.

The process followed in developing a practice question aligns with the inclusion of an interprofessional team was to examine the specific practice concern (Dang & Dearholt, 2017). All relevant stakeholders were included to develop an EBP question using the PICO format; Identify key stakeholders to involve throughout the EBP process; Determine leadership; Schedule regular team meetings.

Table 2

Steps Utilised for Identifying the Practice Question

Step	Process
Step 1	Identify an EBP question
Step 2	Define the scope of practice question
Step 3	Assign responsibility for leadership
Step 4	Recruit Multidisciplinary team
Step 5	Schedule team conference

Table 3

Application of PICO Element

PICO Heading	Description
Patient/Population/Problem	Ward nurses who encounter DVA patients after hours then use SmartPage© refer to after-hours clinical support.
Interventions	Interventions are the specific intervention/ approach to be examined. Here the interventions are the difficult venous access referrals from ward nurses through SmartPage© during after-hours to improve patient outcomes.
Comparison	Identify what other interventions are to be compared with.

Outcome	Review of the current literature, Analysis of SmartPage© data. Team members identify expected outcomes based on the implementation of the practice change. SmartPage© referrals to the appropriate person using the DVA pathway; avoid delays in getting venous access, thus improving patient outcomes.
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Gathering Evidence

In this phase, internal and external sources have been searched, appraised, summarised, and synthesised to develop recommendations for change. The steps for collecting evidence are shown in Table 4.

Table 4

Steps Utilised for Collecting Evidence

Step	Description
Step 1	Conduct an internal and external search for evidence
Step 2	Appraise all types of evidence
Step 3	Summarise evidence
Step 4	Rate strength of evidence
Step 5	Develop recommendations for change in processes or systems of care based on the strength of evidence

The Research & Knowledge Centre, Waitemata District Health Board (WDHB) approved this research project. This included permission to conduct the study and utilise WDHB resources. Locality authorisation was granted by WDHB Research & Knowledge Centre on the 5th of May 2020. SmartPage© data to conduct the research was organised through WDHB Health Information Group. Waitemata Central staff assisted with the data extraction by exporting the data to Microsoft Excel, then deleting all patients/personal identifiers. The Auckland University of Technology Ethics Committee (AUTEC) representative waived the ethics approval as the project did not meet the criteria for requiring AUTEC approval (C. Grinter, personal communication, February 19, 2020).

Translation

In this phase, the fit and feasibility of the recommended change or practice have been determined. It is now ready to create and implement an action plan and evaluate and report outcomes. This phase involves the following steps, as shown in Table 5.

Table 5

Steps Utilised in Translation Phase

Step	Description
Step 1	Determine the appropriateness and feasibility of translating recommendations into the specific practice setting
Step 2	Create action plan
Step 3	Implement the change
Step 4	Evaluate outcomes
Step 5	Report results of the preliminary evaluation to decision-makers
Step 6	Secure support from decision-makers to implement recommended change internally
Step 7	Identify next steps
Step 8	Communicate findings

Methods/Methodology

This section will discuss the methods and methodologies used for this project. This includes the aim of the project, ethical considerations, the research methods, the research approach, the data collection, the sample selection, the type of data analysis, and the pathway development.

Aim / Anticipated outcomes

This quality improvement practice project aims to create a Clinical Referral Pathway for the Management of Difficult Venous Access situation (DVA) for Ward Nurses at North Shore Hospital (NSH).

The potential future outcomes of undertaking this quality improvement project are:

- Reduction in the delay in responding to IV access requests

- Reduction in inappropriate SmartPage© conversations to obtain relevant information for IV access and thus enable the clinical managers to prioritise their jobs to attend to other essential tasks
- Improved clinical practice and quality of patient care
- Improved patient outcomes by:
 - Reducing the number of IV cannulation and phlebotomy attempts
 - Alleviating unnecessary suffering, pain, and patient complications
 - Reducing delays in treatments and procedures
- Reduction in patient anxiety
- Reduction in premature device failure

Resources and Budget

The resources and budgets required for this study are shown in Table 6.

Table 6

Resources and Budget

Resource	Funding
Data Collection Assistance	WDHB
Statistician (AUT)	AUT
Proof-reader	\$30 per hour x no of hours
Stationary/ Equipment	\$300
Printing and Binding	\$500

Setting / Research Strategy

The setting for this study was North Shore Hospital (NSH), WDHB, a New Zealand publicly funded healthcare delivery organisation. NSH has over 46,000 patients admitted through the emergency department every year that may require IV access (Waitemata District Health Board, 2020b).

Waitemata Central supported the communication and resource issues. Waitemata Central is part of the daily operations support team of WDHB (Waitemata District Health Board, 2016).

Waitemata Central focuses on patient safety and outcomes, improving patient, 28hanau and

staff experience, timeliness of care, and avoiding delays. Waitemata Central clinical support team consists of Clinical Nurse Manager and Waitemata central nursing team. One of the goals of the Waitemata Central team is to increase senior presence in the hospital 24 hours 7 days a week and increase support for clinical staff after-hours (Waitemata District Health Board, 2016).

Delivering quality improvements is a crucial objective of WDHB and can be evaluated across the critical criteria of patient safety and clinical effectiveness (Waitemata District Health Board, 2020c). This quality improvement project meets both requirements.

Methods

Descriptive statistical analysis and thematic analysis of free-text data are employed to answer the posed. This was achieved through the analysis of SmartPage© data and the consultation of DHB IT professionals, Clinical Nurse Managers (CNMs), Anaesthetic technicians, SmartPage© technicians and Waitemata Central clinical support nurses.

SmartPage© is a web and smartphone communication system that replaces hospital pagers (Gill et al., 2013b). After business hours, ward nurses page the CNMs for assistance with DVA. The referrals are sent through SmartPage©. WDHB stores the previous referral data in a database using a tool called Qlik Sense (Waitemata District Health Board, 2020a). Qlik Sense is a new generation business tool that WDHB uses to gain insights to clinicians into patient characteristics and clinical care through data visualisation and exploration (Waitemata District Health Board, 2020a). This database consists of page id, NHI, Link, Hospital, page date, page completed, category, receiver name, receiver role, sender, bed, sender ID, triage, pages, and content. The content is free text data which is the actual message sent from the ward nurses to the clinical manager. Descriptive statistical methods were applied to analyse the retrospective data collected from SmartPage.

The proposed development of a clinical pathway for DVA has been approved and supported by WDHB. Moreover, the project is utilising SmartPage© data. Hence, I negotiated support

from Health Intelligence, Health Information Group, and WDHB to access SmartPage© data and help retrieve the data. WDHB IT, SmartPage© professionals, and CNMs assisted with accessing the data. Anaesthetic technicians were contacted to discuss a similar project they are currently undertaking where nurses' are training for ultrasound-guided insertion. Clinical Managers and Clinical Support Nurses were contacted and updated at various stages regarding various discussions around the project and to share their ideas. A retrospective review of SmartPage© referral data was used (an example of data is shown below in **Error! Reference source not found.**).

Figure 2

A Sample of SmartPage© Referral Data

Infusion/Fluids	IVAB/IV meds	Procedure	Who Tried	How many staff tried	Diagnosis/Other info	Urgent	Routine	Due Time	late by
	1								
		OT	RN	1	TBI				

Request	Completed	Time taken	Request type	Ward	Success	Difficult	Attempts	IVL	Bloods
01/02/20 02:15	01/02/20 03:56	101	IV line	ward D		1		1	
01/02/20 05:39	01/02/20 06:16	37	IV line	Ward B			3	1	1
01/02/20 05:46	01/02/20 06:36	49	Blood tests	Ward U					1

Sample Size

A six-month sample of SmartPage© referral information for patients referred to the CNM for difficult venous has been utilised. A total of 1,514 records were found valid and included in the study.

Streamlining the referral process for DVA could potentially improve the time to commence treatment for many of these patients. There are no guidelines for staff to follow when dealing with DVA or what they need to include in DVA referrals on SmartPage. Their steps in DVA

referral and management are currently just word of mouth. A hospital policy limits the number of attempts by a nurse to two, but this is not always followed (Waitemata District Health Board, 2018). Suppose all relevant information such as ‘the number of attempts, the purpose of IV access, degree of patient distress, known difficulty or not, the patient condition’ is included in the referral. In that case, the clinical manager (Waitemata Central) can triage the need for assistance and respond within an appropriate timeframe. Suppose the need for assistance is not urgent, and no attempts at the venous access have been made by ward staff before referral. In that instance, nurses working on the ward are encouraged to attempt with a maximum of two attempts, promoting the ward nurse's ability to perform venous access. A referral must be sent to the anaesthetic team for ultrasound-guided venous access for patients with a history of expert staff having difficulty with IV cannulation.

Data Collection

An extract of after-hours communications identified by keywords IV line/ IV cannula/ Blood tests. The sample data is collected by utilising existing data collected in the SmartPage© communication tool as part of the after-hours ward routine. The data is downloaded from the clinical dashboards (Waitemata District Health Board, 2020a). Data within the date range from February 2020 to July 2020 has been collected. The parameters used for the data collection are shown in Table 7.

Table 7

Parameters Utilised for the Data Collection

Name	Parameter
Page Hospital	North Shore Hospital
Page Year-Month	2020-Feb to 2020 July
Category	IV-line, IV cannula, Blood tests
Receiver Role	Clinical Nurse Manager

Data anonymisation:

Data anonymisation is a data processing technique that results in anonymised data (Bayardo & Agrawal, 2005). It is the process of removing personal information from data sets

to protect patient privacy (Ghinita et al., 2007). Data anonymisation in research maintains the privacy and anonymity of those who participate in research and should be respected (Zimmer, 2010). Therefore, personal information concerning research participants should be kept confidential, and sensitive information also should be protected in some instances. It is also essential to take appropriate measures to store the research data securely (Stankovic, 2014).

All personal information and sensitive data have been removed to protect patient privacy. For example, columns with the patient's name, NHI, and RN name have been removed from the original data. After removing all personal identifiers, one of the clinical managers retrieved the data to protect data privacy and handed it to me. I have also secured the data with a password for additional security and stored it in the G drive.

Data reduction process:

The PRISMA flow diagram shows the data collection and reduction process (Figure 3).

Data Analysis/Statistics

According to the John Hopkins Nursing Evidence-Based Practice (JHNEBP) model, the data analysis goal is to collect evidence for practice change (Schaffer et al., 2013). After removing personal identifiers, data were prepared for analysis by checking for missing data, removing outliers, and transforming variables. Data were collated and analysed using IBM SPSS statistical software for Windows, version 24.0 (IBM Corp., Armonk, NY, USA). A statistical analysis (SPSS) was undertaken on six month's data, and the results are summarised. Due to some incomplete data, only descriptive statistics are used for data analysis.

The text contents are systematically labelled, and the themes are quantitatively analysed using the descriptive statistical method. A qualitative approach is also used to analyse the meanings of contents within texts. Finally, thematic analysis was completed by arranging the data into common themes and summarising the findings concerning the aim of the research.

Descriptive Statistics

Statistical analysis helps researchers understand numeric information (Denise & Cheryl, 2013). Effective presentation of study results typically starts with frequencies and descriptive statistics (Shreffler & Huecker, 2021). In statistics, frequency is the number of times an event occurs (Sarka, 2021). Descriptive statistics summarise or describe the essential characteristics of any sample data set (Thompson, 2009). It refers to collecting, presenting, describing, analysing, and interpreting the data (Pérez-Vicente & Ruiz, 2009).

Nurses often use the three main types of descriptive statistics to analyse and present data in practice improvement projects (Vaismoradi et al., 2016). These are frequency, central tendency, and measures of dispersion or variation (Mishra et al., 2019). Examples of frequency measures are count, percent and frequency (Mishra et al., 2019). Common measures of central tendency are the mean, median and mode (Manikandan, 2011). The measures of central tendency are mainly used in mathematics, evidence-based practice, research, and quality improvement (Conner, 2017). Nurses use descriptive analysis to analyse and present data in practice improvement projects

Descriptive statistics summarise a set of observations as simply as possible. The summaries typically involve quantitative data and visuals such as graphs and charts (Conner, 2017). Kaur et al. (2018) identify descriptive statistics as summarising raw data from a sample or population. For example, when we collect health information from a population, it is impossible to collect data on everyone for logistical or cost reasons. In such cases, we use descriptive statistics such as average age and percentage of females.

Frequency analysis is a descriptive statistical method that shows the number of occurrences of each response chosen by the respondents. While using frequency analysis, SPSS can also calculate the mean, median, mode, counts and percent to help users analyse the results and draw conclusions (Ho, 2013). The frequency distribution helps the researcher organise and summarise the data in a tabular format, interpret the data and discover the extreme values in the data set (Polit & Beck, 2009). For example, the frequency distribution can represent the anxiety scores of a group of preoperative patients. This helps better

understand the data as the values can be arranged from lowest to highest and a count or percentage of how many times each value occurred.

Thematic analysis

Thematic analysis is one of the most common qualitative data analysis methods used in nursing research (Roberts et al., 2019; Vaismoradi et al., 2016). According to Guest et al. (2011), thematic analysis allows a researcher with a qualitative method and design to translate observations and apply statistical analysis to determine the validity of the themes or code. A good code may emerge from one or more original themes. I have used an inductive approach to thematic analysis using Braun & Clarke method (Braun & Clarke, 2006). An inductive approach allows the data to decide the themes instead of coming to the data with some preconceived themes (Braun & Clarke, 2012).

Thematic analysis helps the researcher process, analyse, or interpret their information regardless of ontology or epistemology (Neubauer et al., 2019). Thematic analysis is involved in identifying themes and analysing each theme to build up the whole (Maguire & Delahunt, 2017). According to Braun and Clarke (2006), various approaches to conducting thematic analysis, the most common form, follow a six-step process, as shown in Table 8.

Table 8

Phases of Thematic Analysis

Phase	Overview
Phase 1	Familiarising with the data
Phase 2	Generating initial codes
Phase 3	Searching for the themes
Phase 4	Reviewing the themes
Phase 5	Defining and naming themes
Phase 6	Writing up

Pathway Development

Data analysis informed referral pathway development. Investigation of pathway development tools guided the development process. Effective models for pathway development are needed to avoid unwanted costs and delays. Therefore, in this study, a DVA flowchart is

developed to guide the nurses in the referral process. The difficult IV access referral pathway flowchart directs the clinical staff to contact after hours.

Conclusion

This chapter explained the design of the project using the JHNEBP model. It explained how the practice question is being developed and how the evidence is gathered and translated using the JHNEBP model tools. The methods and methodologies used to design this project are also discussed in this chapter. The next chapter will communicate the results using descriptive statistics and thematic analysis to define and name themes from the data analysis.

Chapter 4 Results

Introduction

This chapter will discuss the results of the data analysis. This includes interpreting the six months' data collected by reporting the descriptive statistics that characterise the data trends. As explained in the preceding project design chapter, this six-month data is analysed using SPSS statistical software for Windows, version 24.0 (Verma, 2012). Braun & Clarke's (2012) 6 steps of thematic analysis are applied to organise the free text into aggregated subthemes and the related themes for the free-text data. The critical focus while analysing the data was how the data interpretation can guide the development of a clinical referral pathway for DVA.

Using descriptive statistics and thematic analysis methods to code and recognise the sub-themes, four main themes emerged from the data analysis. These are 'patient clinical condition', 'difficult access', 'staff education and training', and 'urgency for treatment.'

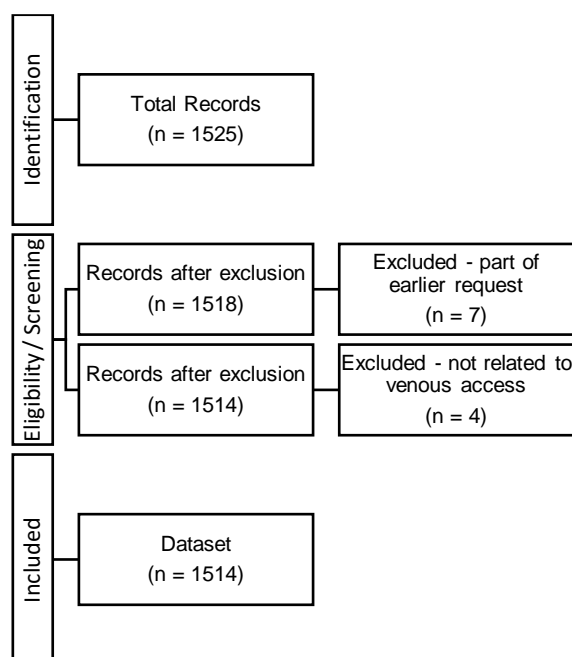
Dataset

SmartPage© data was retrieved from 1 February 2020 to 31 July 2020, including 1525 records. Data were cleaned using the method shown in the below diagram (**Error!**

Reference source not found.).

Figure 3

Prisma Diagram Representing SmartPage© Records Included



Interpretation of Data

This practice project examines the information contained in the SmartPage© referral data to streamline a clinical referral pathway. The dataset's structure is shown in Table 9 with headers, the ward's name that sent the request, the type of the request and the free text message.

Table 9

Sample Dataset

Ward	Request	Message
Ward H	IV line	Hiya, please, are you able to come and put in an IVL for pt, his old one came out and he needs it for fluids. He is difficult to access. Thanks :) (ivf)
Ward H	Blood tests	Could you please come up and take blood for my pt as she had 1 unit RBC transfusion this afternoon? Thanks (bloods)
Ward C	IV line	Hello, is there someone who can do a luer for this pt? attempted already. thanks (ivl)
Ward E	IV line	Pt IVL ++painful, need new IVL. ++difficult access. pt has IVF + IVAb overnight so need ASAP please (no access).

Analysis of the six month's data has been completed to validate the contents of the referral.

The results have been summarised as shown in Tables 10 to 16.

Table 10 shows the time the request has been sent, the job completion time, and the total time for completion calculated in minutes for a sample of eight records.

Table 10

Time Between Page and Completion

Time of request	Time completed	Time taken
01/02/2020 02:15	01/02/2020 03:56	101
01/02/2020 05:39	01/02/2020 06:16	37
01/02/2020 05:46	01/02/2020 06:36	49
01/02/2020 06:29	01/02/2020 07:21	53
01/02/2020 11:32	01/02/2020 16:38	306
01/02/2020 14:28	01/02/2020 15:07	39
01/02/2020 16:13	01/02/2020 17:04	50
01/02/2020 18:46	01/02/2020 19:32	46

There were 1476 free text DVA requests, and 55 of them replied to earlier requests asking for further information. Out of these 1476 requests, 1272 were already attempted by staff and failed. Fifty requests (3.4%) were stated as 'Now or ASAP', and thirty-eight (2.6%) were stated as urgent requests. Table 11 shows a summary of DVA requests in six months.

Table 11

Number of Page / Requests in six months

	Number	Percentage
Number of requests	1476	
Number of replies	55	3.7%
Staff tried	1272	86%
Now or ASAP	50	3.4%
Stated urgent	38	2.6%

Table 12 shows the reasons mentioned in the referral by the staff for not trying busy/heavy workload, skill mix, not IV certified, and not confident. Most of the reasons were busy/heavy workload 7.5% (n = 111). The second most was 1.8% (n = 26) - staff not IV certified. Nine

staff reported skill-mix as the reason for not attempting (0.6%). Five nurses stated that they were not confident to try (0.3%).

Table 12

Reasons for Page / Request

	Number	Percentage
Busy/heavy workload	111	7.5%
Skill mix	9	0.6%
Not IV Certified	26	1.8%
Not confident	5	0.3%

Table 13 shows various patient clinical conditions for referral stated by the nurses and their respective numbers and percentages. The stated clinical conditions are patients in isolation, febrile, deteriorating \pm vitals, needs 2nd or 3rd line, access stopped working, stated patient 'sick', and patient with high Early Warning Score (EWS). Among these, the highest percentage was 'access stopped working (9.0%).'

Table 13

Patient Clinical Conditions

	Number	Percentage
Isolation	8	0.5%
Febrile	54	3.7%
Deteriorating \pm Vitals	9	0.6%
Needs 2nd or 3rd line	28	1.9%
Access stopped working	133	9.0%
Stated patient "sick"	6	0.4%
Patient Scoring (EWS)	20	1.4%

Table 14 shows the number of 'known difficult', 'stated difficult', and 'picc mentioned' and their percentages. About 34% of the referrals from the nurses stated the IV access is 'difficult'. There were 1.2% of 'known difficult' referrals, and only 1.4% were 'PICC mentioned'.

Table 14

Mentioned Difficult Line in Request

	Number	Percentage
Known difficult	18	1.2%
Stated difficult	505	34%
PICC Mentioned	21	1.4%

Table 15 shows the number of reasons for pages: blood transfusion/post blood transfusion, IV fluids, IV antibiotics (IV AB), IV medications (IV Med) and their percentages. The most requests were for IV antibiotics - 236 (16%). The second most was administering IV fluids - 142(10%). IV medications (in general) were 97 (6.6%). Blood transfusions were only 32 (2.2%) of the total requests.

Table 15

Reason for Request / Page

	Number	Percentage
Blood transfusion/post blood transfusion	32	2.2%
IV fluids	142	10%
IV AB	236	16%
IV Med	97	6.6%

Table 16 shows the type of requests such as IV-line, blood tests, blood cultures, and percentages. Among the three, IV lines are the most requested (62%) than blood tests (47%). Blood cultures are only 2.6% of the total requests.

Table 16

Type of Request / Page

	Number	Percentage
IV line	905	62%
Bloods	697	47%
Cultures	38	2.6%

Data Processing and Statistical Analysis

The frequency analysis results are summarised as shown in Figure 4 to Figure 6. Figure 4 shows that most of the requests were between 1700 -1800hrs (n=157), and the second most between 2000 to 2100 hrs (n=135). The least requests were between 0800 to 0900 hrs

(n=3). Figure 6 shows the busiest times are from 1700 hrs to 2200 hrs and between 0100-0200 hrs and from 0500 hrs to 0700 hrs in the morning.

Figure 4

Distribution of Messages Across the 24 Hours

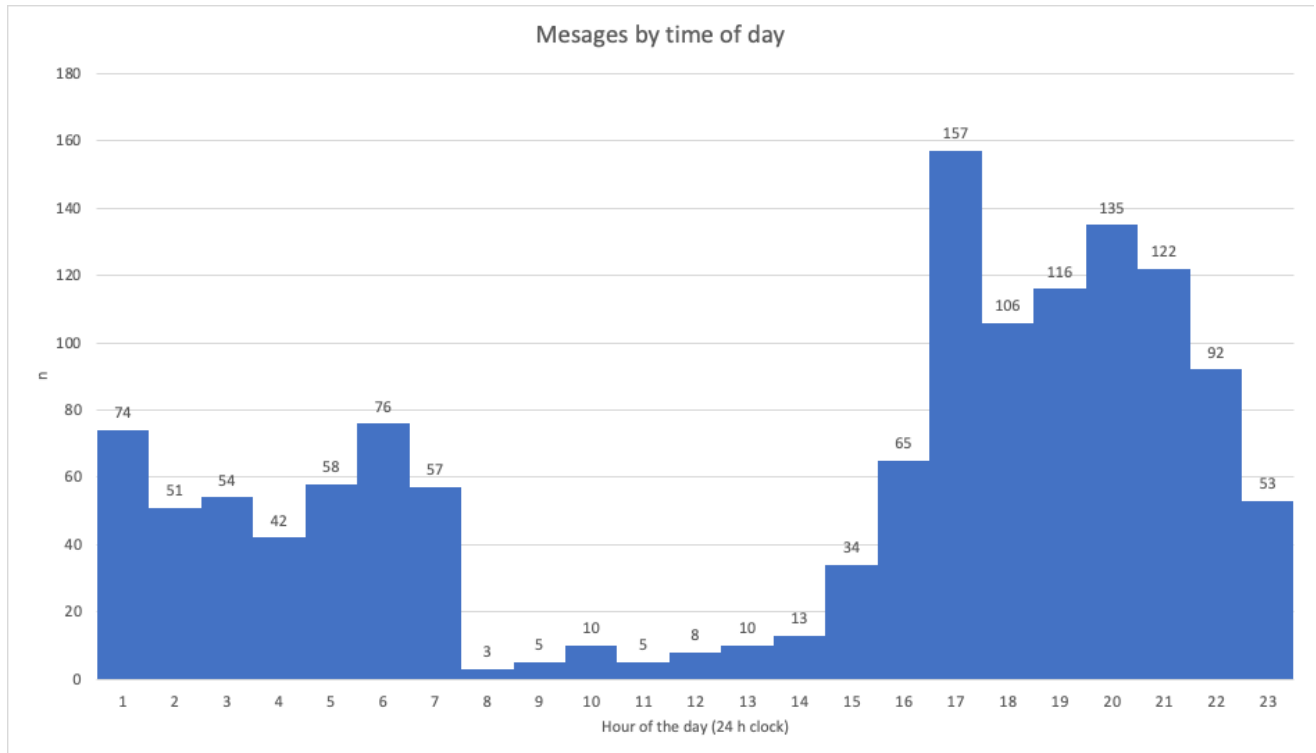


Figure 5 shows the number of pages from each ward. The highest number of requests are from ward H (n=196) and the second-highest is ward G (n=186). The lowest number of requests are from ward L (n=1). This data is very important as staff from the highest DVA requests might benefit from training and education to improve their venous access skills.

Figure 5

Number of Requests/Pages from Ward

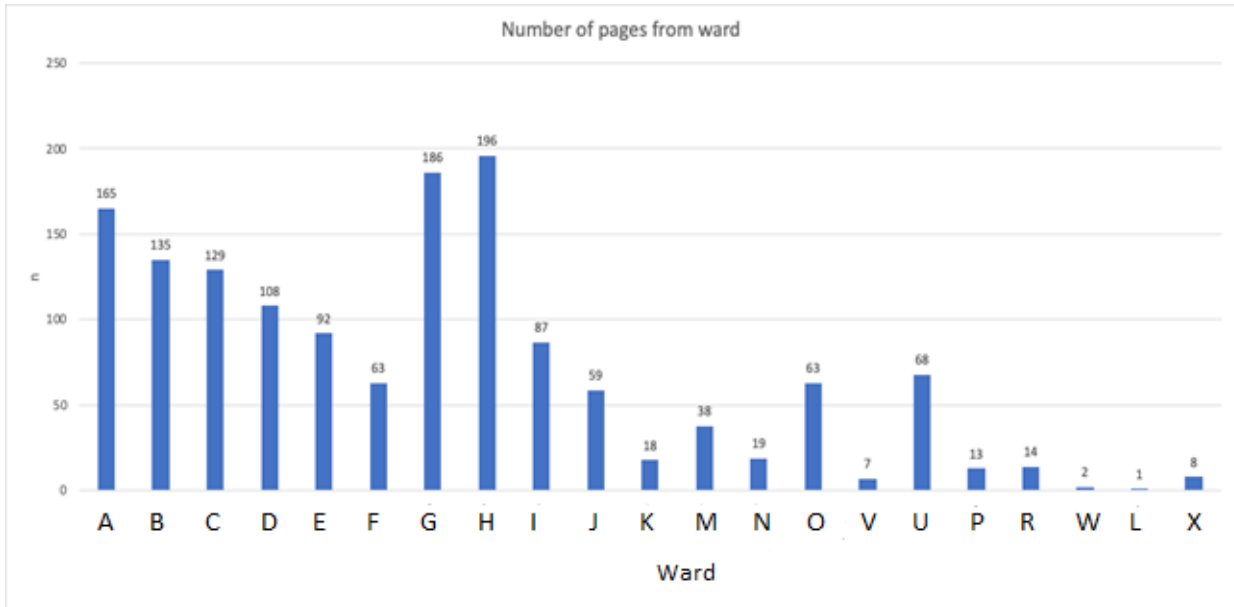
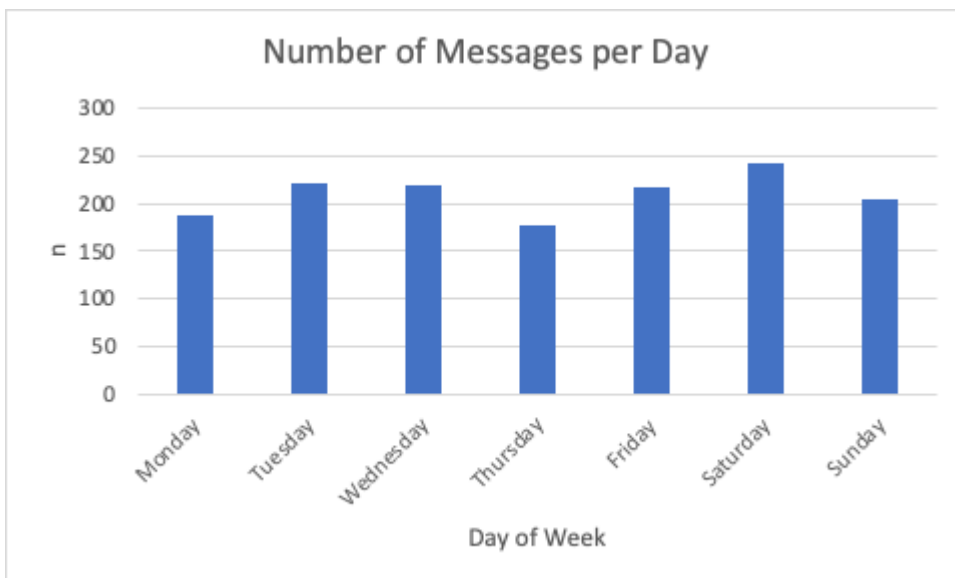


Figure 6 shows the number of messages received per day. The highest number of requests were received on Saturdays and the lowest on Thursdays.

Figure 6

Number of Messages per day of Week

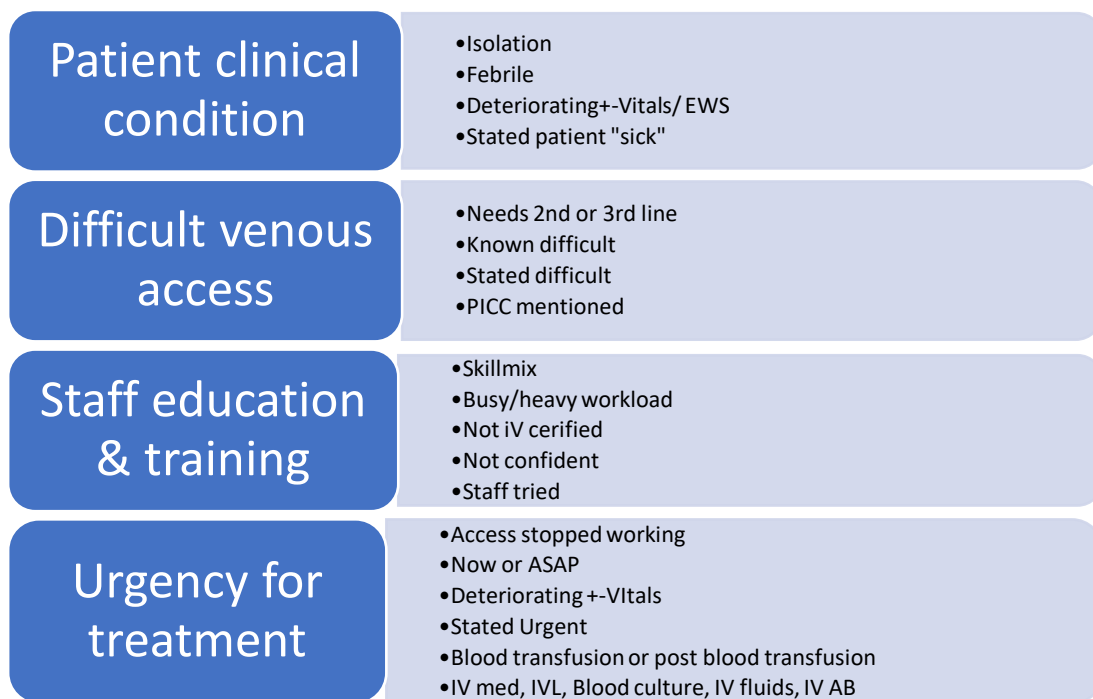


Thematic Analysis of the data

Four main themes arose from the data: patient clinical condition, difficult access, staff education and training, and urgency for treatment. Each theme has sub-themes, as shown in Figure 7.

Figure 7

Main Themes and Sub-Themes



Patient Clinical Condition

In this research, patient clinical condition emerged as one of the main themes as this plays a vital role in managing DVA. The sub-themes were patient clinical conditions such as isolation, febrile, deteriorating+-vitals/ EWS and stated patient "sick".

Isolation is one of the sub-themes identified during the analysis, which comes under the main theme 'patient clinical condition.' This identifies the patient having any isolation precautions, for example, contact precautions for patients with extended-spectrum beta-lactamase (ESBL) infections and airborne precautions for patients with chickenpox (Sarit et

al., 2015; Tschudin-Sutter et al., 2017). This warns the clinicians to wear proper infection control precautions while attempting venous access.

Febrile is another clinical condition that is significant in identifying the urgency for a blood culture for a febrile patient. This was identified as a sub-theme during the data analysis.

Deteriorating +/- Vitals / EWS is another sub-theme that identifies the page as urgent as the patient need critical venous access due to their deterioration in vital signs.

Stated patient "sick" is another sub-theme identified during the analysis that formed the central theme 'patient clinical condition.'

Difficult Access

Another prominent theme that emerged during the analysis was 'difficult access.' The sub-themes were needs second or third line, known difficult, stated difficult, and PICC mentioned.

The sub-theme 'needs 2nd or 3rd line' indicates that the patient already has IV access and needs a second or third IV cannula. This can be due to administering more than one intravenous medication or patient clinical deterioration.

Known difficult is another sub-theme through which the nurse who pages the request identifies the patient as already difficult to access.

Another sub-theme is 'stated difficult', which means that the patient is stated as a 'difficult access' by the nurse who requested the venous access. This can be because of multiple failed attempts, the previous difficulty getting IV access or the patient clinical condition.

'PICC mentioned' sub- theme says that the patient already got a PICC line or is waiting for a PICC insertion.

Staff Education and Training

Staff education and training is another theme identified during thematic analysis. The sub-themes were skill-mix, busy/heavy workload, not IV certified, not confident, and staff tried.

Skill mix is one of the sub-themes that formed the main theme 'staff education and training.' Staff identified a lack of skill mix in the shift as one of the reasons for the page. This means that there is no senior available or the senior RN is busy, so they cannot attempt the venous access.

Busy/heavy workload is another sub-theme that was picked out during the data analysis, which formed the main theme 'staff education and training'. Staff stated they are busy with their workload and cannot perform the venous access. If all the staff are adequately educated and trained for DVA access, they might help each other even if one person gets busy with the workload.

Urgency for treatment

Another prominent theme that emerged during the analysis is 'urgency for treatment.' The sub-themes were access stopped working, now or ASAP, deteriorating +-vitals, stated urgent, blood transfusion or post blood transfusion, IV med, IVL, blood culture, IV fluids, and IV AB.

Clinical Pathway

The third step of the JHNEBP model is translating the evidence (Dang & Dearholt, 2017). The results of the SmartPage© data analysis informs that nurses would benefit from a pathway for managing patients with DVA. The steps involved in the translation process to implement the clinical pathway are detailed below.

Step 1: Determine the appropriateness and feasibility of translating recommendations into the specific practice setting

The first step in translation is to determine the appropriateness and feasibility of translation recommendations in the specific practice setting. To assess the feasibility of developing this pathway, I investigated available resources in the DHB that could assist me in developing the clinical guidelines (Waitemata District Health Board, 2015, 2020a). I had discussed the results of the data analysis with the clinical

managers, anaesthetic technicians, charge nurse managers, and clinical support nurses, who provided input in developing the clinical guidelines.

Step 2: Create an action plan

The next step is to create an action plan, which is achieved by developing a clinical referral pathway. I used the results of the data analysis in the evidence and the literature review to establish the clinical guideline to support nurses when dealing with patients with DVA. I developed this in consultation with the clinical managers, shift coordinators and clinical support nurses. I consulted about clinical support nurses providing supervised practice to nurses and everybody welcomed it. This will boost the nurses' confidence, and more nurses will be capable of successfully practising venous access in the future.

Step 3: Implement the change

The third step is to implement the change. This practice project does not inform the implementation as this is only a 60-point paper, and the implementation part will be done later.

Step 4: Evaluate outcomes

Evaluation of the outcome of the practice project is the next step. The expected result of the project is to avoid delays in referrals and reduce inappropriate referrals, which helps reduce the delays in commencing treatments. Once the clinical pathway is in place, it will be reevaluated after a year by re-evaluating the SmartPage© data.

Step 5: Report results of the preliminary evaluation to managers.

Once the clinical policy or pathway is evaluated, the results will be reported to decision-makers.

Step 6: Secure support from decision-makers to implement recommended change internally

In this step, the recommended change is implemented by seeking support from the decision-makers.

Step 7: Identify the next steps

In this step, the following steps are identified.

Step 8: Communicate findings

Here, the results are communicated.

The Streamlined DVA Referral Pathway

The result of the study highlights the need for educating the nurses in managing known DVA to avoid multiple failed attempts. As shown in

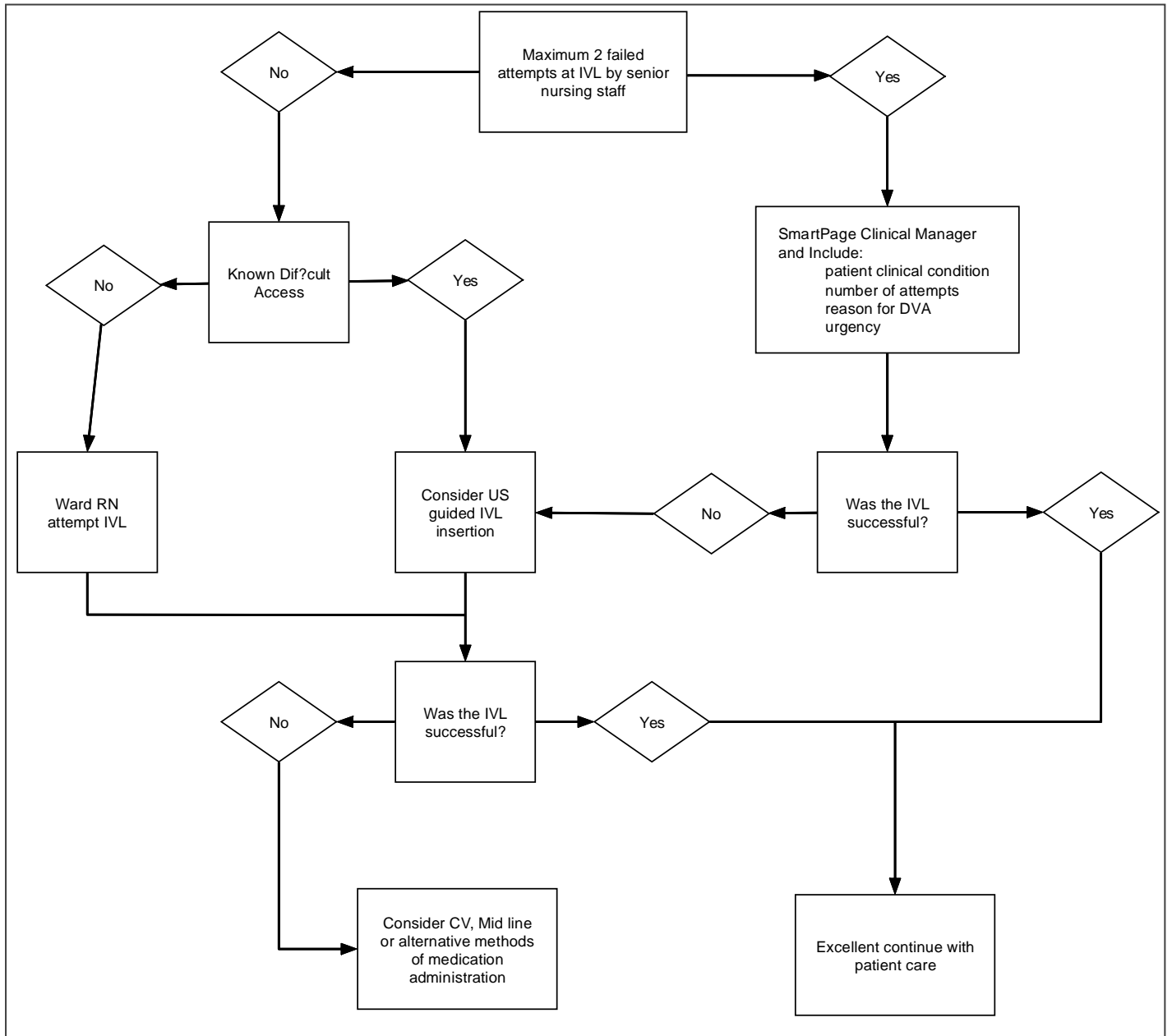
Figure 8*Difficult Venous Access Clinical Referral Pathway*

the DVA clinical referral pathway prompts the ward nurses to attempt no more than twice. The literature indicates that multiple attempts can increase pain and distress in patients (Walsh, 2008). Prompting the nurses to attempt twice encourages the nurses to attempt the venous access and become confident. According to the hospital policy, patients should have no more than two attempts at peripheral cannulation by any individual (Waitemata District Health Board, 2018). If the clinician must attempt more than twice, the practitioner has to get consent from the patient and document the circumstances in the patient notes. If two failed venous access attempts, the nurses can activate the DVA pathway. Nurses can contact the after-hours clinical support through SmartPage© by specifying the number of attempts, clinical condition, and urgency for treatment.

From the results of the data analysis, it is clear that staff were unsuccessful in 86% of the requests. The clinical support nurses can guide the nurses to increase their confidence or become trained/certified in venous access. They can attempt the venous access in the supervisor of clinical support nurses, which makes them confident in future DVA attempts. This will be very beneficial during after-hours as there is no nurse educators or clinical coaches to train the nurses. The results show that 35.2% of the requests were known difficult / stated difficult by nurses. If known DVA and ward senior RNs cannot attempt, the anaesthetic technician or a doctor can be contacted for ultrasound-guided insertion if no support is available for ultra-sound guided insertion or it is not successful. In that case, the next step is to contact the doctors for alternate options such as changing oral medications or considering a PICC line/Midline for difficult access patients who require long-term care treatments.

Figure 8

Difficult Venous Access Clinical Referral Pathway



Conclusion

This chapter explained how the six month's data is cleaned for data analysis using the PRISMA flow diagram. The results of the descriptive statistics and thematic analysis are described in detail. The four themes from the data analysis are used to develop the streamlined clinical referral pathway using the JHNEBP model, as depicted in the flowchart (figure 8). The next chapter will discuss the benefits, challenges, limitations of the project and some future recommendations to improve.

Chapter 5 Discussion and Recommendations

Introduction

This quality improvement practice project aims to improve the SmartPage© referral process by developing a clinical pathway for managing difficult venous access situation (DVA) requests that may improve patient outcomes. This project analysed the SmartPage© data and used this to inform the revised DVA pathway. Four major themes emerged from the data analysis, as described in the previous chapter, which helped to look at the term 'DVA' more broadly so that the reasons for DVA requests can be addressed. These themes were: 'patient clinical condition', 'difficult access', 'staff education and training, and 'urgency for treatment.' Analysis and critique of the findings enabled understanding of the complexities that influence a DVA alert, with significant insights into factors to consider when developing a streamlined and more effective DVA process.

This final chapter will discuss and evaluate this practice project's significance, key benefits, challenges, and limitations. Future directions and recommendations will also be addressed.

Discussion

Patient clinical condition

The results of the data analysis informed a clinical policy or pathway that helps the nurses to improve their practice and the way referral is being made when dealing with a patient with DVA. Patient clinical condition emerged as one of the main themes during the data analysis. The analysis results show that the nurses identified the patient clinical condition as a contributor or to support their request for DVA. Sick patients and patients with deteriorating vital signs may need urgent venous access for blood tests, antibiotics, or intravenous (IV) medication therapy. In New Zealand, the national early warning score (NZEWS) is designed for detecting the deterioration of adult patients who are hospitalised and non-pregnant (Forster & Pirret, 2017). They need a prioritised clinical response to prevent serious health outcomes (Patel et al., 2018).

While doing referrals, the nurses need to mention the patient's clinical condition so that the deteriorating patient or patient with NZEWS receives urgent medical attention. For example, febrile patients may need blood cultures to be taken urgently as bloodstream infections are a significant cause of mortality and morbidity in adults (Pien et al., 2010). The study results show that out of the 1476 requests, only 258 nurses specified the patient clinical condition (17.5%), which needs to be improved to enhance the patient health outcomes (Patel et al., 2018).

Patient clinical condition is an essential factor for the clinical manager in deciding the reason and urgency for the DVA request. The review of current literature (Chapter 2) reveals medical conditions (such as diabetes, sickle cell disease, obesity, underweight, chronic illness, dehydration, chemotherapy and previous IV drug use in patients with chronic diseases, morbid obesity, dehydration, and IV drug use) can make DVA challenging for the nurses (Panebianco et al., 2009). In these cases, an expert team of clinicians is needed for managing DVA (Whalen et al., 2017). Including the clinical condition and patient status in the referral text allows the clinical manager to prioritise the job and thus avoid delays in getting access and improve patient outcomes.

Similarly, the patient condition can allow the clinical manager to gain a more comprehensive view of a deteriorating patient's needs and impact on the ward and hospital and help the clinical manager prioritise the broader needs of the hospital. Winters and Neville (2012) state that nurses are forced to prioritise their nursing care in New Zealand due to several factors such as changes in staffing levels and nursing skill mix. The patient's clinical condition, clinical history, and examinations and tests needed are considered while prioritising the care (Andersson et al., 2006). Therefore, it would be helpful to include the patient's clinical condition while referring the patient for DVA and include it in the streamlined pathway.

Difficult access

The results of the data analysis identified 'difficult access' as another prominent reason for nurses finding it challenging to perform venous access. According to Hawes (2007), difficult

access can lead to delays in medication administration, total or partial loss of the prescribed dose of medication and the need to insert central venous lines. This can also increase resource utilisation, nurses time, unwanted costs, and length of hospital stay. From the literature review in chapter 2, it is evident that certain patient clinical conditions lead to difficult access. Conditions that increase the difficulty in getting IV access include tough skin such as tattoos and scars, obesity, chronic conditions, IV drug use, diabetes and dehydration (Plohal, 2021). This can cause multiple failed attempts. Patient's pain and suffering can be increased by repeated attempts to gain venous access, resulting in the insertion of IV catheters in inappropriate locations leading to severe complications (Armenteros-Yeguas et al., 2017).

Data analysis identified the reasons for difficult access as the patient needs a second or third line, the patient is a known DVA, the patient is stated as difficult by the nurse or a peripherally inserted central catheter (PICC) is mentioned in the referral. Sometimes, patients already have a line and need a second or third line for multiple IV medications, infusions, or fluids therapy (Uslusoy & Mete, 2008). Data analysis showed that sometimes the patient refuses IV access by ward nurses, or the nurses are reluctant to try as the patient is a known DVA. From the findings of this clinical project, it was apparent that the patient clinical condition could hamper the nurses with undertaking successful venous access. If the nurses mention the number of attempts and reason for DVA in the referral, the clinical manager can then prioritise the job and get an anaesthetic team for an ultrasound-guided insertion instead of attempting multiple times. Reducing the number of failed attempts saves time and improves patient outcomes (Weiner et al., 2013). For this reason, the number of attempts and reasons for DVA in the referral flow chart.

Staff education and training

Smith (2021) states that peripheral IV access is the most common procedure performed in hospitals and is mainly the nurse's responsibility. Studies suggest that approximately 11% of patients have DVA, and staff education and training are crucial in this context. Optimal

venous access and management require clinicians to have appropriate education and skill on the best procedural techniques (Moureau, 2019).

The data analysis results highlighted staff education and training necessary to manage difficult access. The data analysis clearly shows that not all the 'difficult access' requests were because of difficult patient conditions. The staff named it 'difficult' as they found it challenging to perform the venous access. From the study, I could find that a patient stated as difficult by nurses when they failed multiple times or had previous difficulty with IV access. This could be because of the staff inexperience in performing venous access, which we can link to 'staff education and training'. If the staff received relevant hands-on training from the clinical support team, they could overcome this difficulty. Supervised practice enables the staff to become more confident and skilled in DVA. The literature review (chapter 2) supports that the operator's skill affects successful cannulation. Through supervised practice, clinical support nurses can pass their specialist knowledge and skills to the nurses in the clinical setting to improve on DVA and manage complications associated with DVA. McGowan (2014) states that nurses play an essential role in improving patient outcomes by recognising and managing complications of cannula insertion. He also states that peripheral IV cannulations require specialist knowledge and skills.

Studies have found that ultrasound-guided peripheral line insertion is associated with an increased success rate (Gottlieb et al., 2018). One solution could be to train senior nurses to use ultrasound-guided insertion, and they can manage DVA successfully in the absence of anaesthetic technicians or other expert clinicians.

Nurses and other clinicians should be supervised while acquiring the necessary education and training (Antohe et al., 2016). As a finding from this study, a change in the practice of clinical support nurses doing the venous access for the ward nurses is recommended to improve this. Clinical support nurses can train and support the nurses in performing venous access instead to learn the proper techniques of finding the right vein and selecting the suitable devices. Latham et al. (2008) developed a mentor and advocacy programme to

support and develop the skills of nurses by dedicated mentors. The programme improved the work environment for nurses and improved patient care outcomes. If the staff are adequately trained, they will be able to prioritise and manage venous access even in the middle of a heavy workload. For an experienced practitioner, it is significantly easier and quicker to perform venous access (Hadaway & Millam, 2007). From the literature review in chapter 2, successful peripheral IV access requires in-depth knowledge and skills. Literature also suggests that this can improve clinical practice and patient outcomes (Plohal, 2021).

Another finding from the study is that staff are reluctant to attempt. The analysis showed that 7.5% of staff said they don't want to attempt due to a busy or heavy workload. 0.6% stated that they are unable to attempt due to skill mix. This may be because there is no staff available or free to attempt who is IV certified. Twenty-six (1.8%) nurses said they haven't attempted as they are not IV certified. This shows that nurses may need more training so that they can become certified. Changing the role of support nurses to assist and supervise them to get signed off and become confident in venous access. Five nurses (0.3%) stated that they didn't want to attempt as they were not confident. This may be because the nurses are reluctant to practice even though they have completed the training for venous access as they are not confident. This may depend on the individual nurse, the culture of the ward, and the culture of nursing, such as relational practices and transactional practices. This can be overcome by clinical support nurses providing supervised training for the ward nurses in getting venous access. Hadaway and Millam (2007) suggest working with clinical mentors to build the nurses confidence in DVA as they get a minimal opportunity at their workplace to get experienced nurses to coach them. The research shows that staff education and training are crucial in managing DVA and, therefore, it is included in the streamlined pathway.

Urgency for treatment

From the study results, 'urgency for treatment' is another reason nurses refer to clinical support. The study identified deteriorating vital signs, stated as 'urgent/ASAP' by the nurse, access stopped working, blood transfusion/ post blood transfusion, IV medications, Blood

tests, IV fluids, and IV antibiotics as the urgent causes for treatment. From the study, the nurse must mention the urgency for treatment in the referrals so that the clinical manager can prioritise the job and improve patient outcomes. The literature suggests that missed attempts and delays in getting venous access can harm patient care and well-being (Brannam et al., 2004; Sarkar & Ibitoye, 2013). This can delay procedures, medication administration, and other treatments resulting in patient distress (Sarkar & Ibitoye, 2013). Early identification of patients with difficult access can prevent such delays (Smith et al., 2013). From the literature and study results, it is evident that nurses have to specify the urgency for treatment while referring patients for DVA so that the request can be prioritised and completed without wasting time. For this reason, I have included urgency in the streamlined referral pathway.

Significance of the research in the discipline area

Waitemata Central (WC) is part of the daily operations support team of WDHB (Waitemata District Health Board, 2016). They aim to focus on patient safety and outcomes, improve patient, whānau and staff experience, timeliness of care and avoid delays. One of the main goals of WC is to enhance senior support and presence in the hospital after-hours when minimal support is available (Waitemata District Health Board, 2016). Implementing this project will benefit our clinical support team, including the clinical manager and clinical support nurses, as the pathway will streamline the referral process. More detail is included in referrals via SmartPage the new clinical pathway, enabling the clinical manager to prioritise the DVA requests and refer them to appropriate clinicians. This prevents delays in getting access and commencing treatments to improve patient outcomes (Weiner et al., 2013). Also, clinical managers can utilise their time effectively for other jobs. The clinical pathway will also enable the ward nurses to enhance their practice. It requires them to make two attempts and not more than two attempts, preventing patient complications and suffering. Literature suggests that multiple venous access attempts increase patient anxiety and pain (Eldridge, 2010; Walsh, 2008).

By implementing the clinical pathway, ward nurses will potentially more supervised DVA after-hours when no nurse educators or clinical coaches are available to train the nurses. The literature review in chapter 2 shows that the clinical pathways improve patient outcomes and positively impact health care quality. Sou et al. (2017b) improved patient outcomes by increasing first attempt success with ultrasound guidance by employing a clinical pathway for DVA.

Benefits of the research

The research was cost-effective to the District Health Board (DHB) as there was no cost associated with the development of this project. This project will potentially improve the DVA referrals through SmartPage© once implemented. The project utilised resources that are already available in the DHB, such as SmartPage© data. There are no external resources involved in this research.

Successful clinical pathway implementation would improve patient outcomes as the study has already suggested solutions to improve venous access. Educating the nurses to manage DVA will improve patient outcomes by alleviating the pain, anxiety and suffering caused by multiple attempts (Harpel, 2013; Walsh, 2008). By avoiding delays in getting treatments and preventing multiple attempts, patient outcomes can be improved.

The research was beneficial to Waitemata Central as they provide clinical support to ward nurses after business hours. The research outcomes supported that more training and supervised practice is needed for ward nurses to become confident in DVA management. I have already discussed this with the clinical managers and clinical support nurses and changed how we approach the DVA requests. Instead of doing the access, clinical support nurses guide/supervise the nurses in the clinical area to do the access by themselves. I have also included this in the proposed pathway.

Working on this project also helped me make new contacts within the DHB and thereby collaborate and build a network of other professionals, including research specialists, charge

nurse managers, IT professionals, clinical and duty managers, and anaesthetic technicians. Working with these professionals enabled me to gain new knowledge and experiences, and their contributions helped me complete this project. I learnt more about SmartPage© and how information is stored in the DHB using Qlik, DHB- wide data discovery tool and pass my knowledge to my colleagues. This will also help me with my future research plans.

Working on this practice project also helped with my professional development. It was the first time I have led a quality improvement project, so the journey was a learning curve for me. This enabled me to become confident in participating in future research, which will benefit the organisation.

Challenges

The data collection process was challenging due to the impact of the COVID-19 pandemic. I used six months of SmartPage© data as I was unsure whether COVID-19 influenced the number of requests on SmartPage©. As I could not do any meetings in person, I had to arrange zoom meetings to communicate with different people regarding the project, which was challenging. Data collection took longer than expected as the meetings with Health Information were disrupted due to COVID-19.

It was challenging to develop the pathway merely based on literature and SmartPage© data. Based on the data analysis, only superficial evidence supported the pathway development. The data needs to be improved to influence the pathway. For example, this aligns with the finding that there is insufficient data to show that the clinical support team completed the difficult access lines. Also, there is no data to show that the unsuccessful/known difficult jobs have been referred to the anaesthetic technician and the outcome.

Limitations of the study

The study utilised SmartPage© data from WDHB only, which is one of the limitations of the study. The findings are only related to one organisation and cannot be generalised to other organisations.

The COVID-19 pandemic might have impacted the number of requests on SmartPage© as the number of hospital admissions was less during this time than in previous months.

I have used a condensed thematic analysis due to the contained 60-point nature of the practice project paper, which is another limitation of the study.

A further limitation is that some of the reasons for the 'multiple attempts'/'difficult accesses were not obvious from the referral data. There may be reasons such as skin colour/ ethnic background etc. From the data, it is noted that patient demographic /characteristics are not included. Literature (chapter 2) says that patient ethnicity/skin colour can be a reason for DVA.

Another limitation of the study is that time constraints may hamper the successful implementation of the streamlined pathway in complicated workload situations. Nurses can be too busy with their workload, so that they might find it difficult to follow the new clinical pathway.

Recommendations

The recommendations to meet the aim of the research are provided by analysing the data. Rather than only developing a DVA clinical referral pathway, the data analysis discovered more areas that needed improvement.

The first recommendation is that staff education and training are crucial in managing DVA, as evidenced by the thematic analysis of the SmartPage© data. Nurses require ongoing training and education to provide quality patient care (Price & Reichert, 2017). Out of the 1476 DVA requests, 1272 were already attempted by staff but failed. This data shows that the staff need more practice and training in managing DVA. Clinical support nurses should teach and guide the ward nurses in inserting IV lines or blood tests and teach them the correct techniques instead of doing it for them. While paging the clinical manager with a difficult access request, the staff should mention the number of attempts and urgency for the treatment (patient's clinical condition) to prioritise the job. A study conducted by Keleekai et

al. (2016) organised a training course for hospital nurses using simulation tools in peripheral intravenous catheter (PIVC) insertion. The participant nurses have already had their formal training in this area. The study results revealed notable improvement in participant nurses knowledge, confidence and skills in PIVC insertion (Keleekai et al., 2016; Price & Reichert, 2017).

There is no scale at WDHB to measure the difficulty of venous access of patients currently. I recommend using a difficult intravenous access (DIVA) scale to identify patients with DVA based on their clinical data. This will save clinicians' time from attempting multiple times, thus delaying treatments. Instead, they can use other techniques such as ultrasound-guided insertion or use expert clinicians in an earlier time frame, improving clinical practice and patient outcomes (Van Loon et al., 2016). Van Loon et al. (2016) developed an adult difficult intravenous access (A-DIVA) scale to identify adult patients with DVA based on their clinical observations. The study used a sample of 1063 patients who are 18 years or older, scheduled for any surgical procedure. A-DIVA score was applied in 3 risk groups from a score of 0 to 4 plus based on the number of failed attempts (Van Loon et al., 2016). The study found that the A-DIVA scale is a reliable and accurate predictive tool for patients with DVA, and the applications of the scale to surgical patients increase the first attempt success rates (Van Loon et al., 2016).

Another recommendation is that staff refer the known difficult cases to anaesthetic technicians/experts for ultrasound-guided insertion instead of multiple attempts causing delays and patient discomfort. Literature suggests that ultrasound-guided insertion can increase the first attempt success rate in patients with DVA (Doniger et al., 2009). This also improves patient comfort, as found by the literature (Morata et al., 2017). I recommend the anaesthetic team train clinical support nurses, doctors, and ward nurses in ultrasound-guided IV insertion. This will create more trained people and reduce delays while the anaesthetic team is busy. Moore (2013) provided individualised training for nurses in

ultrasound-guided IV insertion with a nurse champion, resulting in a success rate from 90% to 98% in one year (Moore, 2013).

If possible, the medical team should consider a midline or CV line insertion depending on the duration of the treatment and the patient condition. This needs a detailed risk and benefit analysis as CV access is associated with many risks (Panebianco et al., 2009). Significant morbidity and mortality can result from complications related to CV lines (Kornbau et al., 2015). Even though it is clear from the literature search that the patients requiring long term IV therapies will benefit from a midline or central line, clinicians should be cautious and consider strategies to prevent possible complications (Marschall et al., 2014). Considering the complications of central lines, other measures such as an ultrasound-guided insertion are preferable to improve patient outcomes (Panebianco et al., 2009).

Future directions

Based on the analysis, improved staff education and training are required for effective DVA management. For this, clinical support is required to guide and support staff to successfully manage a DVA instead of undertaking the clinical procedure. Staff being confident in managing DVA can reduce the number of DVA requests from ward staff so that clinical managers can better prioritise their valuable time. Upskilling the staff also prevents unwanted treatment delays and improves patient outcomes.

From the data, it was evident that staff used a lot of abbreviations in the referrals. This can be because of various reasons like busy workload, or it may be a common practice in the workplace. This cannot be inferred from the data and because no link was made between the use of abbreviations and the reason for doing the referral, further research would need to be carried out if this is deemed an area of interest.

I recommend re-doing the SmartPage© data audit in one year and then comparing it with the previous data so that we can see any improvements in DVA management.

Dissemination & Outcome

The research outcome will be shared with all Waitemata Central Clinical Support nurses, Clinical Managers, Duty Managers and Operations Managers to optimise the patient experience and treatment. The project will also be written up and submitted for publication in an academic journal.

Conclusion

In conclusion, staff education and training are more critical in managing DVA. Through the analysis of SmartPage© referral data, it is apparent that staff need more education and on-site training to perform the venous access independently. Also, the study findings inform a DVA referral pathway by identifying the need for including patient clinical condition, managing DVAs by experts promptly without delays and providing staff training. The referral pathway also ensures that the staff attempts twice before referring the patients to appropriate clinicians.

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