


1-1-2016

The Relation Between Patient Education And Picc Line Occlusion

Patricia Louise Petroulias
Wayne State University,

Follow this and additional works at: http://digitalcommons.wayne.edu/oa_dissertations

 Part of the [Databases and Information Systems Commons](#), [Nursing Commons](#), and the [Other Education Commons](#)

Recommended Citation

Petroulias, Patricia Louise, "The Relation Between Patient Education And Picc Line Occlusion" (2016). *Wayne State University Dissertations*. Paper 1574.

This Open Access Dissertation is brought to you for free and open access by DigitalCommons@WayneState. It has been accepted for inclusion in Wayne State University Dissertations by an authorized administrator of DigitalCommons@WayneState.

**THE RELATION BETWEEN PATIENT EDUCATION AND
PICC LINE OCCLUSION AND INFECTION**

by

PATRICIA PETROULIAS

DISSERTATION

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2016

MAJOR: NURSING

Approved By:

Advisor

Date

© COPYRIGHT BY
PATRICIA PETROULIAS
2016
All Rights Reserved

DEDICATION

I am grateful to all of the incredible nurses and patients who contributed to this research. I am forever indebted to Dr. Sally Lusk, who planted the seeds of a nurse researcher in me. I dedicate this manuscript to my loving husband, who ate many take out dinners. I also dedicate this to my parents, who always believed that I would complete a doctorate. Their spirits live on in me and my large family of six sisters, my brother, and all of their spouses and children. Lastly, my children and my grandson are my inspiration to keep going. I will always be tenacious P.

ACKNOWLEDGEMENTS

I would like to acknowledge Dr. Janna Roop for her support and guidance. I would also like to acknowledge my committee members: Dr. Margaret Campbell, Dr. Timothy Spannaus, and Dr. Hossein Yarandi.

A special thanks to the nurses and patients who participated in the study. Without their assistance, this study could not have been completed.

I would also like to thank the Smiths Medical Gardner Foundation for their financial assistance during this research.

To everyone else who provided support and encouragement throughout this journey, thank you.

TABLE OF CONTENTS

Dedication.....	ii
Acknowledgements.....	iii
List of Tables	vii
List of Figures.....	viii
CHAPTER 1 – INTRODUCTION	1
Patient and Caregiver Education.....	3
Being Overwhelmed	4
Statement of Problem.....	6
Patient Information about Self-care	7
Electronic Tablets for Education	8
Statement of Purpose	9
Research Aims and Questions	9
Study Significance to Nursing, Healthcare, and Society	10
Summary.....	11
CHAPTER 2 – THEORETICAL FRAMEWORK AND REVIEW OF THE LITERATURE	12
Introduction.....	12
Theoretical Framework: The Cumulative Complexity Model	12
Patient Workload of Demands.....	14
Burden of Treatment (BOT)	15
Burden of Treatment for Patients with PICC Lines.....	16
Patient Capacity	18
Burden of Illness.....	18

Conceptual Relationships in the CCM.....	18
Review of Literature	21
Being Overwhelmed and Decision-Making.....	22
Patient education.....	25
Theoretical Guides for Design of Intervention	28
Adult Learning Principles	28
Gagné’s Conditions of Learning.....	29
Cennamo’s and Kalk’s Recommendations for Instructional Design	34
Friedman’s Alternatives for Design.....	38
Limits to Design.....	41
Summary.....	41
CHAPTER 3 – METHODOLOGY.....	42
Restatement of the Purpose.....	42
Specific Aims, Research Questions	42
Design	43
Human Subjects Protection.....	43
Sample.....	43
Size.....	43
Inclusion and Exclusion Criteria.....	44
Recruitment.....	44
Instruments.....	45
Patient Capacity	45
Burden of Illness	45

Being Overwhelmed	46
PICC Line Patency Status	48
PICC Line Associated Infections	48
Intervention	48
Data Collection Procedures	50
Data Entry Procedure	50
Threats to Internal and External Validity	50
Data Analysis	52
Summary	54
CHAPTER 4 – RESULTS	55
Description of the Sample	55
Research Questions	58
Anecdotal Findings	61
Summary	62
CHAPTER 5 – SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	63
Summary	63
Results	63
Participants	63
Results Related to Research Questions	64
Occlusion and Infection	65
State of Being Overwhelmed	66
Evaluation of Intervention	67
Study Limitations	68

Implications and Recommendations	68
Nursing Practice.....	68
Nursing Research.....	69
Conclusions.....	70
Appendix A – Flushing a PICC: The 10 Steps of Flushing.....	71
Appendix B – Wayne State University Institutional Review Board Approval	72
Appendix C – Instruments	74
References.....	79
Abstract.....	92
Autobiographical Statement.....	94

LIST OF TABLES

Table 1	Study Variables	47
Table 2	PICC SEIC Timeline	49
Table 3	Statistical Analysis	53
Table 4	Demographic Characteristics of the Sample (N = 11)	56
Table 5	Patient Capacity (N = 11).....	57
Table 6	Cancer Diagnosis (N = 11).....	57
Table 7	t-Tests for Dependent Samples – State of Being Overwhelmed	59
Table 8	t-Tests for Dependent Samples – Burden of Illness	59
Table 9	Wilcoxon Signed Ranks Pair Test – Burden of Illness	60

LIST OF FIGURES

Figure 1	Cumulative Complexity Model.....	14
Figure 2	Midrange Theory	20

CHAPTER 1: INTRODUCTION

Healthcare providers use central venous access devices, such as peripherally inserted central catheters (PICCs), for infusion therapy to access a patient's venous circulation safely (Molloy, Smith, & Aitchison, 2008). Such access allows providers to instill medications, especially vesicants and irritants, as well as larger volumes of fluid into major veins with minimal risk of pain or damage to the vessel wall. PICCs are indicated in patients requiring at least six days and up to one year of infusion therapy (O'Grady et al., 2011). Common indications for PICC lines include a need for parenteral delivery of nutrition, antibiotics, and analgesics, as well as chemotherapy and repeated blood transfusions (Tariq & Huang, 2006). The Joint Commission (2014) estimated that three million PICCs were placed in 2013 in the United States.

Potential complications have been associated with the use of a PICC line. These complications include central venous access device-associated infections, occlusion of the PICC line, deep vein thrombosis of the upper extremity, thrombophlebitis, catheter pinch-off syndrome, catheter dislodgement, catheter migration, superior vena cava syndrome, air embolism, and damage to the PICC line itself (Alexander et al., 2010). This study focused on the complications that are mutable with flushing: occlusions and infections.

The length of time a PICC remains functional is dependent on the care provided to prevent occlusion. PICCs may occlude for several reasons, with thrombus the most common cause of occlusion. Virchow's triad is an explanation for the pathophysiological formation of venous thrombus, involving the presence of three factors: (a) vessel wall damage or injury related to mechanical or irritant trauma, (b) blood flow obstruction and (c) hypercoagulability of the blood (Infusion Nurse Society [INS], 2011). Occlusion within the catheter lumen also can result from a reflux of blood into the catheter tip. Other causes of occlusion are associated with

drug precipitate, lipid deposits, catheter pinch-off syndrome, or malposition of the catheter tip (Alexander et al., 2010). Reported PICC occlusion rates vary from 14 to 36% (Barrier et al., 2013; Dougherty, 2014; Moureau et al., 2001; Ngo & Murphy, 2005). Such occlusions result in treatment delays, surgical replacement, patient discomfort, and increased patient care costs (Alexander et al., 2010).

Catheter associated blood stream infections (CABSIs) can also occur with PICC lines. Indwelling venous access devices usually develop biofilm, a community of microorganisms surrounded by a slime matrix that accumulates within the line and needleless injection caps. Bacteria from the biofilm can detach from the catheter surface and contribute to CABSIs. In addition, microorganisms can enter the catheter surface when the line is manipulated, resulting in either a localized or a systemic infection (Alexander et al., 2010).

Management of PICCs, as well as patient and family education regarding these devices, is within the scope of nursing practice and is included in the standards of practice for the Oncology Nursing Society (ONS) and Infusion Nurses' Society (INS). PICC occlusion and infection often are directly attributed to poor maintenance techniques, specifically failure of aseptic technique when manipulating the line, failure to flush lines properly, and/or failure to use the locking solution recommended for a specific device. (Alexander et al., 2010; Cummings-Winfield, & Mushani-Kanji, 2008; Ferroni et al., 2014; Hadaway, 2005). The use of the pulsatile flushing technique with a 10-milliliter syringe is recommended to create turbulence inside the line to clear the catheter and decrease bacterial colonization (Ferroni et al., 2014, INS, 2010). Additionally, both the frequency and technique of flushing is important. Pulsatile flushing with normal saline is a simple and effective technique to reduce catheter bacterial colonization and occlusion. It should be performed routinely and after catheter use. (Camp-Sorrell, 2011).

Patient and Caregiver Education

The insertion of a PICC line can have significant impact on patients' lives, especially when the line is inserted into the dominant arm (Sharp et al., 2014). Effective patient and caregiver education is believed to be fundamental to providing infusion therapy safely and decreasing the risk of PICC-related complications (Alexander et al., 2010). The patient and caregiver need to be able to perform the tasks of PICC maintenance and to know when to contact a healthcare provider if complications arise.

A major goal of infusion nursing care is to deliver therapy that is free of complications, thereby promoting positive patient outcomes (INS, 2016). In most settings, nurses are responsible for providing patient and caregiver education related to PICC line maintenance (INS, 2016). Education of patients and caregivers begins in the healthcare setting, either through individualized education or in a group setting, such as a line-care class. The education continues with short-term home care nursing, where independence with PICC care is the goal. Patients and caregivers need to learn and demonstrate appropriate techniques to prevent catheter occlusion and infection to ensure safe and effective self-management. The Infusion Nurse Society's (INS, 2016) recommended guidelines for patient/caregiver education include device description, reason for placement, aseptic technique, basic device flushing, dressing and injection cap change, level of discomfort the patient may experience, site assessment for adverse outcome symptoms, potential complications, and prevention and management of complications (INS, 2016).

Because of the volume and complexity of the information, patients have described the education as unhelpful, excessive, and frightening (Molloy et al., 2008). Patients feel overwhelmed and, therefore, their retention of this critical information is severely limited (INS, 2016; Molloy et al., 2008). Furthermore, PICC line care in the healthcare setting can be

inconsistent when different caregivers provide central line flushing and care. How well patients and caregivers can maintain a patent, infection free PICC depends on their ability to learn new self-care behaviors and to integrate them into their healthcare practices, skills that can be greatly impeded by their state of being overwhelmed.

Being Overwhelmed

The origin of the term, *overwhelm*, came from 14th century English, from *over* + *whelmen* that meant to turn over or to cover up (Merriam Webster, 2001). The definition includes: upset, overthrow, to cover over completely or submerge, to overcome by superior force or numbers, and to overpower in thought or feeling. Being overwhelmed is an internal, subjective human experience, much like the experience of fear. It is a state of feeling overpowered by stress that influences affective (emotional) responses, as well as psychological and cognitive capability (thought). The dictionary definition of overpowered in thought and feeling could be a descriptor of the experience of one who is overwhelmed, but the observable presentation of being overwhelmed can be expressed as the inability to make decisions or the general lack of ability to participate in activities or tasks that are important to quality of life. Being overwhelmed also can be expressed as ambivalence about making choices or being unclear about the nature of the choices, the consequences, or the outcomes of those choices (Sinding et al., 2010).

Three defining attributes are associated with *being overwhelmed*: high emotional *intensity*, impaired *attention*, and low *clarity* (Kerns & Berebaum, 2010). The qualities of intensity, attention, and clarity are thought to reflect how people process their affective responses. It has been theorized that overwhelmed individuals are motivated to decrease the intensity of their emotional reaction (Kerns & Berebaum, 2010). Overwhelmed individuals may experience an intense emotional reaction to the situation although this reaction may or may not

be expressed outwardly. The intensity of the emotional reaction could be self-reported, but it is not necessarily an observable state. Attention refers to the ability of a person to focus during his/her emotional reaction. Attention is required to learn a new task or to notice changes in the environment and it requires consideration of the internal, as well as the external environment. Clarity is the ability to make sense of emotional reactions. Clearness of thought and vision require lucidity, precision, and fluency of thought. Clarity is the ability to assess a problem and understand its significance, as well as to consider possible solutions.

Precursors to being overwhelmed include high self-care demands, as well as a high burden of treatment, including treatment-related effects for people who are ill (Bohlen, Scoville, Shippee, May, & Montori, 2012). The stress of the demand to learn new and complex self-care skills can contribute to the state of being overwhelmed. Shortened lengths of stay in hospitals have necessitated that individuals quickly adapt to the change. The participants in self-care are required to learn new skills rapidly for complex procedures or medical devices and integrate these behaviors into their own self-care routines. Not only are there new processes for self-care to be learned, the knowledge and judgment of when to contact the healthcare provider for potential deviations in health also are required of the patient and/or the caregiver. Patients are discharged home and they, with their caregivers, must understand what to do, when to do it, and when to call for assistance. Overwhelmed patients may simply not perform all of the required self-care behaviors, even if they are able to express the self-care steps. They often require self-directed learning that can be repeated until the steps are mastered and can benefit from enhanced self-paced patient education that occurs in their homes.

As noted earlier, research on treatment decision-making characterizes patients who resist an active role in their care as being overwhelmed, unclear about the nature of the treatment

decisions, or lacking the capacity to participate (Sinding et al., 2010). In a study of transitions of care in five European countries, patient and caregiver discharge information was found to be provided piecemeal and, consequently, patients were often unaware of the importance of the information, unable to recall the information, and overwhelmed when they were told that they were being discharged from the hospital (Hesselink et al., 2012). A study of overwhelmed patients with diabetes found that patients who had a high burden of treatment and self-care demands experienced preventable non-adherence, increased costs, and poorer quality of life (Bohlen et al., 2012). Similarly, oncology patients have been found to be anxious and overwhelmed at the start of chemotherapy and tend to have trouble retaining new information (Duggleby, Ghosh, Cooper, & Dwernychuk, 2013; Malone, 2007).

Statement of Problem

PICC occlusion continues to occur frequently, even though this adverse patient outcome is considered preventable with adequate line flushing. As patients and caregivers are becoming more responsible for PICC line care, educational interventions are needed to promote appropriate methods for maintaining them. The standard method of education is that the infusion nurse demonstrates how to flush the PICC line and provides the patient with a written handout describing the steps, but these current educational strategies still result in an unacceptably high occlusion rate for PICC lines. Furthermore, although it is believed that a relationship between education and decreased complications exists, there is a paucity of literature on this topic. Research is needed to provide support for this conjecture.

This study, therefore, proposed a new strategy for patient and caregiver education – a comprehensive educational intervention (PICC self-care educational intervention [PICC SCEI]) using electronic tablets to reduce the incidence of PICC line occlusion in the adult outpatient

population that may be overwhelmed with self-care demands. The use of technology would allow repetition and self-paced learning that could help patients improve their ability to perform the self-care practices needed to care for their PICC lines.

Patient Information about Self-care

Healthcare information can be unfamiliar, complex, and often inherently threatening. This information often is acquired under substantial time pressures (Cimprich, 1992). Clinical research has demonstrated that during and following periods of medical treatment, people experience substantial and persistent losses of the ability to focus and concentrate. Attentional ability cannot support information demands associated with many patient education approaches. In a study of women with newly diagnosed breast cancer, the capacity to focus attention significantly decreased over a one-month interval, extending from initial diagnosis to the start of adjuvant chemotherapy or radiation (Cimprich, 1998). In that study, older women (65 to 79 years old) demonstrated the lowest levels of capacity to direct attention over the one-month study interval, regardless of the extent of surgery. The finding suggested that advancing age has a negative association with patient capacity, as older women treated for breast cancer demonstrated a greater risk of decline in their capacity to direct attention. Capacity to direct attention is experienced as a loss of focus and concentration, as well as an increase in distractibility. A person experiencing a loss of capacity to direct attention exhibits impairment in purposeful functioning, such as making effective treatment decisions, carrying out self-care, and adhering to complex treatment plans. Northouse (1989) found that women with newly diagnosed breast cancer were confronted with multiple informational, affective, and behavioral demands requiring considerable use of the capacity to direct attention during pretreatment and early post-surgical periods. Examples of these demands included understanding the diagnosis and making

treatment decisions under time pressure and high emotion, confronting existential concerns and family distress, adjusting to the loss of a breast, and modifying life activities to enable treatment. This loss of attentional capacity can have detrimental effects on recovery, impede learning new self-care activities, and result in being unable to cope with life-threatening illness (Cimprich, 1998).

Electronic Tablets for Education

With the proliferation of electronic tablets, smart cell phones, and other devices that can be used as teaching tools, patients can learn self-care techniques using electronic devices. Combining technology and educational theory can provide unique experiences for patients who are learning self-care techniques to manage their PICC lines. The healthcare environment, where learning is expected to occur, contains multiple distractions in the form of noise, traffic and multiple caregivers in an impersonal surrounding (Cimprich, 1992). Such conditions decrease attention and are difficult to ignore, thereby requiring considerable mental effort simply to make sense of the environment and to overcome distractions before learning can occur. By shifting the learning environment to the patients' homes or environments of choice, the intervention can take place in a patient-controlled environment.

An assumption of this study was that using an electronic tablet to detail the steps required for flushing their PICC lines could help patients master the process better than receiving the standard method of patient education. Therefore, the intervention for this project was a coaching session with the researcher who is an infusion nurse, along with providing the patient with a video on an electronic tablet that outlined the ten steps of flushing (See Appendix A.) The tablet could be taken home to provide a demonstration that could be replayed as needed. In addition, a nurse could use free voice and audio calls such as *Facetime* or *Skype* to coach the patient through

the process. It was believed that as patients became more proficient at flushing their PICC lines, the negative outcomes of occlusion and infection should be reduced.

Statement of Purpose

This pilot study had three purposes for a sample of community dwelling adults:

1. To test the feasibility of using an electronic tablet to supplement patient and caregiver education about PICC lines.
2. To determine the changes in the state of being overwhelmed, burden of illness, and treatment burden pre- and post- intervention.
3. To compare the percentage of PICC line occlusion and infections in the pilot study participants with national percentage rates of the same adverse outcomes.

Research Aims and Questions

This study has the following specific aims and research questions:

Specific Aim 1: To determine the percentage of PICC line occlusions and infections in adult outpatients who have participated (with or without their caregivers) in a self-care educational intervention (SCEI) that was supported with electronic tablets.

Research Question 1: What is the percentage of PICC line occlusions and infections in adult outpatient participants who complete a SCEI for PICC line care using an electronic tablet?

Specific Aim 2: To examine the change in the state of being overwhelmed, the burden of treatment, and the burden of illness pre- and post-intervention.

Research Question 2: Are there changes in the state of being overwhelmed, the burden of treatment, and the burden of illness in outpatients who (with or without their caregivers) complete a SCEI for PICC line care?

Specific Aim 3: To determine if the percentage of line occlusions or infections differs between patients who (alone or with their caregivers) have completed a SCEI for PICC line care and the national percentage rates of line occlusions or infections.

Research Question 3: Is there a difference in the percentage rate of line occlusion and infection in patients who (with or without their caregivers) have completed a SCEI for PICC line care and national percentage rates of the same adverse outcomes?

Study Significance to Nursing, Healthcare, and Society

The study investigated the feasibility of an educational intervention to enhance PICC self-care for patients and caregivers, and thus decrease adverse outcomes of occlusion and infection. As healthcare costs continue to escalate and home care benefits are being reduced, self-care is becoming increasingly important. The more patients are learning about self-care at home, away from the distractions of the healthcare environment, the more they can be involved in their care at home, and the less they are exposed to improper flushing techniques and bacteria that can cause catheter-related blood stream infections. Integrating technology into healthcare practices could provide an innovative way to help patients and nurses manage complex health conditions. Professional nursing can benefit from studies that extend knowledge and augment the science of nursing and healthcare. Results of this study contributed to the body of nursing knowledge.

Decreasing PICC line occlusion and infection is important in a healthcare environment that is struggling to contain costs by maintaining or improving quality of patient care. Patients with adequate insurance coverage may have home care support and education to support their transition to caring for their PICC lines independently. Underinsured and uninsured patients may

not have this support and may need inexpensive methods to learn how to minimize negative outcomes by applying proper care techniques with their PICC lines.

Summary

The self-care practices of flushing a PICC line are necessary to prevent adverse outcomes of occlusion and infection. Some patients can become overwhelmed with the burden of their illness and the burden of this treatment. It was believed that patients' and caregivers' self-care would improve with the use of a standardized education program delivered via electronic tablet.

Chapter 1 has presented the background of the study, the problem statement, and purpose of the study, along with the research aims and questions, and the significance of the study for nursing and healthcare. The theoretical framework and review of literature are presented in Chapter 2, and the methods used to collect and analyze the data are presented in Chapter 3. The results of the study can be found in Chapter 4. A discussion of the findings, implications for nursing and healthcare, and recommendations for future study are included in the Chapter 5.

CHAPTER 2: THEORETICAL FRAMEWORK AND REVIEW OF THE LITERATURE

Introduction

Chapter 2 presents the theoretical framework for the study and a comprehensive review of the pertinent literature. In addition, theoretical guides for the study and alternatives for the intervention's design are reviewed.

Theoretical Framework: The Cumulative Complexity Model

Chronic health conditions are present in half of the population in the United States and are linked to approximately 70% of deaths each year (Bodde et al., 2013). Twenty-one percent (21%) to 23% of adults are multi-morbid, having two or more chronic conditions. Multiple chronic conditions add to the complex care requirements for patients, their caregivers, and the healthcare system. Patients with chronic conditions and multiple-comorbidities face treatment demands, including managing health appointments, adhering to medication and treatment schedules, as well as self-monitoring their conditions and practicing new health behavior. The treatment demands are compounded by financial concerns, complex medical regimes, and self-care behaviors. In addition, poor self-efficacy, low health literacy, and fears about treatments can be complicated by mental health disorders, including depression, increasing the burden and negatively impacting chronic disease self-care. Shippee et al. (2014) developed a model to describe patient complexity, the cumulative complexity model (CCM).

In this study, the CCM (Shippee et al., 2014) was used to explain the relationship between six constructs: (a) the patient workload of demands, (b) burden of treatment, (c) patient capacity, (d) burden of illness, (e) self-care, and (f) health outcomes. The CCM was derived from the normalization process theory (NPT) that examines the integration of new demands into existing routines. The NPT includes factors that promote and/or inhibit incorporation of complex

interventions into routine practice (May et al., 2007). The NPT is comprised of four main components: (a) coherence (sense-making); (b) cognitive participation (engagement); (c) collective action (work done for the intervention to happen); and (d) reflexive monitoring (formal as well as informal appraisal of the benefits and costs of the intervention). These components are not linear, but are in dynamic interrelationships with each other (May et al., 2009). The NPT also describes how interventions work, examining the transition from beginning implementation of a new intervention to the point where the intervention becomes so embedded into routine practice that it becomes normalized. The cognitive participation component which is illustrated in the CCM was most relevant to this project.

The CCM focuses on patient complexity, which is a dynamic state in which personal, social, and clinical aspects of the patient experience define the complicating factors. The CCM describes the relationship between patients' ability to integrate self-care into existing daily routines and the workload of being a patient. It further proposes that a balance between capacity and workload predicts successful enactment of self-care (Bodde et al., 2013). Additionally, the CCM addresses the burden of treatment, a variable that is not always considered by clinicians and, if ignored, may increase but has a marked effect on ability to manage their conditions effectively. The model also addresses the longitudinal nature of chronic illness, and how factors may interact over time, with the possibility of patients becoming overwhelmed or, alternately, developing a resilience that allows them to normalize the burden of illness, and develop successful management.

The CCM incorporates a feedback loop, connecting poor health outcomes to the increased burden of treatment, resulting in decreased patient capacity and complex patient care. The primary driver of disruptions in care, self-care, and outcomes is an imbalance between

patient workload of healthcare demands, which includes burden of treatment, burden of illness and patient capacity. The imbalance between these factors results when workload exceeds capacity. Figure 1 presents the Cumulative Complexity Model.

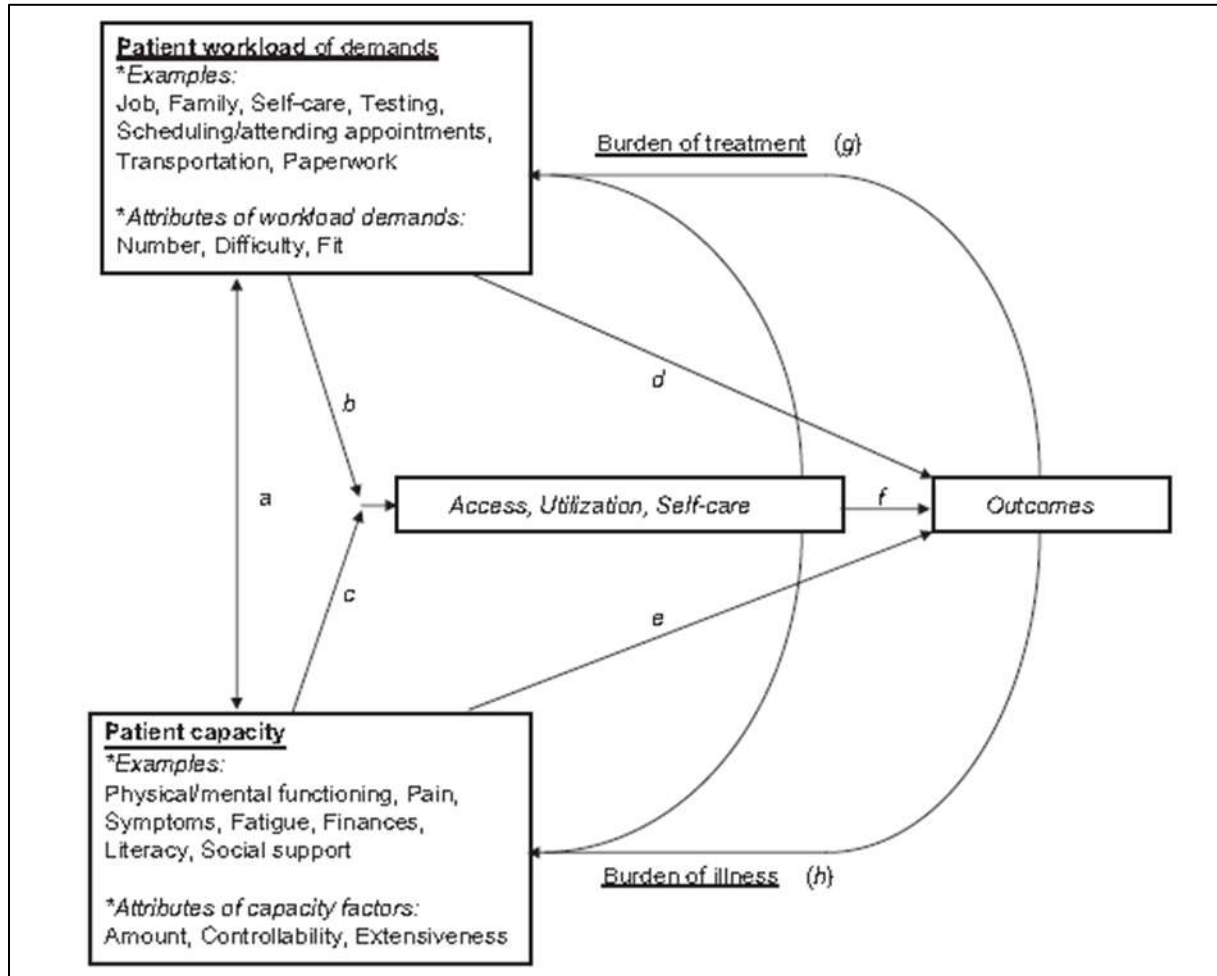


Figure 1 – Cumulative Complexity Model (Shippee, 2012, p. 1044)

Patient Workload of Demands

Patient workload of demands refers to all the tasks and responsibilities people cope with on a daily basis, including job/family, self-care, clinical appointments, and other priorities combined with the responsibilities of being a patient. Excessive workload can challenge patients, causing non-adherence, a low quality of life, or other problems.

Burden of Treatment (BOT)

Burden of treatment (BOT) is defined as the workload of healthcare, which includes the responsibility associated with proactively treating and managing illness (Eton et al., 2012). The BOT also has been examined in a concept analysis and review of literature (Sav et al., 2013). BOT refers to the tasks that patients and caregivers undertake to engage in treatment, such as managing medications, therapies, and medical interventions. The attributes of the BOT describe burden as a dynamic, multidimensional process. For this study, the BOT is the 10 steps associated with flushing a PICC line.

The construct burden of treatment (BOT) includes: (a) learning about self-care, (b) engaging others in self-care, (c) adhering to the plan of care, and (d) monitoring effects of self-care. Learning about self-care involves understanding the components and behaviors required to maintain health. Engaging others in self-care encompasses the inclusion of caregivers (e.g., family or others) in helping the patients maintain their health regimen. Adhering to the plan of care requires patients to adhere to the self-care routine by incorporating the behaviors into their life. Monitoring effects of self-care requires patients to be aware of the adverse outcomes of their treatment and to know when to seek professional assistance for any health-related problems. Antecedents to BOT (e.g., individuals' age and gender, their family circumstances, comorbidities, high use of medications, characteristics of treatment, and their relationship with their health-care providers) can influence patients' perceptions of treatment burden (Sav et al., 2013).

Evidence exists that the healthcare system contributes to the BOT. Despite the aim of improving health and wellness, inefficient healthcare services, such as poor coordination between healthcare professionals and poor communication between patients and healthcare

professionals, can be characterized as burdening. Ineffective communication about treatment can lead to confusion about the treatment and unnecessary treatment (Moss & Crane, 2010). Healthcare professionals' responses to poor patient outcomes can intensify treatment, resulting in a more complex treatment regimen, ultimately leading to greater levels of burden of treatment. The most prevailing consequences of BOT are poor health and well-being, non-adherence to treatment, ineffective resource use, and burden on significant others. In addition, many of these consequences also can become antecedents, reflecting the cyclic and dynamic nature of treatment burden. The additional burden can exacerbate patients' efforts to maintain their self-care regimen (Tran et al., 2012). Patients may have feelings of dependence, resulting in frustration and worry about issues such as physical health effects on their caregivers, caregivers' emotional and mental health, and concerns about financial costs of care (Coussineau, McDowell, Hotz, & Hebert, 2003).

State of Being Overwhelmed

Learning requires planning, problem solving, initiating and carrying out effortful tasks, as well as self-monitoring (Cimprich, 1992). These efforts require the ability to pay attention, also known as attention capacity. Attention capacity is defined as the capacity to focus and concentrate. It has been researched in populations of breast cancer patients as a critical mental activity integral to therapeutic self-care (Cimprich, 1992). Successful operation of attention can result in mental clarity, characterized by positive attitude, stress reduction, ability to make decisions, and lower level of self-reported burden. Multiple factors related to illness, healthcare, and learning new self-care behaviors are intense and increase attentional requirements (Cimprich & Ronis, 2001). Affective factors, such as worry about the future, anticipated or actual losses and associated painful thoughts act as continuous distractions to attention and purposeful

activity. These factors can result in attentional fatigue. Mental pre-occupations with disturbing thoughts can be commanding distractors increasing the mental effort needed to attend to urgent information.

Engaging others in self-care. Engaging others encompasses mobilizing resources to help with the required treatment, such as involving family members to participate in care management (Gallacher, May, Montori & Mair, 2011). Patients may engage their family practitioner to access medical information from specialists. Patients expend time and effort on organizational aspects of self-management, such as organizing prescriptions and arranging transportation to medical appointments. With a central venous access line, engaging others includes involving a caregiver in the process of education for line flushing, as well as contacting the infusion center if a problem with the treatment is suspected.

Adhering to the plan of care. Adhering to treatments and lifestyle changes encompasses logistic, organizational, financial and practical day-to-day activities that support adherence to the treatment plan (Gallacher, May, Montori & Mair, 2011). For example, patients develop routines to cope with complicated plans, such as medication administration and managing adverse side effects. With a central venous access line, adhering to treatment includes establishing a routine for flushing the line, as well as maintaining the flushing schedule.

Monitoring effects of self-care is the work that patients undertake to continuously track treatments, and make adjustments as necessary (Given, Given & Kozachik, 2001). With a central venous access line, monitoring treatment includes watching for signs of occlusion and infection. Tracking treatments requires patients to keep logs or diaries to assess potential problems or complications over time. The logs or diaries can be shared with the infusion center nurse at regular intervals to determine if adjustments to treatment are needed.

Patient Capacity

Patient capacity is comprised of the resources and limitations affecting patients' ability or readiness to do work (Shippee et al., 2012). Meeting self-care demands requires some level of functioning; thus, limitations on capacity can be expected to impact how patients take part in, and experience their lives and healthcare. In this study, capacity was assessed by obtaining data on having a caregiver, having an electronic device, having health insurance, and home care status. Capacity also encompasses the demographic characteristics of the patient, such as age, gender, race, marital status, educational level, and cancer diagnosis, all of which impact the ability of the patient perform self-care.

Burden of Illness

The burden of illness (BOI) includes the aspects of poor health that impact patients' functioning and quality of life and links poor outcomes and/or disease progression to further decreased capacity. BOI includes symptoms of illness, such as fatigue, anxiety, confusion, depression, anger, and pain. The BOI influences patients' functioning and well-being and may further disrupt their ability to manage demands. BOI is a feedback mechanism driving patient complexity through the erosion of capacity and exemplifies the lost potential of unsuccessful self-care.

Conceptual Relationships in the CCM

The Cumulative Complexity Model is representative of a balance between the two concepts of patient capacity (physical, cognitive and social factors), and the patient workload of demands (demands of daily living, such as self-care, employment, and transportation). The relationship between patient capacity and patient workload burden of demands is reciprocal, with changes in one affecting the other. When patient capacity and burden of treatment are in

equilibrium, patients experience resiliency, are capable of meeting their self-care needs, and achieve positive health outcomes. When patient capacity is decreased by factors such as pain, fatigue, or mental health disorders, the patient's ability to provide self-care is in a state of disequilibrium.

Patients whose workload exceeds capacity may experience care as burdensome, fragmented, or low quality, which may, in turn, worsen adherence to a plan of care. Adapting to burdensome demands with insufficient abilities and resources to respond is a stress process that may generate breakdowns in self-care and health. As burdens accumulate, some groups of patients are overwhelmed and the consequences are likely to be poor health outcomes for the patient, increased strain on caregivers and rising demand and costs of healthcare services (May et al., 2014). The burdens of treatment as well as the burden of illness influence both the patient workload of demands and patient capacity by increasing the workload of demands and decreasing patient capacity.

The cumulative complexity model incorporates a feedback loop, where poor health outcomes (increase in illness) are connected to a decrease in patient capacity and intensifying demands (burden of treatment and patient workload) so that patient complexity may build through cumulative cycles (Shippee et al., 2012). Health outcomes often are not final endpoints in chronic care, but rather have ongoing consequences for patient care and well-being via their experiential impacts on patients. An imbalance in which the workload exceeds capacity is the primary driver of disruptions in care, self-care, and outcomes. Responding to burdensome demands with insufficient abilities/resources represents a stress process that may generate breakdowns in self-care and health.

When the patient workload exceeds the patient’s capacity for self-care, the result can be the state of being overwhelmed. A mid-range theory “Overwhelmed with Self Care Demands” has been developed to explain the concepts and relationships among patient workload, patient capacity, burden of treatment, and burden of illness, and being overwhelmed. This mid-range theory identified relational statements, with mid-range propositions derived from these relational statements. (See Figure 2.) The relational statements within the theory are:

1. When patient capacity and patient workload of demands are balanced, patients are able to provide self-care and their health outcomes are optimized.
2. An increase in burden of treatment and/or the burden of illness cause an imbalance in patient capacity and/or patient workload of demands.
3. An imbalance between patient capacity and patient workload of demands can result in the state of being overwhelmed.
4. When patients are overwhelmed, their ability to perform self-care is diminished and health outcomes are negatively impacted.

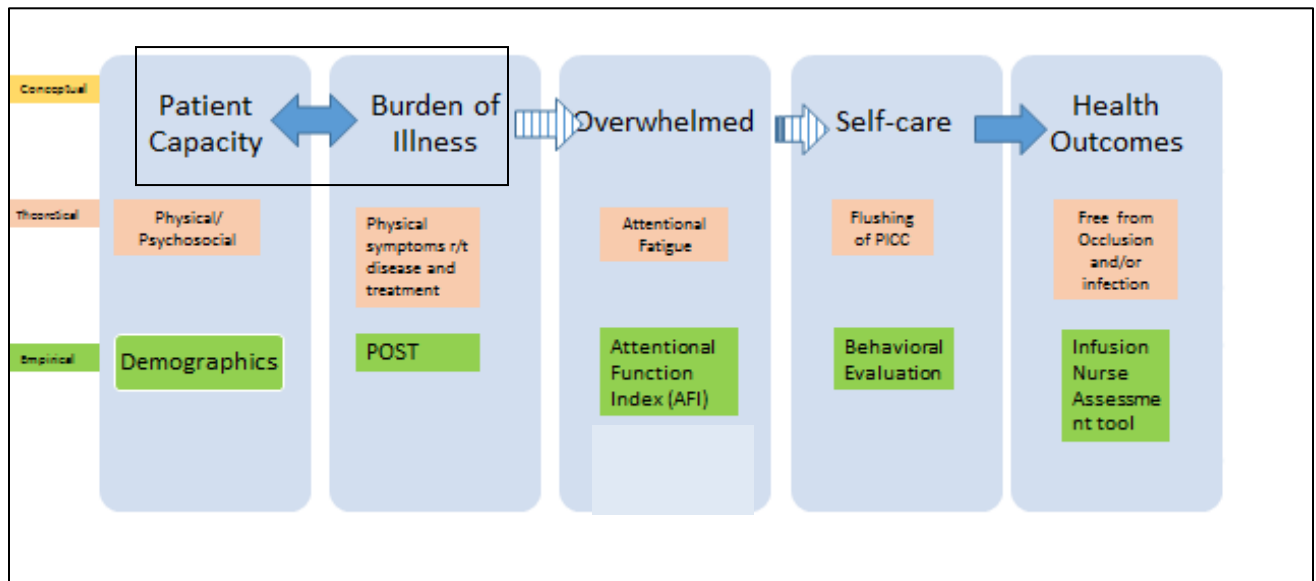


Figure 2: Midrange Theory of Being Overwhelmed with Self-Care

Review of Literature

The purpose of this literature review is to examine the state of the science and address the gap in the knowledge regarding the extent to which a PICC patient education program using an electronic tablet improves outcomes. The current state of research in the literature regarding PICC line care education, the content of the education, cultural and health literacy considerations, and outcome measures are explored in this discussion.

Databases used to search the literature included PubMed, MEDLINE, CINAHL, and the National Guideline clearinghouse. Inclusion criteria for the literature review were research articles and reviews published in the past 10 years, in the English language, and only human, not animal studies. Exclusion criteria were inaccessibility or presentation in a form that did not provide sufficient detail to allow a critical review. This review provides a critical analysis and synthesis of the literature on the phenomenon of “being overwhelmed” related to the adult oncology population being treated for their disease condition with chemotherapeutic agents and having to perform self-care for a PICC line and patient education.

A total of 73 relevant articles were identified. A keyword search using the combination of keywords overwhelmed patients, self-care, central venous access device, infusion, patient education and occlusion prevention resulted in zero articles. A search for overwhelmed oncology patients yielded 12 articles. A search for infusion device, patient education, and occlusion prevention yielded one descriptive article recommending the use of a pump device for occlusion prevention. Forty-two articles were obtained from the search criteria of infusion device and patient education and 18 articles were obtained with the search criteria of central venous access device and patient education. Of the 73 articles that were found, 12 articles met the inclusion criteria for the literature review, with eight articles addressing overwhelmed cancer patients and

four related to educational interventions for patients with PICC lines. The resulting literature review is divided into two major sections: overwhelmed oncology patients, and content of education interventions and PICC line care.

Being Overwhelmed and Decision-Making

The research articles reviewed in this section provided support that patients diagnosed with cancer are overwhelmed with the complexity of their illness and treatment demands. Being overwhelmed as self-reported by patients often is associated with a decreased desire for making decisions. In contrast, physicians were found to over-estimate the number of patients under their care who were overwhelmed.

Nine articles (Daneault, 2004; Elit et al., 2003; Ernst, 2003; Ernst et al., 2013; Lacey 2002; Lansdown, Martin, & Fallowfield, 2008; McGrath, Paton, & Huff, 2004; Penbethy et al., 2012; Vadaparampil et al., 2009; Yogaparan et al., 2009) were found that addressed overwhelmed cancer patients. Each article examined decision making abilities of patients diagnosed with cancer and identified the state of being overwhelmed as having a negative influence on decision capabilities.

Lansdown, Martin, and Fallowfield (2008) used an international online survey to compare the extent to which the breast cancer patients (n = 600) felt overwhelmed to their surgeons' (n = 462) perceptions of the patients feeling overwhelmed. Sixteen percent of the patients reported feeling overwhelmed, but in contrast to 63% of the physicians responded that their patients were overwhelmed by the amount of information given to them. The study demonstrated that both providers and patients believed that the gravity and volume of patient information contributed to the state of being overwhelmed, but a disparity existed between patient and provider perceptions

of the frequency of the state of being overwhelmed, with providers reporting substantially higher occurrence rates.

Oncology patients were found to be overwhelmed by the complexity of the illness as well as the therapies and did not assume responsibility for medical decision making (Ernst et al., 2013; Penbethy et al., 2012). The studies included participants who were hematological patients (n = 11) ranging from ages 39 to 70 (Ernst et al., 2013) and African-American patients eligible for therapeutic cancer trials (Penbethy et al., 2012). Ernst et al. (2013) conducted qualitative, semi-structured interviews with 11 hematological patients during the 12 to 18 months following their initial diagnosis of cancer. Penbethy et al. (2012) completed a two and one half year study of African American patients eligible for therapeutic cancer clinical trials. The state of being overwhelmed had a direct effect on the treatment choice of some cancer patients in that study. Both studies (Ernst et al., 2013; Penbethy et al., 2012) reported that a high level of medical complexity increases the difficulty of patient participation in their medical decision making.

Female cancer patients and their medical decision making abilities regarding their treatment plan were the focus of studies by Lacey (2002), Vadaparampil et al. (2009), and Elit et al. (2003). Lacey (2002) completed a descriptive phenomenological study of 12 breast cancer patients using semi-structured interviews. A major theme that emerged from the interviews was the patients feeling too stressed and overwhelmed to make decisions. A qualitative study by Vadaparampil et al. (2009) was completed using interviews with 26 high-risk breast cancer patients who had not attended genetic counseling after being contacted via letter from their oncologist. Many breast cancer patients perceived that dealing with the genetic counseling and testing process in the midst of a cancer diagnosis and treatment was too overwhelming. Elit et al. (2003) used a qualitative study of 21 women with stage 3 and 4 ovarian cancer who had recently

undergone surgical treatment for their disease. One theme that emerged from the study was participants' descriptions of being overwhelmed when making treatment decisions. They indicated their feelings of being overwhelmed resulted from the unexpected diagnosis of cancer, analgesics, effects of grief, feeling pressured into medical decisions, and the severity of the treatment and the illness. All three studies found being overwhelmed directly influenced the patients' medical decision making, as well as participation in diagnostic testing.

Three qualitative studies of leukemia patients were reviewed: Ernst et al. (2013), McGrath, Paton, and Huff (2004) and Yogaparan et al. (2009). Each study found that hematological patients and their families report a decreased desire for shared decision-making related to being overwhelmed. The McGrath study was a 5-year longitudinal study of eight pediatric patients and their families and found that families became overwhelmed from cumulative factors of exhaustion associated with attending to demands of caring for the child, as well as fatigue, worry, and poor nutrition. Yogaparan et al. (2009) interviewed 31 adult patients over 50 years of age who were diagnosed with leukemia. In regard to their treatment decision-making, most patients preferred having a passive role rather than an active one. The patients indicated they were feeling overwhelmed with decision making related to treatments. Similar to the Yogaparan et al. (2009) study, Ernst et al. (2013) interviewed 11 patients from 39 to 70 years of age to investigate shared decision making in regards to their diagnoses of hematological cancers. They found that patients were overwhelmed by the complexity of the illness and require therapy. The patients did not want to make decisions about their medical treatment. The qualitative research findings of these studies provided support that patients and their families often felt overwhelmed when faced with a cancer diagnosis and treatment need for their care.

Daneault et al. (2004) interviewed 26 terminally ill cancer patients to define their suffering experiences. Based on the interview results, the cancer patients defined suffering in terms of being deprived and/or overwhelmed physically, psychologically, and socially. Being overwhelmed as an oncology patient was a major finding in several studies that identified the state of being overwhelmed as negatively affecting decision making in terms of medical treatment for their cancer.

Patient education.

Studies have also shown that education and self-care were associated with better outcomes for PICC care. Based on the results of the studies, patients who received educational interventions about PICC line care were more likely to experience fewer incidents of occlusion and infection. In addition, these patients tended to be compliant and adherent in flushing their PICC lines.

Five research articles (Alpenberg, Joelsson, & Rosengren, 2015; Moller, Borregard, Tvede, & Adamsen, 2005; Ngo & Murphy, 2005; Sharp et al. 2014; Yap, Karapetis, Lerose, Iyer, and Koczwa, 2006) addressed patient education and infusion. Four of these five studies examined patient education programs, and one tested an educational intervention for nurses. The number of these studies demonstrates the dearth of published research literature on the use of education in PICC line maintenance.

Moller et al. (2005) completed an interventional study in Denmark that investigated effects of catheter-care training for patients and family caregivers on catheter-related infections. The study was a prospective randomized controlled intervention that used a sample of 82 pairs of oncology patients and caregivers. Each pair of patient and caregiver was assigned to either an intervention or a control group. The intervention group received the educational intervention and

performed catheter care independently and the control group had catheter care by a nurse either in the hospital or at a home Moller et al. (2005) provided teaching sessions for each pair in both inpatient and outpatient settings. Education included both theoretical concepts and practical training in several areas: general PICC principles, function, risk factors and hygiene, and practical guidance and instruction on clinical procedures. The content included four modules that started one to six weeks after catheter insertion and finished within two months. A clinical nurse specialist provided the education. Evaluation included controlled testing of patients' theoretical knowledge and observation of practical execution of techniques. The study found a significant difference in the rate of catheter-related infections between the intervention and control groups (2.55/1000 catheter days for the intervention group, 5.91/1000 catheter days for the control group, $p = 0.05$). The results indicated that an individualized, structured, and supervised patient education program and self-care decreased catheter-related infections. Patients providing their own central venous access care demonstrated a high rate of compliance with the procedures.

Ngo and Murphy (2005) used an experimental study of an educational intervention for registered nurses to examine outcomes of PICC line occlusion and catheter-related infections in the patient population and self-efficacy of the nurses. A sample of 402 professional nurses attended a class about caring for patients with PICC placements. Ngo and Murphy (2005) videotaped a demonstration of various nursing techniques for PICC management. The demonstration included checking for blood return, flushing, assessing for occlusion, and patient position changes. Pre- and post-tests for knowledge and self-efficacy were administered before and after the intervention. Nurses' knowledge and self-efficacy regarding PICC management improved as an outcome of the intervention.

Yap, Karapetis, Lerose, Iyer, and Koczwa (2006) completed a prospective analysis of an educational intervention for 88 oncology patients to determine complication rates associated with PICC lines. The authors defined complications as either infective or non-infective. An infusion nurse educated professional nurses in formal classes on PICC aftercare and adherence to aseptic techniques. Following this training, the nurses provided education to patients regarding the importance of hygiene and seeking medical attention for problems of pain, swelling, or redness at the PICC line insertion site. The control group for this study was a retrospective cohort of patients at the same institution. The timing of the teaching intervention was not dependent on the patient's course of treatment. The educational program was completed and data were collected on all oncology patients with PICC lines during a 14-month period following the intervention. Patients who participated in the educational interventions had fewer adverse infective outcomes related to their PICC lines than patients in the control group (5.7% for the intervention, 25.9% for the control, $p = 0.004$). There was no difference in the rate of non-infective complications.

A qualitative study was used by Alpenberg, Joelsson, and Rosengren (2015) to study 10 oncology patients with PICC lines inserted for at least one month. Alpenberg et al. interviewed the patients face-to-face to obtain data regarding their lived experiences while receiving chemotherapy treatment. They found that patients perceived PICC lines as important tools in their treatment program and they were confident in the use of the PICC line after being educated about the function of the PICC line. The patients indicated that the information they received was adequate and necessary in caring for their PICC lines.

Theoretical Guides for Design of Intervention

Adult Learning Principles

Research on patient education afforded support for the use of adult learning theory in providing patient education for individuals diagnosed with cancer and their caregivers. The study of adult learning, pioneered by Knowles, is the art and science of helping adults learn (Fidishun, 2000; Zmeyov, 1998). Adult learning theory holds a set of assumptions about how adults learn and emphasizes the value of the process of learning (Knowles, 1970). The process of learning is problem-based, experiential, and collaborative, rather than didactic. Knowles identified six principles of adult learning:

1. Adults are internally motivated and self-directed. Adult learners resist learning when they feel others are imposing information, ideas, or actions on them. Instead, they are motivated to learn when the subject matter has meaning to them (Fidishun, 2000, Knowles, 1970). In the design of this study, it is recognized that adults are accustomed to being autonomous and self-directed and the subject matter of PICC line flushing is relevant to their need to perform self-care.

2. Adults bring life experiences and knowledge to learning experiences. Adults like to use their existing foundation of knowledge and apply their various life experiences to their own learning needs. In this study design, adults participate and contribute to the flushing activity.

3. Adults are goal oriented. Adult learners become ready to learn when they perceive a need to understand a concept or theory as a means of improving their lives and managing real-life problems (Knowles, 1980). In this study, the infusion nurse's role is to facilitate a participant's readiness for problem-based learning and increase his or her awareness of the need for the knowledge or skill presented.

4. Adults are relevancy oriented. Adult learners want to know the relevance of what they are learning to their desired achievements. In this study, it is known that adults want courses that focus on real-life problems and tasks rather than academic material. A strong how-to focus is desired. The education is focused on the information that is needed to perform PICC flushing self-care.

5. Adults are practical. Through practical fieldwork experiences, as well as interacting with real clients and their real-life situations, adults are able to move from classroom and textbook mode to hands-on problem solving where they recognize the application of what they are learning to life and the work context. In this study, the content is needed to perform self-care behaviors.

6. Adult learners like to be respected. Learners expect to be treated as colleagues who bring unique perspectives and valuable life experiences to learning situations. In this study, the participants will be encouraged to express new ideas, reasoning, and feedback.

Gagné's Conditions of Learning

The conditions of learning, based on experimental learning psychology, identify the mental conditions needed for learning (Gagné, 1965). The theory was updated to incorporate ideas from cognitive psychology (Gagné, 1985). Conditions of learning were based on the information processing model of mental events that occurred when adults were presented with various stimuli. Gagné's (1965) theory stipulated that several different types or levels of learning exist and that each specific type requires unique types of instruction.

Learning was defined by Gagné (1985) as cumulative. Intellectual development is the building of increasingly complex structures of human capabilities. Learning also is the mechanism by which one becomes a competently functioning member of society. Learning

results in different kinds of human behaviors and capabilities that are required from environmental stimulation and cognitive processing of participants.

Gagné's (1985) underlying assumptions are that learning is a complex, diverse operation and that outcomes and capabilities require different instructions for processing by participants. Learning is affected by both internal and external states. The internal condition of learning focuses on acquisition of new skills; with external conditions of learning acting as the environmental stimuli that support the internal learning process. The five identified categories of learning include: verbal information, intellectual skills, cognitive strategies, motor skills, and attitudes. Learning hierarchies defined what intellectual skills are to be learned and the sequence of instruction. Gagné (1985) defined nine events in the learning process:

1. Gain attention. The first step is to engage participant interest with novelty or surprise and appeal to the participant, so that he or she can be motivated to engage with the content. In this study, the use of an electronic tablet in providing patient education is an innovative way to deliver content, with a combination of pictures and video, as well as live contact with the patient and caregiver. The flushing video uses a cartoon character, Pearl O. Wisdom, to engage the interest of the participants. The character introduces herself at the beginning of the video and interjects pearls of advice throughout the film.

2. Inform participant of objectives. The second step is to inform the participant of expectations of involvement in the study. In this study, it was assumed this information can help reduce anxiety in participants who would not be aware of what they need to know about PICC lines and their care. The objectives for the PICC SCEI are listed on the electronic tablet. The objectives are:

1. The participant will be able to identify the key features, functions, and general care of a PICC line.
2. The participant will be able to demonstrate the basic use of an electronic tablet, which includes: turning the electronic tablet on and off, accessing and playing the flushing video, and using the program “FaceTime.”
3. The participant will be able to demonstrate the 10 steps of flushing.
4. The participant will be able to identify when to contact a health professional for symptoms of occlusion and/or infection of the PICC line.

Content related to objectives 3 and 4 is displayed immediately after the opening screen of the flushing video to inform the participants of the expected behaviors. The 10 steps of flushing are reviewed, and then repeated at the end of the video. The objectives of the coaching session between the participant and the infusion nurse (PI) via the electronic tablet are presented orally at the beginning of the coaching session.

3. Stimulate recall of prior learning. Adult participants retain concepts and new information if the concepts are related to prior experiences. They can make the connection to their personal experiences and the learning can be more meaningful. As skills and knowledge are acquired, it is important to have the participant demonstrate their learning to the nurse using FaceTime. In this study, return demonstrations enable the infusion nurse (PI) to view, and the patient to experience, the progress in their understanding and application of the education. The nurse takes action to correct any mistakes made by the patient. The primary purpose of this return demonstration is to verify the ability of the patient to master the self-care skills. Seeing progress and realizing a tangible movement forward in the learning process can increase the patient's motivation to learn more. Information that goes into the patient’s long-term memory is

more likely to be recalled if the nurse provides opportunities in the session for the participant to apply the acquired knowledge (Zemke & Zemke, 1995).

4. Present stimulus material. For the participant to retain information, the content must be organized into meaningful chunks, and a variety of methods must be used that are appealing to all learning styles. Using examples and real-life situations enhance the retention of information, as participants can apply the material to their own life experiences and internalize the content.

In this study, chunks are a set of topics that are grouped together logically. Each chunk can be a different category of knowledge and the size of the chunk is dependent on the participant and their needs (Cennamo & Kalk, 2005). Chunking data is an important step in the design process, especially for the overwhelmed oncology patient. These patients are given a large amount of information initially about their diagnosis, prognosis, treatment plan, and side effects of treatment. In addition, the education of the utility and function of a PICC line and its care is provided to patients in the same short time frame. The chunks of data assist participants to obtain and review educational content. The three chunks of content chosen for the intervention are: (a) what is a PICC, (b) 10 steps of flushing, and (c) how to identify and troubleshoot problems. Within the flushing video, chunks of 10 steps have been created to assist with learning the information and evaluating the participants' flushing behaviors.

5. Provide participant guidance. Communication between the instructor and the participant is essential for providing guidance. Communication helps the participant stay on track, focused, and ensures that the instructor has feedback regarding how participants are doing. Other means of guidance come in the form of visual material such as pictures, videos, case

studies, and analogies that assist the participant in retaining and encoding information into long-term memory.

In this study, communication between the instructor and participant took place in the infusion center or at their homes. The live interaction between the infusion nurse (PI) and the participant during their flushing of the PICC line in the home via the electronic tablet provides synchronous coaching and feedback.

6. Elicit performance. After the content is presented and understood, the participants need an opportunity to practice. Good practice items should specify the practice format, nature of the participant response, and relevance to the objective. The practice items also should elicit the exact performance stated in the objective and be provided immediately following instruction as possible. In this study, practice was the first time that the participant flushed his/her own PICC line and was evaluated on the objectives of flushing.

7. Provide feedback. Feedback is additional guidance and provides comments about the participant's performance, is immediate, and enables participants to correct their mistakes when possible. In this study, real-time responses of the infusion nurse who observed the patient's flushing behaviors allowed the patient to demonstrate his/her knowledge and to be remediated on self-care behaviors that were new to him/her. An example of this demonstration was a participant contaminating their sterile supplies, with the infusion nurse instructing the participant to repeat the step with new supplies.

8. Assess performance. The patients' performance will be assessed in two ways. In this study, a posttest to assess knowledge was completed. Next, the behavioral skills for each of the 10 steps of flushing were observed by an infusion nurse. The purpose of the one-on-one evaluation session is to identify errors that can be remediated immediately and to determine

where participants may encounter problems in understanding the material. The infusion nurses' assessments should match the stated objectives to provide accurate judgment.

9. Enhance retention and transfer. In this study, the course was designed to instruct the patient and caregiver on PICC line care at the beginning of chemotherapy. They were expected to assume responsibility for these self-care behaviors on a daily basis for weeks or months. After the knowledge test and demonstration of the behaviors to the infusion nurse, the patient continued daily flushing. The electronic references of PICC information and the flushing video were available to the patient and caregiver for six weeks.

Cennamo's and Kalk's Recommendations for Instructional Design

In instructional design, the first step is the completion of a needs assessment to identify the instructional need, or the gap in knowledge between the current status and the ideal situation of the targeted audience (Cennamo & Kalk, 2005). In the initial phase of defining the project, a needs statement is created from the understanding of the audience and goals and outcomes of the instruction. The important characteristics of the audience are obtained by conducting a participant analysis. The participant analysis examines the participants' needs, such as their motivation, cognitive and physical characteristics, relevant prior experiences, setting and application context, and other factors that directly influence participant's abilities. In this study, each factor is explored with the audience of oncology patients with PICC lines and their caregivers.

Motivation of the participants. Participants in the study were expected to learn the subject matter. The participants' self-efficacy, or the confidence to perform a specific task or behavior (Bandura, 1997), is an important element in the participants' motivation. The population of interest was patients diagnosed with cancer who are experiencing rapid changes in

their healthcare status. Patients who are having difficulty managing emotional distress associated with facing a life-threatening disease and its treatments may be experiencing feelings of being overwhelmed. Active engagement in meaningful activities can be an antidote to ruminative distress and feelings of despondency and futility (Bandura, 1997). The educational intervention was designed specifically to meet the needs of overwhelmed patients. The initial activity of flushing patients' PICC lines in their own environment was targeted. Remote coaching with the use of technology could be an innovative approach to patient education. Real time coaching of a self-care activity was expected to result in an increase in self-efficacy.

Physical and cognitive characteristics. Several physical characteristics could have had a negative effect on the ability to perform PICC line care. The PICC line was inserted to infuse chemotherapeutic agents that are associated with multiple physical symptoms, such as fatigue, nausea and vomiting, and pain. The participants may have had several comorbidities, such as diabetes or heart disease that could affect their physical ability to perform self-care. Another factor that can negatively influence patients' ability to flush a PICC line is manual dexterity. The PICC line usually is inserted into the patient's non-dominant arm, but also could be inserted into the patient's dominant arm at the antecubital space. An extension tube was connected to the line so that the patient may use both hands to perform the PICC care.

All participants were cognitively alert, and able to understand and communicate in the English language. The PICC SCEI used the English language exclusively and a fifth grade language proficiency level was used for the written and video content of the intervention. The fifth grade language proficiency was chosen by the research center's patient education department as the targeted level for all patient education material.

Attention is the awareness and ability to process thought. It is the concentration required to learn a new task and the clearness of thought to assess a problem and understand its significance, as well as possible solutions. Cognitive requirements for participants include understanding the process of PICC flushing and care, as well as the ability to discern if and when to contact a health professional for a perceived adverse outcome associated with an inserted PICC line. The cognitive skills necessary are the ability to recognize the signs and symptoms of PICC occlusion, as well as infection associated with having an implanted device. Being overwhelmed with self-care can have a direct impact on cognitive abilities and attention of an oncology patient.

Relevant prior experiences. The participants are oncology patients and caregivers who are new to the experience of an implanted PICC line. The patient and caregiver are expected to assume the care of these medical devices upon discharge from the interventional radiology department of the hospital. Patient and caregiver knowledge deficits for PICC line care and flushing are not unusual in self-care following hospital discharge (Infusion Nurse Society [INS], 2010). The standard of care for patient education is an oral description and written material explaining the basic information about PICC lines, PICC line care, and complications that may occur. The oncology physician and multidisciplinary team nurse review the information with the patient after insertion of the PICC.

The participants' education, training, and employment status are factors associated with their previous relevant experiences. The literacy level is an audience characteristic that can affect their ability to participate in the educational intervention that includes reading level, vocabulary, and language skills. These factors are expected to vary among the potential participants who are receiving treatment at an urban oncology center. The participants' prior experience with the use

of technology also was a consideration, as they needed to be familiar with operating an electronic device (such as laptop, smartphone, or tablet) to access the educational content, a flushing video, and a videoconference with FaceTime™. The intervention was delivered on an electronic tablet, with real-time communication via video chat. The use of video chat (i.e., FaceTime™) was an experience that patients and/or caregivers might possess, but whether or not they had experience, the participants were given a tutorial on the electronic tablet and FaceTime™ during the initial phase of the intervention.

The use of technology, in the form of an electronic tablet, can be a barrier to learning for some participants. Some individuals may lack the technical knowledge, skills, or desire to use a tablet for educational purposes. Lack of interest is a primary barrier to accessing health information with electronic technology (Abdullah et al., 2005). Participants who are most likely to have a computer generally had higher incomes and levels of education, while those lacking access were more likely to have low incomes, be less educated, be part of a minority group, or were disabled (Gilmour, 2006). Although older adults in the United States are using technology in greater numbers, they typically report more difficulty than younger individuals in learning to operate and interface with computers and electronic tablets (Czaja et al., 2006).

Research at an urban medical clinic in North Carolina seeking to provide internet-based patient education revealed that one-third of the population in the community did not access the internet (Denizard-Thompson, Feiereisel, Stevens, Miller & Wofford, 2011). Although patients are increasingly taking advantage of computer and internet for health-related reasons, a gap in knowledge exists between those who have effective access and those with limited or no access (Lorence, Park & Fox, 2006).

Coaching and scaffolding are methods to provide learners with support for their knowledge acquisition. With scaffolding, learners are asked to perform a task and are provided with the level of support they need, based on their performance of the task (Cennamo & Kalk, 2005). When learners initially begin to perform the task, they have resources readily available to consult if they encounter difficulty in completing the task independently (Cennamo & Kalk, 2005). As their competence increases, the support is no longer needed and is removed. Coaching is used to prompt learners and encourage them beyond their current understanding. Thus, an association exists between taking action and gaining content knowledge. In a study of remote coaching to increase participant self-efficacy related to diabetes self-management, significant improvement in participant self-efficacy was found as a result of the treatment effect with nurse health coaching (Patmon, Young, Miyamoto, Ward & Griffin, 2012). The increased levels of satisfaction with care in the Patmon et al. study validated acceptability of coaching through home-based technology.

Friedman's Alternatives for Design

Several alternatives for the design of the PICC SCEI were considered. Friedman, Cosby, Boyko, Hatton-Bauer, and Turnbull (2011) completed a systematic review of practice guideline recommendations, identifying teaching strategies used in patient education: traditional lectures, discussions, simulation, computer technology, and written material, audiovisual sources for self-study, demonstration, and role playing, as well as combinations of these strategies. Considerations of his findings are summarized in the following sections.

Classroom design. Traditional lecture in a live classroom is an option for the educational intervention to address several participants concurrently. For this study, a mixture of lecture and simulation with the model, "Chester Chest," could have been used to give

participants hands on experience with flushing before they are required to perform these skills with their own PICC lines. The benefit of a classroom design is the instructor's ability to interact with participants in a group setting. The classroom design can also be a forum for discussions among participants, allowing role modeling, role playing, and peer support to occur. The participant would be given the opportunity to perform skills on a model prior to performing these self-care tasks on themselves. Education regarding PICC line care can be delivered in a simulation lab with the use of SimMan. This option allows participants to simulate the flushing behaviors on a mannequin before attempting this activity on their own PICC line. The simulation lab locally is housed at Wayne State University College of Nursing. Limited time is available for the use of the lab, as students enrolled in several nursing courses use the facility. In addition, participants would need to come to the simulation lab at a designated time that may or may not coincide with their initial experience in flushing of the line. Another barrier is access to the facility, as parking is limited and costly. The limits to this design are the lack of ability for the participant to repeat the educational content in an asynchronous fashion. The PICC SCEI is limited to a one-time simulation in the classroom, and participants are still responsible for independently flushing the line for the first time at home. In either the classroom or the simulation lab, the instructor lacks the ability to coach participants through the process in their natural environment.

Self-study with DVD or videotape. Bandura (1997) asserted that vicarious experiences using models serve as an effective tool in promoting self-efficacy beliefs. Video modeling assists viewers to identify behaviors performed by models acting in videotapes and develop confidence in their own performance of specific practices related to their self-care. DVDs and/or videotapes can hold a great deal of content and are a versatile and cost effective media for instruction.

DVDs and videotapes are independent of the Internet and can be used in many environments. In an integrative literature review of video modeling and its application to clinical practice, Krouse (2000) identified nine studies that used videotapes as a medium to teach patients self-care behaviors. She found that nurse-developed videotaped instruction can be beneficial and cost effective in delivering patient education in a timely manner.

Self-study with a DVD is an excellent asynchronous method of learning, where the information can be repeated by the participant as needed, and the DVD can be played on a DVD player or computer while the patient performs flushing behaviors. As with the live classroom experience, the ability of the infusion nurse to perform one-on-one coaching would not be available with this educational design.

Self-directed study as well as the repeatability of the recorded patient education are characteristics that were incorporated into the final design of the PICC SCEI. A flushing video was produced and hosted on an electronic tablet. The video was played at the first meeting with participants at the hospital, and these participants were encouraged to view the video again on the electronic tablet prior to meeting the infusion nurse on FaceTime.

Website. Educational content hosted on a website can provide adult learners with opportunities for self-paced learning. PICC line education material is available on “YouTube,” but these video presentations are intended for nurses, not patients. For this study, educational content could have been provided on a webpage to address the ability to provide live coaching for the first flushing experience via Skype, but this educational approach would have required internet connectivity in the participant’s home. The absence of internet connections in some homes could limit participation in the study and present a bias against participants with lower socioeconomic backgrounds.

Final design

The most important feature of the final design was the ability to provide real-time remote coaching to patients when they flushed their PICC line independently for the first time in their home environment. Components from alternate designs were incorporated into the final design, which included the use of a video to teach the 10 steps of flushing prior to the live coaching and the educational content regarding the introduction to a PICC line and its components. Participants could view the information on the tablet independently and repeatedly.

Limits to Design

A factor for consideration when using electronic technology is the difficulty with connectivity to the Internet. The electronic tablets used in the study were enabled with 4G connections and have two antennae. The manufacturer reported that the tablets had the ability to connect to the Internet from most places. Each tablet had a data plan from Verizon cell services, with the minimum monthly fee of \$30.00 paid by the researcher through the research grant.

Summary

Cancer patients taking responsibility for the care of a PICC line, need education to internalize the required self-care behaviors. It was believed that better self-care of these devices can lead to a decrease in PICC line occlusion and infection. The PICC SCEI is an innovative intervention using mobile electronic technology to educate patients to facilitate self-care actions needed to reduce PICC complications.

CHAPTER 3 – METHODOLOGY

Restatement of the Purpose

This pilot study had three purposes for a sample of community dwelling adults:

1. To test the feasibility of using an electronic tablet to supplement patient and caregiver education about PICC lines.
2. To determine the changes in the state of being overwhelmed, burden of illness, and treatment burden pre- and post- intervention.
3. To compare the percentage of PICC line occlusion and infections in the pilot study participants with national percentage rates of the same adverse outcomes.

Specific Aims, Research Questions

Specific Aim 1: To determine the percentage of PICC line occlusions and infections in adult outpatients who have participated (with or without their caregivers) in a self-care educational intervention (SCEI) that was supported with electronic tablets.

Research Question 1: What is the percentage of PICC line occlusions and infections in adult outpatient participants who complete a SCEI for PICC line care using an electronic tablet?

Specific Aim 2: To examine the change in the state of being overwhelmed, the burden of treatment, and the burden of illness pre- and post-intervention.

Research Question 2: Are there changes in the state of being overwhelmed, the burden of treatment, and the burden of illness in outpatients who (with or without their caregivers) complete a SCEI for PICC line care?

Specific Aim 3: To determine if the percentage of line occlusions or infections differs between patients who (alone or with their caregivers) have completed a SCEI for PICC line care and the national percentage rates of line occlusions or infections.

Research Question 3: Is there a difference in the percentage rate of line occlusion and infection in patients who (with or without their caregivers) have completed a SCEI for PICC line care and national percentage rates of the same adverse outcomes?

Design

This pilot study employed a quasi-experimental research design to examine the incidence of occlusion and infection in a sample of patients with cancer who participated in a patient education program for flushing PICC lines. This type of research design does not meet the criteria of a true experiment because a control group was not available. The research questions were answered using inferential statistical analysis. All decisions on the statistical significance of the findings were made using a criterion alpha of .05.

Human Subjects Protection

The research proposal was approved by the Institutional Review Board (IRB) at Wayne State University prior to beginning the research study. The IRB ensured that the human subject research was conducted ethically, and in compliance with Federal regulations, requirements of applicable Michigan State and local law, and institutional policies and procedures. This study adhered to rules, regulations, guidelines, and commonly accepted professional codes or norms. A copy of the IRB approval is presented in Appendix B.

Sample

Size

A sample of 11 oncology patients with PICC lines with or without caregivers was recruited from an outpatient oncology population. Patients were in the initial phase of their infusion therapy for treatment of cancer in outpatient infusion clinics.

Inclusion and Exclusion Criteria

To be included in the study, all participants had to be non-pregnant, at least 18 years of age, outpatient, and diagnosed with cancer. Additionally, all participants had to be cognitively alert, able to understand and communicate in English, and agree to participate. In addition, all participants had to be familiar with the operation of an electronic device (e.g., a laptop, smartphone, electronic tablet) and able to access the virtual classroom via the Internet. PICC line tip placement had to be verified prior to beginning the intervention.

Participants were excluded from the study if they were under 18 years of age, not cognitively alert, pregnant, did not have a PICC line, could not communicate in English, or could not demonstrate the ability to use an electronic tablet. In addition, patients who were hospitalized were excluded from participation in the study.

The participants were either outpatient oncology patients who had a PICC line placed or their caregivers who were assisting with line care. Caregivers were included in the PICC Self-care Educational Intervention (SCEI) as their roles for the oncology patient included being a resource or as an active participant in the flushing process.

Recruitment.

A letter was distributed to physicians, nurse practitioners, or physician assistants to explain the study. They were asked to refer potential participants with whom they had a clinical relationship. In addition, a flyer was posted at local hospital that provided a phone number for interested patients to contact the researcher. When a potential participant called the researcher, the researcher indicated that the study was part of a research project to study the effects of an educational intervention on PICC line occlusion. The researcher, who is also an infusion nurse,

further explained that as participants, they would be expected to meet with her to check their PICC line for possible occlusion or infection.

Instruments

Demographic Variables

Demographic variables were measured using a short investigator-developed demographic survey. The survey consisted of 11 items. The first seven items measured demographic characteristics of the sample and four measured patient capacity. The variables that were collected to describe the sample and test the research questions developed for the study are presented in Table 1.

Patient Capacity

Patient capacity is defined conceptually as the resources and limitations that could affect ones' ability to do the work of being a patient. The last 4 items on the demographic survey measured patient capacity as having a caregiver, having experience with using an electronic device (tablet, smart phone), having insurance, having home care benefits. The four variables were self-reported by the patient at the initial visit. The responses were dichotomous, with a "no" scored as a 0 and a "yes" as a 1.

Burden of Illness

Burden of illness was evaluated with the Psycho Oncology Screening Tool (POST). The POST has 33 items in three subscales, physical and emotional distress, depression and concerns, and social concerns. In the first subscale, six symptoms (variables) were measured using horizontal visual analog scales to assess fatigue, anxiety, confusion, depression, anger, and pain. The participants rated each symptom using a 0 to 100-point scale ranging from none to most possible. Individual scores for each item (0-100) and a composite score ranging from 0 to 600 for

the six items were used to measure symptoms. The participants indicated which of the items they had experienced in the past week.

The second subscale lists 14 symptoms of depression and concern. The patient checks which symptoms or concerns she/he has had in the last week. The number of checked items ranging from 0 to 14, is used as the score for this subscale. The third subscale asks about 13 social concerns. Total scores for this subscale range from 0 to 13.

The internal consistency of the three subscales measuring symptoms, depression and concerns, and social concerns were .80, .88, and .73 respectively (Kilbourn et al., 2012). A confirmatory factor analysis was used to affirm the construct validity of the POST. The three latent factors (emotional and physical distress, depressive symptoms, and social concerns) were significantly related to similar measures. The concurrent validity was determined by correlating the three subscales with scores from other similar measures (Kilbourn et al., 2012).

Being Overwhelmed

Kerns and Berebaum (2010) theorized that overwhelmed individuals are motivated to decrease affective responses to their particular situations. In this study, the Attentional Functional Index (AFI; Cimprich, Visovatti, & Ronis, 2010) was used to measure patients' self-report of being overwhelmed. The 13-item instrument had four subscales measuring positive attitude, stress reduction, making decisions, and self-reported burden. Each of the items used a visual analog scale with 100 mm horizontal line anchored with opposite phrases from *not at all* (0 mm) to *extremely well or a great deal* (100 mm). The participants were asked to place a hash mark on the line to indicate their current functional levels; the score was recorded in millimeters measured from the anchor *not at all* to the hash mark. The scale has been used with men and women, ages 22 to 84 years old. The alpha coefficient of 0.92 provided evidence that the scale

had excellent internal consistency as a measure of reliability. Validity was assessed with a multiple regression analysis that indicated a significant predictive relationship between total AFI scores and the Symptom Distress Scale (SDS; McCorkel, & Young, 1978).

Table 1 presents the study variables and associated scales of measurement.

Table 1

Study Variables

Variable	Description	Scale of Measurement
Demographic Variables		
Age	Date of birth	Ratio
Gender	Male/Female	Dichotomous
Race/Ethnicity	African American, Caucasian,	Nominal
Marital Status	Single, married, divorced, widowed, cohabitating	Nominal
Educational Level	Less than high school, high school graduate, GED, College, Graduate School	Ordinal
Cancer Diagnoses	Actual diagnosis	Nominal
Patient Capacity		
Caregiver status	Yes/No	Dichotomous
Having electronic device	Yes/No	Dichotomous
Insurance	Yes/No	Dichotomous
Home care status	Yes/No	Dichotomous
State of Being Overwhelmed		
Positive attitude	Attention Functional Index	Interval
Stress reduction		
Making decisions		
Self-reported burden		
Burden of Illness		
Fatigue	POST	Interval
Anxiety		
Confusion		
Depression		
Anger		
Pain		
PICC line status		
PICC line patency	Infusion nurse assessment tool: Partial/Total Occlusion, or patent	Dichotomous
PICC line infection	Infusion nurse assessment tool: CLABSI	Dichotomous

PICC Line Patency Status

PICC line status (*line patent, sluggish, or occluded*) was assessed by a clinic infusion nurse on a weekly basis for six weeks in the infusion center. PICC lines could have two possible outcomes: partial/complete occlusion, or patent. According to INS, both partial and complete occlusions are considered to be occlusions of a central venous access device (CVAD).

Complete occlusion. The signs of complete occlusion are: inability to aspirate blood, flush the line, or infuse solutions.

Partial occlusion. The signs of partial occlusion are: resistance to flushing, sluggish infusion, or increasing occlusion alarm activation with the use of an electronic infusion pump.

Patent. A *patent* catheter is a PICC lines that functions normally.

PICC Line Associated Infections.

A PICC line associated infection could be local or systemic, as outlined in the following Center for Disease Control (CDC) definitions (O'Grady et al., 2002). PICC line associated infections were assessed by a clinic infusion nurse weekly for a total of six weeks.

Exit site infections. Exit site infections have erythema or induration and/or purulent drainage within 2 centimeters of the catheter exit site.

Central line-associated bloodstream infection (CLABSI). According to the CDC National Healthcare Safety Network (NHSN; visit NHSN CLABSI information) a CLABSI is a primary blood stream infection (BSI) that a patient can develop within the 48-hour period of having a central line inserted. It is diagnosed by blood culture.

Intervention

After the consenting process was completed, the participants watched a video presentation on an electronic tablet of the 10 steps of flushing. An electronic tablet was provided

to the participants for a period of two weeks. An appointment was arranged for the patient, caregiver and infusion nurse (PI) to meet using Facetime and for the patient and/or caregiver to perform the steps of flushing with the infusion nurse (PI) observing and providing coaching. The participants had access to an infusion nurse (PI) via real time conferencing (Facetime) to provide coaching for the first time flushing the PICC line, and telephone access to an infusion nurse, (PI) for six weeks. The tablet was used to communicate with the infusion nurse (PI) for flushing coaching, and was loaded with the flushing video. The time line for the intervention is presented in Table 2.

Table 2

PICC SEIC Timeline

Event Timeline	Intervention Group
Initial Meeting	<ol style="list-style-type: none"> 1. Enrolled in study and consented 2. Instruction and pamphlet by PI nurse 3. Journal given with instruction <p>Measurement tools to be completed:</p> <ul style="list-style-type: none"> • POST • AFI <p>Intervention</p> <ol style="list-style-type: none"> 4. Tablet instruction 5. Video of flushing viewed on tablet 6. Date and time arranged for virtual meeting
Week 1 through 5	<ul style="list-style-type: none"> • Virtual meeting for flushing with PI nurse • Clinic Nurse documentation of line patency and infection • Daily patient journaling
Week 6	<ul style="list-style-type: none"> • Clinic Nurse documentation of line patency and infection • PI observation of line patency and infection • Daily patient journaling <p>Measurement tools to be completed:</p> <ul style="list-style-type: none"> • POST • AFI

Data Collection Procedures

Data collection began after receiving approval from the Wayne State University Institutional Review Board (IRB). After signing a consent form indicating their willingness to participate in the study, the patients were asked to complete the pretest measures that included the demographic survey, the POST psycho-oncology-screening tool, and the Attentional Function Index (AFI). This process was completed with each patient individually.

The participants received instruction on using the iPad video application for PICC line care and watched the flushing video contained on the iPad. The researcher provided a demonstration on the use of FaceTime on the iPad. The participant and researcher made an appointment to use FaceTime to perform their first independent flushing. If the participant had a caregiver, the caregiver was also asked to participate in the flushing. The participant returned to the infusion center weekly for six weeks and the clinic infusion nurse examined the PICC line for occlusion and infection. The clinic infusion nurse documented the status of the PICC line at these visits. At the end of the six-week period, the participant completed the same pretest surveys for post testing.

Data Entry Procedure

All data were entered into Microsoft Excel. Error checking routines were created as part of the database application. The Excel file was converted to an SPSS data file using the Statistical Program for Social Sciences (SPSS, Version 23). Data files were saved to a password protected USB drive, and backed up on the researcher's home computer.

Threats to Internal and External Validity

The principles that address threats to validity in this design are identification and study of plausible threats to internal validity, primacy of control by design, and coherent pattern matching

(Shadish, Cook & Campbell, 2002). Internal validity is the extent to which the study findings are accurate. Threats to internal validity include variations in the independent variable, the reliability of the instruments and statistical procedures used to measure and detect the effects, and the choice of statistical methods. The intervention in this study is an educational intervention that involves coaching via an electronic tablet for first time PICC line flushing in the home.

Threats to internal and/or external validity can occur at any point in the study and consist of anything that distorts study findings in a systematic way that arises from the study methodology. Examples of threats to validity are sample selection being too small or biased, or errors in data coding, entry or dissemination. To address the possibility of threats to study validity, the principal investigator also assessed for occlusion and infection symptoms and compared her findings to the documentation from the clinic infusion nurses on a weekly basis to verify that all outcome data was being coded appropriately for each study participant. This process provided interrater reliability verification.

Another possible threat to internal validity is subject attrition as subjects may drop out of the study before completion. If this attrition is systematically related to any feature of the study, the intervention, or the instrumentation; a whole class of alternative explanations could be possible to account for the outcomes. At the beginning of the study, the importance of completing the study was stressed to encourage subject retention.

A major threat to internal validity is the possibility of extraneous variables: forces other than the treatment under investigation that could influence study outcomes at the same time that the intervention is introduced. These variables usually are uncontrolled and cannot be measured directly. Events outside of the study or between repeated measures of the dependent variable may affect participants' responses to experimental procedures. Examples of extraneous variables that could affect the outcomes of this study include secondary infections unrelated to the PICC lines, change in catheter design, implementation of new healthcare policies, new medications, or treatment procedures for cancer patients, a cure for cancer, a new patient education program that is launched concurrently with the research study, a change in PICC line and flushing equipment, or a radical change in the chemotherapy protocols in the midst of the study. Anecdotal notes would have been made if any of the extraneous variables occurred, but none was noted.

Data Analysis

Analyses were performed using IBM SPSS, version 23. Data analysis began with preparatory activities such as examining the file for missing data, and using the Examine command to identify outliers. Descriptive statistics were obtained for all study variables and examined for the presence of random or systematic missing data, significant skewness, and outliers and other such data cleaning tasks. The distributions of the continuous measures were graphically displayed for visual inspection regarding normality, kurtosis, and skewness. Appropriate steps were taken as needed to correct any problems and descriptive statistics on altered variables were recomputed and examined. A missing values analysis was completed to determine how to manage missed responses on the data collection instruments.

The first set of analyses used a combination of frequency distributions and measures of central tendency and dispersion to provide a profile of the participants. The continuous variables were summarized using descriptive statistics to present baseline information. Pearson product moment correlations were used to examine the relationships among the continuous variables as part of the bivariate analysis. A combination of descriptive and inferential statistical analyses were used to address the research questions developed for the study. All decisions on the statistical significance of the findings were made using a criterion alpha level of .05. Table 3 presents the statistical analyses used to test each of the research questions.

Table 3

Statistical Analysis

Research Question	Variables	Statistical Analyses
1. What is the number of PICC line occlusions and infections in adult outpatient participants who complete a SCEI for PICC line care using an electronic tablet?	Number of PICC line occlusions Number of infections	Frequency distributions were used to summarize the number of PICC line occlusions and number of infections among participants
2. Are there preintervention and postintervention changes in patient capacity, the state of being overwhelmed, and the burden of treatment factors in outpatients who have PICC lines?	Pretest and Posttest measures Patient capacity State of being overwhelmed Burden of treatment factors	A paired difference t-tests and Wilcoxon signed rank test were used to determine if changes in the pretest and posttest measures were statistically significant
3. Is there a difference in the percentage rate of line occlusion and infection in patients who have completed a SCEI for PICC line care and national percentage rates of the same adverse outcomes in patients and caregivers who were educated by usual methods?	Percentage rate of PICC line occlusions Percentage of infections	Analysis of frequency was used to compare the percentage of PICC line occlusions and percentage of infections among participants with the national percentages of the same adverse outcomes in patients and caregivers educated by the usual method.

Summary

Chapter 3 presents the methodology that was used to collect and analyze the data needed to address the research questions and associated hypotheses. The topics that were included were the research design, sample selection, instrumentation, data collection procedures, and data analysis. A quasi-experimental research design was used in this pilot study to determine the effects of using an electronic tablet as an educational intervention for teaching newly diagnosed cancer patients how to flush their PICC lines appropriately to avoid infections and occlusions. The results of the data analysis are presented in Chapter 4.

CHAPTER 4 - RESULTS

This chapter presents the results of the data analyses that were used to describe the sample and address the research questions. The purpose of this study was to test the feasibility of using an electronic tablet to supplement patient and caregiver education about PICC line maintenance and to compare the percentage of PICC line complications in the intervention group with national percentage rates for patients and caregivers. In addition, this study also determined changes in the state of being overwhelmed and burden of illness.

Description of the Sample

Eleven oncology patients with PICC lines were recruited from an oncology population. Patients were receiving treatment for cancer in outpatient infusion clinics. During the study, one participant moved out of the area. Therefore 10 participants completed the study. The ages of the subjects ranged from 38 to 88 years old, with a mean age of 66.64 (SD = 13.37) years. Four participants (36.4%) were female and seven (63.6%) were male. Four (36.4%) of the participants were Caucasian and 7 (63.6%) were African American. Six (54.5%) participants were single, 4 (36.4%) participants were married, and 1 (9.1%) was widowed. Three (27.3%) of the participants had some high school, with a like number indicating they were high school graduates. One (9.1%) participant had completed some college, and 2 (18.2%) had obtained a Bachelor of Science degree. Two (18.2%) of the participants had attended a vocational or trade school. Table 4 presents results of these analyses.

Table 4

Demographic Characteristics of the Sample (N = 11)

Variable	Mean	St. Deviation
Age (Range = 38-88 years)	66.6	13.4
Variables	Frequency	Percent*
Gender		
Male	4	36.4
Female	7	63.6
Race/Ethnicity		
African American	7	63.6
Caucasian	4	36.4
Marital Status		
Single	6	54.5
Married	4	36.4
Widowed	1	9.1
Educational Level		
Some high school	3	27.3
High School graduate	3	27.3
Some College	1	9.1
Vocational or Trade School	2	18.2
Bachelor of Science	2	18.2

*Percentages may not add to 100.0% due to rounding

Regarding patient capacity, the majority (n = 8, 72.7%) had a caregiver and 3 (27.3%) did not have a caregiver. Nine (9; 81.8%) had used an electronic device (laptop computer, cellphone, or tablet), and 2 (18.2%) had not. All participants had health insurance and were receiving home care services. Table 5 presents results of these analyses.

Table 5

Patient Capacity (N = 11)

Patient Capacity	N	%
Caregiver Status		
Yes	8	72.7
No	3	27.3
Electronic device (laptop computer, cellphone, tablet)		
Yes	9	81.8
No	2	18.2
Health Insurance		
Yes	11	100.0
Homecare Services		
Yes	10	90.9
No	1	9.1

The patients were asked to indicate the type of cancer with which they had been diagnosed. Three (27.3%) had leukemia, 2 (18.2%) had ovarian cancer, 2 (18.2%) had pancreatic cancer. The remaining 4 patients had been diagnosed with either breast, bone, stomach, or lung cancer. Table 6 presents results of this analysis.

Table 6

Cancer Diagnosis (N = 11)

Types of Cancer	N	%*
Leukemia	3	27.3
Ovarian	2	18.2
Pancreatic	2	18.2
Breast	1	9.1
Bone	1	9.1
Stomach	1	9.1
Lung	1	9.1

*Percentages may not add to 100.0% due to rounding

Research Questions

Three specific aims and associated research questions were developed for this study. The results of the statistical analyses used to address the research questions are presented in this section. All decisions on the statistical significance of the inferential statistical analyses were made using a criterion alpha level of .05.

Research Question 1: What is the percentage of PICC line occlusions and infections in adult outpatient participants who complete a SCEI for PICC line care using an electronic tablet?

Result: Over the course of six weeks, no patients developed occlusions or infections, however 1 (9.1%) patient developed a thrombophlebitis in his upper arm that required removal of the PICC line. The only adverse event that was recorded for the 10 participants who completed all components of the study was this incidence of thrombophlebitis.

The patients in the present study did not experience any line occlusions during the six weeks of the intervention,

No PICC line associated infections were noted in the pilot study participants over the six weeks of the study.

Research Question 2: Are there changes in the state of being overwhelmed or the burden of illness in outpatients who (with or without their caregivers) complete a SCEI for PICC line care?

The changes in the state of being overwhelmed were measured with the Attentional Functional Index and were compared from preintervention to postintervention using paired difference t-tests for dependent samples. The Attentional Functional Index has four subscales: positive attitude, stress reduction, making decisions, and self-reported perceptions of being a burden to others. Table 7 presents results of these changes.

Table 7

t-Tests for Dependent Samples – State of Being Overwhelmed

Variable	N	<u>Preintervention</u>		<u>Postintervention</u>		t-Value	p Value
		M	SD	M	SD		
Attention Functional Index	10	413.60	251.15	441.70	237.20	0.55	0.598
Positive attitude	10	57.20	14.73	58.80	12.28	0.78	0.446
Stress reduction	10	32.60	11.29	35.30	8.39	1.07	0.313
Making decisions	10	9.70	2.98	9.40	2.37	0.28	0.789
Self-reported burden	10	8.76	2.77	7.61	2.41	1.08	0.310

The results of the paired difference t-tests for dependent samples provided no evidence of statistically significant changes in and the state of being overwhelmed.

The change in the burden of illness as measured by fatigue, anxiety, confusion, depression, anger, and pain from pre-intervention to post-intervention were compared using paired difference t-tests for dependent samples. Table 8 presents results of this analysis.

Table 8

t-Tests for Dependent Samples – Burden of Illness

Variable	N	<u>Preintervention</u>		<u>Postintervention</u>		t-Value	p Value
		M	SD	M	SD		
Fatigue	10	11.70	16.45	30.70	21.40	3.29	0.009
Anxiety	10	7.00	10.09	13.30	19.49	0.85	0.416
Confusion	10	7.00	13.72	12.30	18.80	0.68	0.509
Depression	10	3.20	3.01	11.70	18.33	1.58	0.148
Anger	10	6.70	8.58	8.60	11.85	0.40	0.694
Pain	10	20.30	22.96	27.20	20.74	1.46	0.179

When the preintervention ($M = 11.70$, $SD = 16.45$) and postintervention ($M = 30.70$, $SD = 21.40$) scores for fatigue were compared, the results were statistically significant ($t = 3.29$, $p = 0.009$). The scores for fatigue increased over the six weeks of the study, signifying an increase in levels of fatigue in the participants from initial measure to completion of the study. While the scores for the remaining variables also increased, the increases were not statistically significant.

In addition, the preintervention and postintervention scores for burden of illness were compared using the Wilcoxon signed rank test. The results of this test are presented in Table 9.

Table 9

Wilcoxon Signed Ranks Pair Test – Burden of Illness

Variable	N	Change in Ranks			Z	pValue
		Neg	Pos	Tie		
Fatigue	10	1	8	1	2.55	0.011
Anxiety	10	3	4	3	0.34	0.735
Confusion	10	2	4	4	0.94	0.345
Depression	10	1	5	4	1.99	0.046
Anger	10	5	3	2	0.14	0.889
Pain	10	1	8	1	1.72	0.086

The comparison of fatigue from preintervention to postintervention was statistically significant ($z = -2.55$, $p = 0.011$). Eight participants had increased fatigue, with 1 participant having a reduction in fatigue and 1 reporting he/she experienced the same level of fatigue from preintervention to postintervention. The scores for depression also changed significantly from preintervention to postintervention ($z = 1.99$, $p = 0.046$). Five participants experienced worsening depression, with four reporting the same level of depression from preintervention to postintervention. One participant had decreased depression from preintervention to

postintervention. The remainder of the variables measuring burden of illness did not change significantly from preintervention to postintervention.

Research Question 3: Is there a difference in the percentage rate of line occlusion and infection in patients who (with or without their caregivers) have completed a SCEI for PICC line care and national percentage rates of the same adverse outcomes?

The patients in the present study did not experience any line occlusions during the six weeks of the intervention; the nationally reported PICC occlusion rates varied from 14 to 36% (Barrier et al., 2013; Dougherty, 2014; Moureau et al., 2001; Ngo & Murphy, 2005). Using analysis of frequency, the findings indicated that the present study had a significantly lower percentage of line occlusion than was noted in national results ($z = 8.33, p < 0.0001$).

No PICC line associated infections were noted in the pilot study participants over the six weeks of the study. Given the nationally reported rate of 0.5% reported PICC line associated infection rate in outpatients (Chopra et al, 2013), the rates of the present study were significantly lower than nationally reported rate ($z = 3.33, p < 0.0001$).

Anecdotal Findings

The study also provided some anecdotal findings. First, a home care infusion nurse requested that I demonstrate flushing for her, as she was unsure that she was following protocol. She was using an alcohol pad to wipe the tip of the flushing syringe and had been teaching patients to use this process. This step is not part of INS standards for flushing, and the INS standards of practice for flushing was shared with the home care infusion nurse. Another infusion nurse reported that she did not teach the “push/pause” technique for flushing as she found this step to be confusing for patients and families. When discussing the current research

and the INS standards for flushing, which supports the push/pause flushing technique, she stated that she was well aware of this information, but her practice was based on personal experience.

Coordination of care for catheter care, dressing changes, and flushing was found to be lacking on some cases. A patient had a PICC placed on September 30, 2015 and the first dressing and flush was not performed until October 9, 2015, even though the patient had gauze under the dressing. INS standards recommend that a central line dressing should be changed within 72 hours if gauze is present. The physician's office refused to use the PICC to draw blood, to change the dressing, or flush the catheter. The assistant told the patient that they would not touch a central line, even though the physician had ordered the PICC placement. I contacted both the infusion center and the physician's office to coordinate the PICC care and flushing, and a referral to a home care company was finally obtained after nine days of PICC placement.

Patients were satisfied with the use of a tablet for providing education on flushing their PICC lines. At the six-week follow-up appointment, one subject had purchased a tablet to use, informing this nurse that he used the tablet to watch movies during chemotherapy visits. Another subject asked how to purchase his own tablet. He stated that his grandchildren used tablets but he never considered using one himself until he was able to use the tablet for the intervention study.

Summary

The results of the data analysis that were used to describe the sample and address the research questions for this study have been presented in this chapter. The conclusions and recommendations based on these findings can be found in Chapter 5.

CHAPTER 5 – SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Chapter 5 provides a discussion of the interpretation of research results, recommendations for future research, and implications for nursing practice and research as well as patient education.

The purpose of this study was to test the feasibility of using an electronic tablet to supplement patient and caregiver education about PICC line maintenance and to compare the percentage of PICC line complications in the intervention group with national percentage rates for patients and caregivers. In addition, this study also determined changes in the state of being overwhelmed and burden of illness.

Results

Participants

Eleven oncology patients were enrolled in this pilot study, with 10 completing the six-week reassessment. One participant left the state to seek treatment at a cancer center in Texas, so his data were not included in the final analysis. Of the 11 patients who were initially enrolled in the study, leukemia was the most frequent diagnosis (3), ovarian (2) and pancreatic (2) cancers and 1 participant each with breast, bone, stomach or lung cancers. These cancers are all included in the list of most expected cancers in 2015, which are breast cancer, lung and bronchus cancer, prostate cancer, colon and rectum cancer, bladder cancer, melanoma of the skin, non-Hodgkin lymphoma, thyroid cancer, kidney and renal pelvis cancer, leukemia, endometrial cancer, and pancreatic cancer (NIH, 2016).

The age range in the participants was from 38 to 88 years of age, with the mean and median age both at 66 years of age. Although oncology patients can be diagnosed and receive

treatment at any age, the median age of the study sample was the same as the median age at diagnosis for all cancers, which is 66 years of age (SEER data 2005-2009) Of note, the 88-year-old who completed the study was transferred to hospice services after data collection was completed.

Results Related to Research Questions

Discussion of research findings are organized by research question. The following research questions were addressed:

Research Question 1: What is the percentage of PICC line occlusions and infections in adult outpatient participants who complete a SCEI for PICC line care using an electronic tablet?

There were no occlusive outcomes in the pilot study participants.

There were no PICC line associated infections in the pilot study participants.

Research Question 2: Are there changes in the state of being overwhelmed or the burden of illness in outpatients who (with or without their caregivers) complete a SCEI for PICC line care?

The state of being overwhelmed was measured with the Attention Functional Index and its four subscales. Although the total score and the scores of the subscales increased from preintervention to postintervention, the differences were not statistically significant.

Burden of illness was measured by six subscales of the POST: fatigue, anxiety, confusion, depression, anger, and pain over the six weeks of the intervention. Two variables, fatigue and depression, differed significantly from pre- to post-intervention, with scores for fatigue and depression worsening. Although the scores on the remaining variables also worsened,

the differences were not statistically significant. The lack of statistical significance could be related to the small sample size.

Research Question 3: Is there a difference in the percentage rate of line occlusion and infection in patients who (with or without their caregivers) have completed a SCEI for PICC line care and national percentage rates of the same adverse outcomes?

There were no occlusive outcomes in the pilot study participants. The national reported PICC occlusion rates varied from 14 to 36% (Barrier et al., 2013; Dougherty, 2014; Moureau et al., 2001; Ngo & Murphy, 2005). There were no PICC line associated infections in the pilot study participants. The national reported PICC line associated infection rate in outpatients was 0.5% (Chopra et al., 2013). The outcomes in the study population, therefore, were better than outcomes in national samples.

Occlusion and Infection

The outcomes of occlusion and infection were the variables used to evaluate the efficacy of the patient education intervention. All participants were successful in completing the PICC line flush behaviors, as witnessed by the researcher remotely via the electronic tablet. Either the patient him/herself or the caregiver was able to demonstrate the 10 steps of flushing successfully. During the six-week study period, no occlusions (partial or complete) occurred. The national reported PICC occlusion rates vary from 14 to 36% (Barrier et al., 2013; Dougherty, 2014; Moureau et al., 2001; Ngo & Murphy, 2005), so participants in this study had better outcomes.

No PICC line associated infections were noted among the pilot study participants. The national reported PICC line associated infection rate in outpatients was 0.5% (Chopra et al., 2013). During the six-week study period, one thrombophlebitis was identified by symptoms of swelling and warmth of the upper arm, during week 6, resulting in the removal of the PICC line.

The thrombophlebitis was consistent with existing research. In a research study (Greene et al., 2015) of more than 70,000 PICC line patients, a strong association was found between having a PICC line and the incidence of upper-extremity deep vein thrombosis (Hazard Ratio [HR] 10.49; 95% CI, 7.79-14.11). Although thrombophlebitis is a common complication, no evidence has linked thrombophlebitis to flushing technique, the focus of this study.

State of Being Overwhelmed

Fatigue. Fatigue is the most common side effect of cancer treatment with chemotherapy, radiation therapy, or biologic response modifiers (Weis & Horneber, 2015). Cancer treatment related fatigue is reported in approximately 96% of patients undergoing cancer treatment (Ghoshal, Damani, & Muckaden, 2015). Fatigue also is seen as a presenting symptom in cancers that produce problems such as anemia, endocrine changes, and respiratory obstruction and is common in people with advanced cancer who are not undergoing active cancer treatment (Weis & Horneber, 2015). Participants in the pilot study were met after the PICC line insertion and at the beginning of their chemotherapy treatments. The second measure for fatigue was completed six weeks after the first measure of fatigue, after participants had completed several chemotherapy infusions. The findings of a significant increase in reports of fatigue in this pilot study sample were consistent with previous studies, demonstrating the increase in the burden of illness.

Depression. Depression affects approximately 15% to 25% of patients with cancer (Lie et al., 2015). Individuals and families who face a diagnosis of cancer can expect to experience varying levels of stress and emotional upset that can lead to depression. Depression in patients with cancer affects the patients themselves, as well as has a major negative impact on their families. Participants in the pilot study completed the measure for depression after the PICC line

insertion and prior to the beginning their chemotherapy treatments. The second measure for depression was completed six weeks later, after participants had received several chemotherapy infusions. The findings of a significant increase in reports of depression in this pilot study sample were consistent with previous studies, demonstrating the increase in the burden of illness.

Anxiety, confusion, anger, and pain. No significant changes were observed in any of these characteristics of the state of being overwhelmed. Because of the small sample size, these and other results must be interpreted with caution.

Evaluation of Intervention

The pilot study of oncology patients with newly inserted PICC lines demonstrated the positive effects of the use of technology to provide remote patient education and coaching in decreasing adverse patient outcomes of PICC occlusion and infection. These adverse patient outcomes are considered preventable with adequate line flushing. As patients are becoming more responsible for their self-care, educational interventions are needed to promote appropriate methods for maintaining PICC lines. The standard method of PICC patient education is the infusion nurse demonstrates how to flush the PICC line and provides the patient with a written handout describing the steps. However, these current educational strategies result in an unacceptably high occlusion rate for PICC lines.

A new strategy for patient and caregiver education was developed for this study. The strategy used a comprehensive educational intervention (PICC self-care educational intervention [PICC SCEI]) using electronic tablets to reduce the incidence of PICC line occlusion in the adult outpatient population. The use of technology allowed repetition and self-paced learning that could help patients improve their ability to perform the self-care practices needed to care for their PICC lines. Previous research has demonstrated that electronic platforms for patient

education improve interactive capabilities and support communication needs beyond the inpatient setting (Sawyer et al., 2016). Studies have utilized e-learning with mobile technology, both with electronic tablets and smart-phones with applications, to improve educational outcomes in patients with chronic illness, which included cancer, asthma, and diabetes (Abernethy et al., 2010, Kaufman, 2013, Nogueira et al., 2013). Several researchers (Abernethy et al., 2010, Granger & Bosworth, 2011, Sherrard et al., 2009) found an increase in patient engagement, decreased post discharge complications, and improved communication between the nurse and the patient.

Study Limitations

The limitations of this study affect the generalizability of the findings. First, the sample size was small with participants volunteering to be in the study. The use of an electronic tablet may have been a limitation in obtaining a greater number of participants in the study. Some potential participants may have been reticent about being in the study because of their lack of experience using electronic media. The study was limited to six weeks for measures of occlusion and infection, and the comparison national data were not limited to a six-week period for measures of these adverse outcomes.

Implications and Recommendations

Nursing Practice

Nurses are responsible for patient education for PICC line maintenance. As noted in the anecdotal findings, the educational methods used by the nurses varied both within and between nurses and was not based on evidence. To ensure consistency among infusion nurses, continuing education on the steps for flushing PICC lines based on current standards of practice needs to be completed both by prelicensure nursing students and by nurses practicing in the community.

A flushing video and application for smart phones and tablets could be developed and distributed to schools and colleges of nursing, as well as organizations that employ infusion nurses. Prior to teaching patients and families self-care for PICC lines, the nurses can review current practice recommendations, based on INS standards of practice.

Novel approaches to patient education need to be developed and tested. Developing applications for electronic tables and smart phones to help with patient education can help overcome some of the visual and auditory problems associated with printed materials. The use of an electronic tablet to provide this type of education while the patient and caregiver are in their home environment can provide opportunities for coaching, reviewing, and reinforcing self-care treatments that can improve health outcomes.

Nursing Research

This study should be replicated with a larger sample to determine if the use of an electronic tablet for patient education for flushing PICC lines is a viable way to reduce the incidence of occlusions and infections. Further testing of the use of an electronic tablet to provide remote patient education and coaching could strengthen the evidence for integration of technology into programs designed to assist patients and caregivers in achieving self-care.

Additional research is needed on developing applications for self-care management for other chronic illnesses, such as diabetes, heart failure, hypertension, and chronic obstructive pulmonary disease (COPD). Patients having these types of chronic illnesses could use these types of applications on tablets and smart phones to reinforce self-care behaviors. An experimental study could compare two groups of patients, those who have access to the applications and those who receive traditional patient education. The results of the proposed study could provide support for the use of electronic media for patient education.

Continuing education is needed to ensure that infusion flushing behaviors are consistent among professional nurses. Care for PICC lines needs to be standardized and follow INS guidelines. The infusion nurses responsible for teaching patients need to be updated to reflect the most current evidence-based practice.

Conclusions

The findings of this pilot study have importance regarding the future of educational interventions for patients with cancer and other chronic illnesses. The study needs to be replicated with a larger sample and with patients with chronic illness that require self-care to determine if the use of continuous education using electronic media is an appropriate patient education tool.

This study sought to determine if an innovative educational intervention could provide a way to help patients with cancer manage their self-care for their PICC lines more effectively. Using an electronic tablet to provide step-by-step instructions on PICC line flushing had not been the subject of prior research in cancer patients. Having a virtual face-to-face interaction in a home setting with an infusion nurse (PI) soon after the insertion of the PICC line provided reinforcement of the education the patient had received about PICC line management. The absence of occlusions and infections among the study participants provided support that these types of educational intervention merit further study.

APPENDIX A**FLUSHING A PICC: THE 10 STEPS OF FLUSHING**

The learner will flush his/her own PICC.

1. Wash your hands. Hand washing is the number one way to prevent infection and is critical in preventing this complication. A 2-minute hand washing will be demonstrated with soap and water.
2. Assemble all equipment: gloves, one 10 ML saline flush syringe, 2 alcohol pads, mask. Each equipment piece will be held up by the instructor to demonstrate what they are.
3. Open sterile field and open syringe packaging-place syringes on sterile field. Open 2 alcohol pads and place on sterile field. Sterile is when there are no germs present. Since germs are present on us, even after we wash our hands, we cannot touch a sterile field. Also, we cannot cough, sneeze or pass over a sterile field with our hands or other objects.
4. Don sterile gloves and mask. The process of putting on a mask, and then sterile gloves without touching the outside of them will be demonstrated.
5. Scrub the hub of the catheter end cap for 15 seconds with alcohol pads-vigorous rub of end cap. The end cap will be held up of the participants to visualize. The need to scrub the hub of the end cap will be emphasized as a way to prevent infectious bacteria from entering the CVAD.
6. Attach 10 ML syringe with normal saline to end of lumen. The tip of the syringe will be placed in the hub of the end cap. The syringe will be held up to demonstrate that there are no air bubbles in the syringe.
7. Unclamp the lumen. The catheter has a roll clamp closing off fluid from entering and exiting the catheter when not in use. The roller clamp opening will be demonstrated.
8. Flush the catheter by intermittently pushing and pausing the plunger of the syringe-stop/start technique to flush.
9. Do not bottom out the syringe- This will be demonstrated by the instructor.
10. Disconnect the syringe- This will be demonstrated by the instructor. Clamp the catheter.

APPENDIX B

WAYNE STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD APPROVAL

**WAYNE STATE
UNIVERSITY**

IRB Administration Office
87 East Canfield, Second Floor
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
<http://irb.wayne.edu>

NOTICE OF FULL BOARD APPROVAL

To: Patricia Petroufias
College of Nursing
5557 Cass Ave., Cohn Bldg., Ro

From: Lawrence R. Crane, M.D. or designee *L. Crane, MD MBS*
Chairman, Medical Institutional Review Board (M1)

Date: October 14, 2014

RE: IRB #: 068114M1F
Protocol Title: 2014-028: The Relation Between Patient Education and PICC Line Occlusion
Funding Source: Sponsor: Gardner Foundation Research Grant
Protocol #: 1407013195

Expiration Date: September 03, 2015

Risk Level / Category: Research not involving greater than minimal risk

The above-referenced protocol and items listed below (if applicable) were **APPROVED** following *Full Board Review* by the Wayne State University Institutional Review Board (M1) for the period of 10/14/2014 through 09/03/2015. This approval does not replace any departmental or other approvals that may be required.

- Protocol (received in the IRB Office 6/30/14), and revised Protocol Summary Form (received in the IRB Office 9/29/14)
 - Revised HIPAA Summary Form (received in the IRB Office 9/29/14) and HIPAA Authorization with Consent
 - Research Informed Consent (revision dated 10/14/14)
 - Clinician Letter
 - Flyer
 - PICC Catheter Care Materials
 - Data Collection Tool: Demographic Survey Questions, SUPPH-29, Attentional Function Index, Post Scales, Self-Perceived Burden Scale, and Infusion Nurse Assessment Tool
-

- * Federal regulations require that all research be reviewed at least annually. You may receive a "Continuation Renewal Reminder" approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval **before** the expiration date. Data collected during a period of lapsed approval is unapproved research and can never be reported or published as research data.
- * All changes or amendments to the above-referenced protocol require review and approval by the IRB **BEFORE** implementation.
- * Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the IRB Administration Office Policy (<http://www.irb.wayne.edu/policies-human-research.php>).

NOTE:

1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the IRB Administration Office must be contacted immediately.
2. Forms should be downloaded from the IRB website at each use.

**WAYNE STATE
UNIVERSITY**

IRB Administration Office
87 East Canfield, Second Floor
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
<http://irb.wayne.edu>

NOTICE OF FULL BOARD CONTINUATION APPROVAL

To: Patricia Petroulias
College of Nursing
5557 Cass Ave., Cohn Bldg., Ro

From: Lawrence R. Crane, M.D. or designee *L. Crane, MD, M1*
Chairman, Medical Institutional Review Board (M1)

Date: September 10, 2015

RE: IRB #: 068114M1F
Protocol Title: 2014-028: The Relation Between Patient Education and PICC Line Occlusion
Funding Source: Sponsor: Gardner Foundation Research Grant
Protocol #: 1407013195

Expiration Date: August 05, 2016

Risk Level / Category: Research not involving greater than minimal risk

Continuation for the above-referenced protocol and items listed below (if applicable) were **APPROVED** following Full Board review by the Wayne State University Institutional Review Board (M1) for the period of 09/10/2015 through 08/05/2016. This approval does not replace any departmental or other approvals that may be required.

- Actively accruing participants.
- Research Informed Consent with HIPAA Authorization (revision dated 8/28/2015)
- Flyer
- Clinician Letter
- Data for this protocol collected between September 3, 2015 and September 9, 2015 is unapproved research, cannot be included with data collected during an approval period, and can never be reported or published as research data.

- * Federal regulations require that all research be reviewed at least annually. You may receive a "Continuation Renewal Reminder" approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval *before* the expiration date. Data collected during a period of lapsed approval is unapproved research and can never be reported or published as research data.
- * All changes or amendments to the above-referenced protocol require review and approval by the IRB **BEFORE** implementation.
- * Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the IRB Administration Office Policy (<http://www.irb.wayne.edu/policies-human-research.php>).

NOTE:

1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the IRB Administration Office must be contacted immediately.
2. Forms should be downloaded from the IRB website at each use.

APPENDIX C

INSTRUMENTS

Demographic Survey Questions

What is your date of birth? _____

What is your gender?

- Male Female

Ethnicity origin (or Race): Please specify your ethnicity.

- Asian / Pacific Islander
 Black or African American
 Hispanic or Latino
 Native American or American Indian
 White
 Other

Education: What is the highest degree or level of school you have completed? *If currently enrolled, highest degree received.*

- No schooling completed
 Some high school, no diploma
 High school graduate, diploma or the equivalent (for example: GED)
 Some college credit, no degree
 Trade/technical/vocational training
 Associate degree
 Bachelor's degree
 Master's degree
 Professional degree
 Doctorate degree

Marital Status: What is your marital status?

- Single, never married
 Married or domestic partnership
 Widowed
 Divorced
 Separated

Do you have a caregiver?

- Yes No

Do you use an electronic device? (laptop, cellphone, tablet)

- Yes No

Do you have medical insurance?

- Yes No

Do you have home care services?

- Yes No

ATTENTIONAL FUNCTIONAL INDEX

- I. At this time, how well do you feel you are functioning in each of the areas below?
Place a mark through the line at whatever point best describes how you are doing in each area at present.

1. Getting started on activities (tasks, jobs) you intend to do. Not at all _____ Extremely well
2. Following through on your plans. Not at all _____ Extremely well
3. Doing things that take time and effort. Not at all _____ Extremely well
4. Making your mind up about things. Not at all _____ Extremely well
5. Keeping your mind on what you are doing. Not at all _____ Extremely well
6. Remembering to do all the things you started out to do. Not at all _____ Extremely well
7. Keeping your mind on what others are saying. Not at all _____ Extremely well
8. Keeping yourself from saying or doing things you did not want to say or do. Not at all _____ Extremely well
9. Being patient with others. Not at all _____ Extremely well

II. At this time, how would you rate yourself on:

10. How hard you find it to concentrate on details. Not at all _____ Extremely well
11. How often you make mistakes on what you are doing. Not at all _____ Extremely well
12. Forgetting to do important things. Not at all _____ Extremely well
13. Getting easily annoyed or irritated. Not at all _____ Extremely well

POST Scales

(VAS)

FATIGUE:	None _____	Most Possible
ANXIETY:	None _____	Most Possible
CONFUSION:	None _____	Most Possible
DEPRESSION:	None _____	Most Possible
ANGER:	None _____	Most Possible
PAIN:	None _____	Most Possible

Depression: Please indicate whether or not you have noticed any of the following during the past week

- Loss of interest in favorite activities
- Loss of interest in sex
- Loss of energy (or feeling fatigued)
- Change in appetite
If yes, Increased or Decreased
- Change in sleep habits
If yes, Increased or Decreased
- Feeling hopeless
- Feeling down on yourself, worthless or guilty
- Feeling irritable or moody
- Feeling restless or fidgety
- Feeling slowed down or sluggish
- Feeling sad or blue
- Trouble thinking or concentrating
- Trouble making decisions
- Thoughts that life is not worth living

Concerns: Please indicate whether or not you have concerns in any of the following areas:

- Practical Concerns:
 - Housing
 - Insurance
 - Work/School
 - Transportation
 - Child care
 - Finances
- Family/Social Concerns
 - Dealing with partner
 - Dealing with children
 - Dealing with other family members
 - Dealing with friends
 - Dealing with medical staff
- Spiritual/Religious Concerns
 - Relating to God
 - Loss of faith

Interest in Services

Would you be interested in talking to a Social Worker or Behavioral Health Specialists about these or any other concerns?

- No Possibly Definitely (if “definitely,” please provide a phone number where we can reach you) _____

Would you be interested in attending a support group if one were offered at the Cancer Center?

- No Possibly Definitely

Social Support

Do you feel you have adequate support to help you cope with illness and treatment?

- Yes No

From which of the following sources do you receive support? (Please check all that apply)

- Spouse/Partner Family Friends
 Religious Community
 Counselor/Therapist Medical Staff Other _____

The Infusion Nurse Assessment Tool

Subject # _____

Week 1 2 3 4 5 6

PICC patency Status

- Patent
- Partial occlusion (sluggish)
- Occluded

Signs of Infection

- None
- Redness at insertion site
- Fever
- Drainage from PICC insertion site

REFERENCES

- Abdullah, M. N., Theobald, D. E., Butler, D., Kroenke, K., Perkins, A., Edgerton, S., & Dugan, W. M. (2005). Access to communication technologies in a sample of cancer patients: an urban and rural survey. *BMC cancer*, 5(1), 1-6. doi: 10.1186/1471-2407-5-18
- Abernethy, A. P., Etheredge, L. M., Ganz, P. A., Wallace, P., German, R. R., Neti, C., ... & Murphy, S. B. (2010). Rapid-learning system for cancer care. *Journal of Clinical Oncology*, 28(27), 4268-4274. doi: 10.1200/JCO.2010.28.5478
- Alexander, M., Corrigan, A., Gorski, L., Hankins, J., & Perucca, R. (2010) *Infusion Nursing: An Evidence Based Approach*. St. Louis, MO: Elsevier.
- Alpenberg, S., Joelsson, G., & Rosengren, K. (2015). Feeling Confident in Using PICC Lines Patients' Experiences of Living with a PICC Line during Chemotherapy Treatment. *Home Healthcare Management & Practice*, 27(3), 119-125. doi: 10.1177/1084822314566300
- Bandura, A. (1997) *Self-efficacy: the exercise of control* New York, W.H.Freeman and Company
- Barrier, A., Williams, D. J., Connelly, M., & Creech, C. B. (2012). Frequency of peripherally inserted central catheter complications in children. *The Pediatric infectious disease journal*, 31(5), 519-521. doi: 10.1097/INF.0b013e31824571b0
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182. Retrieved from <http://www.public.asu.edu/~davidp/classes/psy536/Baron.pdf>
- Bodde, A., Shippee, N., May, C., Mair, F., Erwin, P., Murad, M., & Montori, V. (2013) Examining health promotion interventions for patients with chronic conditions using a

novel patient-centered complexity model: protocol for a systematic review and meta-analysis. *Systematic Reviews*, 2(1), 1-7. doi: 10.1186/2046-4053-2-29.

Bohlen, K., Scoville, E., Shippee, N., May, C., & Montori, V. (2012). Overwhelmed Patients: A video graphic analysis of how patients with type 2 diabetes and clinicians articulate and address treatment burden during clinical encounters. *Diabetes Care*, 35(1), 47-49. doi: 10.2337/dc11-1082

Camp-Sorrell, D. (2011) *Access Device Guidelines: Recommendations for Nursing practice and education*. Pittsburgh, PA: Oncology Nursing Society.

Cennamo, K., & Kalk, D. (2005) *Real world instructional design* Belmont, CA: Thompson Wadsworth.

Center for Disease Control, (2011). 2011 Guidelines for the prevention of intravascular catheter-related infections. Retrieved from: <http://www.cdc.gov/hicpac/bsi/04-bsi-background-info-2011.html>

Chopra, V., O'Horo, J., Rogers, M., Maki, D., & Safdar, N., (2013) The risk of bloodstream infection associated with peripherally inserted central catheters compared with central venous catheters in adults: A systematic review. *Infection Control and Hospital Epidemiology*, 34(9), 908-919. doi: 10.1086/671737

Cimprich, B. (1992) A theoretical perspective on attention and patient education. *Advanced Nursing Science*. 14(3), 39-51. Retrieved from http://journals.lww.com/advancesinnursingscience/Abstract/1992/03000/A_theoretical_perspective_on_attention_and_patient.7.aspx

- Cimprich, B. (1998). Age and extent of surgery affect attention in women treated for breast cancer. *Research in Nursing* 21, 229-238. Retrieved from https://deepblue.lib.umich.edu/bitstream/handle/2027.42/34676/6_ftp.pdf?sequence=1&isAllowed=y
- Cimprich, B., & Ronis, D. (2001). Attention and symptom distress in women with and without breast cancer. *Nursing Research*. 50(2), 86-94. http://journals.lww.com/nursingresearchonline/Abstract/2001/03000/Attention_and_Symptom_Distress_in_Women_With_and.4.aspx
- Cimprich, B., Visovatti, M., & Ronis, D. L. (2011). The Attentional Function Index—a self-report cognitive measure. *Psycho-Oncology*, 20(2), 194-202. doi: 10.1002/pon.1729
- Cousineau, N, McDowell, I, Hotz, S. & Hebert, P. (2003) Measuring chronic patients' feelings of being a burden to their caregivers: Development and preliminary validation of a scale. *Medical Care*, 41(1), 110-118. Retrieved from http://journals.lww.com/lww-medicalcare/Abstract/2003/01000/Measuring_Chronic_Patients__Feelings_of_Being_a.13.aspx
- Cummings-Winfield, C., & Mushani-Kanji, T. (2008). Restoring patency to central venous access devices. *Clinical Journal of Oncology Nursing*, 12(6), 925-934. doi:10.1188/08.CJON.925-934
- Czaja, S.J., Charness, N., Fisk. A.D., Hertzog, C., Nair, S. N., Rogers, W. A. et al. (2006). Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and Aging*, 21(2), 333-352. doi: 10.1037/0882-7974.21.2.333
- Daneault, S., Lussier, V., Mongeau, S., Paille, P., Hudon, E., Dion, D., & Yelle, L. (2004). The nature of suffering and its relief in the terminally ill: A qualitative study. *Journal of*

palliative care, 20(1), 7-11. Retrieved from <http://criugm.qc.ca/journalofpalliativecare/?lang=en>

- Denizard-Thompson, N. M., Feiereisel, K. B., Stevens, S. F., Miller, D. P., & Wofford, J. L. (2011). The digital divide at an urban community health center: Implications for quality improvement and healthcare access. *Journal of Community Health*, 36(3), 456-460. Doi: 10.1007/s10900-010-9327-5
- Dougherty, L. (2014). Frequency, Diagnosis, and Management of Occlusive and Mechanical PICC Complications. In S. Sandrucci & B/ Mussa (Eds.). *Peripherally Inserted Central Venous Catheters*, (pp. 85-94). New York: Springer.
- Duggleby, W., Ghosh, S., Cooper, D., & Dwernychuk, L. (2013). Hope in newly diagnosed cancer patients. *Journal of Pain and Symptom Management*, 46(5), 661-670. doi: 10.1016/j.jpainsymman.2012.12.004
- Elit, L., Charles, C., Gold, I., Gafni, A., Farrell, S., Tedford, S., & Whelan, T. (2003). Women's perceptions about treatment decision making for ovarian cancer. *Gynecologic Oncology*, 88(2), 89-95. doi:10.1016/S0090-8258(02)00090-2
- Ernst, J., Berger, S., Weißflog, G., Schröder, C., Körner, A., Niederwieser, D., ... & Singer, S. (2013). Patient participation in the medical decision-making process in haemato-oncology – A qualitative study. *European Journal of Cancer Care*, 22(5), 684-690. doi: 10.1111/ecc.12077
- Eton, D., de Oliveira, D, Egginton, J., Ridgeway, J., Odel L., May C., & Montori V. (2012) Building a measurement framework of burden of treatment in complex patient with chronic conditions: a qualitative study. *Patient Outcome Measures* 3, 39-49. Retrieved from http://s3.amazonaws.com/academia.edu.documents/45229960/Building_a_

measurement_framework_of_burd20160430-22840-mp6koy.pdf?AWSAccessKeyId=AKIAJ56TQJRTWSMTNPEA&Expires=1466626200&Signature=oYzcRKm4kelz2GwZiBIcpN7NDaI%3D&response-content-disposition=inline%3B%20filename%3DBuilding_a_measurement_framework_of_burd.pdf

Ferroni, A., Gaudin, F., Guiffant, G., Flaud, P., Durussel, J. J., Descamps, P., ... & Merckx, J. (2014). Pulsative flushing as a strategy to prevent bacterial colonization of vascular access devices. *Medical Devices (Auckland, NZ)*, 7, 379-383. doi: 10.2147/MDER.S71217

Folkman, S., & Lazarus, R. S. (1988). *Manual for the Ways of Coping Questionnaire*. Palo Alto, CA: Consulting Psychologists Press.

Friedman, A. J., Cosby, R., Boyko, S., Hatton-Bauer, J., & Turnbull, G. (2011). Effective teaching strategies and methods of delivery for patient education: a systematic review and practice guideline recommendations. *Journal of Cancer Education*, 26(1), 12-21. doi: 10.1007/s13187-010-0183-x

Gagné, R. M. (1965). *The conditions of learning and theory of instruction* (1st ed.). New York, NY: Holt, Rinehart & Winston.

Gagné, R. M. (1985). *The conditions of learning and theory of instruction* (4th ed.). New York, NY: Holt, Rinehart & Winston.

Gallacher, K., May, C. R., Montori, V. M., & Mair, F. S. (2011). Understanding patients' experiences of treatment burden in chronic heart failure using normalization process theory. *The Annals of Family Medicine*, 9(3), 235-243. doi: 10.1370/afm.1249

- Greene, M., Flanders, S., Woller, S., Bernstein, S., Chopra, V. (2015) The association between PICC use and venous thromboembolism in upper and lower extremities. *The American Journal of Medicine*, 128, 986-993 doi:10.1016/j.amjmed.2015.03.028
- Gifford, H., DeLegge, M., & Epperson, L.A. (2010) Education methods and techniques for training home parenteral nutrition patients. *Nutrition in Clinical Practice*. 25(5), 443-450. doi: 10.1177/0884533610379816
- Gilmour, J. A. (2007). Reducing disparities in the access and use of Internet health information. A discussion paper. *International journal of nursing studies*, 44(7), 1270-1278. doi: 10.1016/j.ijnurstu.2006.05.007
- Given, B. A., Given, C. W., & Kozachik, S. (2001). Family support in advanced cancer. *CA: A Cancer Journal for Clinicians*, 51(4), 213-231. doi: 10.3322/canjclin.51.4.213
- Ghoshal, A., Damani, A., & Muckaden, M. A. (2015). 374PD Association of cancer related fatigue with other symptoms and impact on quality of life of palliative care patients in a tertiary cancer institute: A prospective observational study. *Annals of Oncology*, 26(suppl 9), ix112-ix113. doi: 10.1093/annonc/mdv531.07
- Granger, B. B., & Bosworth, H. (2011). Medication adherence: Emerging use of technology. *Current Opinion in Cardiology*, 26(4), 279-287. doi: 10.1097/HCO.0b013e328347c150
- Gredler, M. E. (1997). *Learning and instruction: Theory into practice*. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Hesselink, G., Flink, M., Olsson, M., Barach, P., Dudzik-Urbaniak, E., Orrego, C., & Manaseki-Holland, S. (2012). Are patients discharged with care? A qualitative study of perceptions and experiences of patients, family members and care providers. *BMJ quality & safety*, 21(Suppl 1), i39-i49. doi:10.1136/bmjqs-2012-001165

Infusion Nurses Society (2016). *Infusion Nursing Standards of Practice*. Norwood, MA: Wolters Kluwer

The Joint Commission. (2012). *Preventing central line-associated bloodstream infections: A global challenge, a global perspective*. Oak Brook, IL: Joint Commission Resources, Retrieved from <http://www.PreventingCLABSIs.pdf>.

Kaufman, N. (2014). Using Health Information Technology to Prevent and Treat Diabetes. *Diabetes Technology & Therapeutics*, 16(S1), S-56-S-57. doi:10.1089/dia.2014.1507

Kerns J., & Berebaum, H. (2010). Affective processing in overwhelmed individuals: Strategic and task considerations. *Cognition and Emotion*, 24(4), 638-660. doi: 10.1080/02699930902927664

Kerner, J.A., Garcia-Careaga, M.G., Fischer, A. A., & Poole, R. L. (2006). Treatment of catheter occlusion in pediatric patients. *Journal of Parenteral Enteral Nutrition*, 30(suppl 1), S73-S81. doi: 10.1177/01486071060300S1S73

Knowles, M. S. (1970). *The modern practice of adult education* (Vol. 41). New York: New York Association Press.

Krohne, H. W., Schumacher, A., & Egloff, B. (1992). *Das Angstbewältigungs-Inventar (ABI)*. *The Mainz Coping Inventory (MCI)* Mainz: Johannes-Gutenberg-Universität, Psychologisches Institute.

Krouse, H. (2000). Video modeling to educate patients. *Journal of Advanced Nursing*, 33(6), 748-757. doi: 10.1046/j.1365-2648.2001.01716.x

Lacey, M. D. (2002, January). The experience of using decisional support aids by patients with breast cancer. *Oncology Nursing Forum*, 29(10), 1491-1497. doi: 10.1188/02.ONF.1491-1497

- Lansdown, M., Martin, L., & Fallowfield, L. (2008). Patient–physician interactions during early breast-cancer treatment: Results from an international online survey. *Current Medical Research and Opinion*, 24(7), 1891-1904. doi: 10.1185/03007990802135042
- Lie, H. C., Hjermsstad, M. J., Fayers, P., Finset, A., Kaasa, S., Loge, J. H., & European Palliative Care Research Collaborative (EPCRC). (2015). Depression in advanced cancer–assessment challenges and associations with disease load. *Journal of affective disorders*, 173(1), 176-184. doi:10.1016/j.jad.2014.11.006
- Lorence, D., Park, H., & Fox, S. (2006). Racial disparities in health information access: Resilience of the digital divide. *Journal of Medical Systems*, 30(4), 241-249. doi: 10.1007/s10916-005-9003-y
- Malone, P. (2007) Implementation of a prechemotherapy education intervention. *Clinical Journal of Oncology Nursing*. 11(5), 707-710. doi: 10.1188/07.CJON.707-710
- May, C. R., Mair, F., Finch, T., MacFarlane, A., Dowrick, C., Treweek, S., ... & Murray, E. (2009). Development of a theory of implementation and integration: Normalization Process Theory. *Implementation Science*, 4(1), 1-9. doi: 10.1186/1748-5908-4-29
- May, C., Finch, T., Mair, F., Ballini, L., Dowrick, C., Eccles, M., & Heaven, B. (2007). Understanding the implementation of complex interventions in healthcare: the normalization process model. *BMC Health Services Research*, 7(1), 148.
- May, C. R., Eton, D. T., Boehmer, K., Gallacher, K., Hunt, K., MacDonald, S., ... & Rogers, A. E. (2014). Rethinking the patient: using Burden of Treatment Theory to understand the changing dynamics of illness. *BMC Health Services Research*, 14(1), 1-11.. doi: 10.1186/1472-6963-14-281

- McGrath, P., Paton, M. A., & Huff, N. (2004). Beginning treatment for paediatric acute myeloid leukaemia: diagnosis and the early hospital experience. *Scandinavian Journal of Caring Sciences*, 18(4), 358-367. doi: 10.1111/j.1471-6712.2004.00293.x
- McPherson, C., Higginson, L., & Hearn, J (2001). Effective methods of giving information in cancer: A systematic literature review of randomized controlled trials. *Journal of Public Health*, 23, 227-234. doi: 10.1093/pubmed/23.3.227
- McQueen, A., & Kreuter, M. (2010) Women's cognitive and affective reactions to breast cancer survivor stories: A structural equation analysis. *Patient Education and Counseling*; 81(S1), S15–S21. doi: org/10.1016/j.pec.2010.08.015
- Merriam Webster. (2001). *Webster's universal encyclopedic dictionary*. New York: Barnes & Noble Books.
- Møller, T., & Adamsen, L. (2010). Hematologic patients' clinical and psychosocial experiences with implanted long-term central venous catheter: self-management versus professionally controlled care. *Cancer Nursing*, 33(6), 426-435. doi: 10.1097/NCC.0b013e3181dc1908
- Moller, T., Borregard, N., Tvede, M., & Adamsen, L. (2005). Patient education – a strategy for prevention of infections caused by permanent central venous catheters in patients with haematological malignancies: A randomized clinical trial. *Journal of Hospital Infection*. 61(4), 330-341. doi: 10.1016/j.jhin.2005.01.031
- Molley, D., Smith, L., & Aitchison, T., (2008). Cytotoxic chemotherapy for incurable colorectal cancer: Living with a PICC-line. *Journal of Clinical Nursing*. 17(18), 2398-2407. doi: 10.1111/j.1365-2702.2008.02359.x
- Moureau, N., Poole, S., Murdock, M. A., Gray, S. M. & Semba C. P. (2002). Central venous catheters in home infusion care: Outcomes analysis in 50,470 patients. *Journal of*

Vascular and Interventional Radiology, 13(10) 1009-1016. doi: 10.1016/S1051-0443(07)61865-X

Ngo, A., & Murphy, S. (2002). A theory based education to improve nurses' knowledge, self-efficacy and skills to reduce PICC occlusion. *Journal of Infusion Nursing*, 28(3), 173-181. Retrieved from http://journals.lww.com/journalofinfusionnursing/Abstract/2005/05000/A_Theory_based_Intervention_to_Improve_Nurses_.aspx

Nogueira, P. C., de Carvalho Nagliate, P., de Godoy, S., Rangel, E. M. L., Trevizan, M. A., & Mendes, I. A. C. (2013). Technology use for health education to caregivers: An integrative review of nursing literature. *Applied Nursing Research*, 26(3), 101-104. doi:10.1016/j.apnr.2013.01.004

O'Grady, N. P., Alexander, M., Dellinger, E. P., Gerberding, J. L., Heard, S. O., Maki, D. G., ... & Raad, I. I. (2002). Guidelines for the prevention of intravascular catheter-related infections. *Clinical Infectious Diseases*, 35(11), 1281-1307. doi: 10.1086/344188

Orem, D. (2001) *Nursing: Concepts of Practice* (6thed) St. Louis, MO: Mosby

Patmon, F., Young, H. M., Miyamoto, S., Ward, D., & Griffin, E. (2012). Nurse Telehealth Coaching for Rural Diabetics: *INNOVATION in CARE*. Virginia Henderson International Nursing e-Repository. Retrieved from <http://www.nursinglibrary.org/vhl/handle/10755/211511>

Penberthy, L., Brown, R., Wilson-Genderson, M., Dahman, B., Ginder, G., & Siminoff, L. A. (2012). Barriers to therapeutic clinical trials enrollment: Differences between African-American and White cancer patients identified at the time of eligibility assessment. *Clinical Trials*, 9(6), 788-797. doi: 10.1177/1740774512458992

Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948. Retrieved from <http://who.int/about/definition/en/print.html>

Sawyer, T., Nelson, M. J., McKee, V., Bowers, M. T., Meggitt, C., Baxt, S. K., ... & Locke, S. C. (2016). Implementing electronic tablet-based education of acute care patients. *Critical Care Nurse*, 36(1), 60-70. doi: 10.4037/ccn2016541

Sav, A., King, M. A., Whitty, J. A., Kendall, E., McMillan, S. S., Kelly, F., ... & Wheeler, A. J. (2015). Burden of treatment for chronic illness: A concept analysis and review of the literature. *Health Expectations*, 18(3), 312-324. doi: 10.1111/hex.12046

Sav, A., Kendall, E., McMillan, S. S., Kelly, F., Whitty, J. A., King, M. A., & Wheeler, A. J. (2013). 'You say treatment, I say hard work': treatment burden among people with chronic illness and their carers in Australia. *Health & Social Care in the Community*, 21(6), 665-674. doi: 10.1111/hsc.12052

Sharp, R., Grech, C., Fielder, A., Mikocka-Walus, A., Cummings, M., & Esterman, A. (2014). The patient experience of a peripherally inserted central catheter (PICC): A qualitative descriptive study. *Contemporary Nurse*, 48(1), 26-35. doi: 10.1080/10376178.2014.11081923

Sherrard, H., Struthers, C., Kearns, S. A., Wells, G., Chen, L., & Mesana, T. (2009). Using technology to create a medication safety net for cardiac surgery patients: a nurse-led randomized control trial. *Canadian Journal of Cardiovascular Nursing*, 19(3), 9-15. Retrieved from <http://www.hsl.unc.edu/Services/Tutorials/ebm/JCNmarked.pdf>

- Shippee, N., Shah, N., May, C., Mair, F., Montori, V. (2012) Cumulative complexity: A functional, patient-centered model of patient complexity can improve research and practice. *Journal of Clinical Epidemiology*, 65 1041-1051. Retrieved from <http://www.hsl.unc.edu/Services/Tutorials/ebm/JCNmarked.pdf>
- Sikorski, A., Wyatt, G. K., Siddiqi, A. E., & Tamkus, D. (2009). Recruitment and early retention of women with advanced breast cancer in a complementary and alternative medicine trial. *Evidence Based Complementary and Alternative Medicine*, 2011. doi:10.1093/ecam/nep051
- Sinding, C., Hudak, P., Wiernikowski, J., Aronson, J., Miller, P., Gould, J., & Fitzpatrick-Lewis, D. (2010). "I like to be an informed person but..."negotiating responsibility for treatment decisions in cancer care. *Social Science & Medicine* 71(6), 1094-1101. doi: 10.1016/j.socscimed.2010.06.005
- Švab, I., Kersnik, J., Wensing, M., Nabbe, P., le Reste, J. Y., le Prielec, A., ... & Elhayany, A. (2012). Measuring use and utility of the bio-psychosocial approach in family medicine. (Abstracts from the EGPRN meeting in Ljubljana, Slovenia, 10th – 13th May, 2012). *European Journal of General Practice*, 18(3), 159-180. doi: 10.3109/13814788.2012.709843
- Tariq, M., & Huang, D. T. (2006). PICCing the best access for your patient. *Critical Care*, 10(5), 315-316. doi: 10.1186/cc5031
- Vadaparampil ST, Quinn GP, Miree CA, Brzosowicz J, Carter B, Laronga C. (2009). Recall of and reactions to a surgeon referral letter for BRCA genetic counseling among high-risk breast cancer patients. *Annals of Surgical Oncology*, 16(7), 1973-1981. doi: 10.1245/s10434-009-0479-4

- Weis, J., & Horneber, M. (2015). Definition and Prevalence of Cancer-Related Fatigue. In *Cancer-Related Fatigue* (pp. 1-10). New York: Springer Healthcare Ltd..
- Williams, S. (2004). Effect of education in managing side effects in women receiving chemotherapy for treatment of breast cancer. *Oncology Nursing Forum*, 31(1), E16-E23. doi: 10.1188/04.ONF.E16-E23
- Yap, Y. S., Karapetis, C., Lerosé, S., Iyer, S., & Koczwaa, B. (2006). Reducing the risk of peripherally inserted central catheter line complications in the oncology setting. *European Journal of Cancer Care*, 15(4), 342-347. doi: 10.1111/j.1365-2354.2006.00664.x
- Yogaparan, T., Panju, A., Minden, M., Brandwein, J., Mohamedali, H. Z., & Alibhai, S. M. H. (2009). Information needs of adult patients 50 or older with newly diagnosed acute myeloid leukemia. *Leukemia research*, 33(9), 1288-1290. doi:10.1016/j.leukres.2008.12.008
- Zemke, R., & Zemke, S. (1995). Adult Learning: What Do We Know for Sure? *Training*, 32(6), 31-34,36,38,40. Retrieved from . <http://eric.ed.gov/?id=EJ504481>

ABSTRACT**THE RELATION BETWEEN PATIENT EDUCATION AND
PICC LINE OCCLUSION AND INFECTION**

by

PATRICIA PETROULIAS**August 2016****Advisor:** Janna Roop, Ph.D**Major:** Nursing**Degree:** Doctor of Philosophy

The purpose of this study was to test the feasibility of using an electronic tablet to supplement patient and caregiver education about PICC line maintenance, to compare the percentage of PICC line complications in the intervention group with national rates. The study also measured changes in the state of being overwhelmed and the burden of illness. Newly diagnosed cancer patients who had PICC lines inserted participated in this study. They used an electronic tablet to learn the 10 steps for flushing their PICC lines correctly. They also met with the researcher via FaceTime to review the steps.

A total of 11 patients participated in this pilot study. They completed three instruments, a demographic survey, the Psycho-Oncology Screening Tool (POST), and the Attentional Functional Index (AFI), before and after the intervention. They met with an infusion nurse weekly who assessed the PICC line for occlusion and/or infection.

The patients had no occlusions or infections from their PICC lines during the six weeks of the study. These results differed favorably from national statistics. One patient did develop a thrombophlebitis that required removal of the PICC line during the sixth week of the study, but this is known to be a complication of PICC lines and is not thought to be related to flushing

techniques. Regarding the state of being overwhelmed and burden illness, significant changes were found for fatigue and depression. Both increased across the six weeks of the study. This finding was not unexpected as most cancer patients experience greater fatigue while receiving chemotherapy and become more depressed with their illness. Other changes in burden of illness were not observed.

The findings of this study provided support that the use of an electronic tablet with instructions for self-care that included flushing a PICC line and remote coaching via Face Time was useful in reducing the incidence of negative outcomes from having a PICC line. Further research should replicate the study with a larger, more heterogeneous sample to validate these findings.

AUTOBIOGRAPHICAL STATEMENT

PATRICIA PETROULIAS

Education	<p>2016 - Doctor of Philosophy, Wayne State University, Detroit, MI Major: Nursing</p> <p>2000 – Master of Science, University of Michigan, Ann Arbor, MI Major: Community Nursing</p> <p>1997 – Bachelor of Science, Oakland University, Rochester, MI Major: Nursing</p>
Licensure	State of Michigan – Nursing
Professional Experience	<p>2016 to Present Residential Homecare and Hospice, Troy, MI Director of Education</p> <p>2014 to 2016 Hospice of Michigan, Detroit, MI Clinical Educator</p> <p>2008 to 2014 Karmanos Cancer Center Quality Clinical Improvement Specialist</p> <p>1992 to 2008 Jorgensen Consulting Nurse Case Manager</p>
Professional Memberships	<p>Infusion Nurse Society Hospice and Palliative Nursing Association Case Management Society of America Sigma Theta Tau</p>
Awards	Smiths Medical Gardner Foundation Research Grant