

4-1-2015

# Exploration of Chemotherapy Safe-Handling Practices and Identification of Knowledge Deficits among Oncology Nurses in the Ambulatory Care Setting

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EXPLORATION OF CHEMOTHERAPY SAFE-HANDLING PRACTICES  
AND IDENTIFICATION OF KNOWLEDGE DEFICITS AMONG ONCOLOGY  
NURSES IN THE AMBULATORY CARE SETTING

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A Dissertation Submitted to the Graduate Faculty of

GRAND VALLEY STATE UNIVERSITY

In

Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF NURSING PRACTICE

Kirkhof College of Nursing

April 2015

## Abstract

The purpose of this project was to explore nursing practice perceptions regarding the safe-administration of outpatient chemotherapy and establish whether a knowledge deficit existed in an ambulatory care setting. Although recommendations for chemotherapy administration exist they are not mandatory and data suggests that contamination may still be occurring, due in part to inconsistent nursing compliance. To provide a foundation for instituting safety improvements in the administration of chemotherapy, a mailed survey was distributed to a population of 68 oncology nurses in an outpatient setting to explore the disparity between evidence-based recommendations and actual implementation.

The *Chemotherapy Handling Questionnaire* previously developed by Dr. Martha Polovich was utilized for the purposes of this project. The questionnaire included scales that measured knowledge, barriers to using personal protective equipment, perceived risks of exposure, self-efficacy, the climate of workplace safety, conflict of interest and interpersonal influences. Each of the survey scales were scored and Spearman's Correlation Coefficients were calculated for data analysis. Project findings suggest that despite high levels of exposure knowledge and moderate levels of self-efficacy for the use of personal protective equipment, total precaution use of outpatient oncology nurses was still low.

This safety improvement project has multiple implications for future research. Nurse perceptions suggest that personal motivation for compliance with safe-handling standards needs to be revisited. Additionally, chemotherapy administration procedures need to be assessed to determine which barriers to safety can be minimized or eradicated and how treatment volume may be reduced or organized to improve outcomes and decrease the risk for unnecessary chemotherapy exposure. Qualitative survey comments urge organizational leaders to ensure that appropriate personal protective equipment (PPE) is readily available to nursing staff, open lines

of communication regarding chemotherapy safety and compliance expectations are present, and implications for work policy changes exist.

This project explored nursing knowledge and perceptions of the safe administration of chemotherapy in outpatient settings of a multi-site clinic using the *Chemotherapy Handling Questionnaire*. The review of this cohort's perceptions suggests a need for ongoing evaluation of the workplace environment, in order to support a climate of safety and foster a culture that supports the well-being of nurses, in addition to their patients and the greater public.

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## CHAPTER 1

### INTRODUCTION

Knowledge is critical to safe nursing practice in all settings, but it is especially significant when a knowledge deficit on the part of the nurse breaches practice and threatens personal safety or the safety of the patient. Past research suggests that chemotherapy may have unintentionally compromised the oncology work setting for more than thirty years (Hazen, Smith-Idell, & Howlett, 2010). Because oncology nurses serve at the point of care for chemotherapy administration in most settings, they serve as the safety net for themselves and their patients. Despite the alarming implications of contamination and the risks they may pose for healthcare workers, there are no mandatory national guidelines for employers or employees. Present guidelines for chemotherapy administration are “voluntary” and only provide suggested recommendations. The Occupational Safety and Health Administration is working on developing standards that would require employers to identify and correct workplace hazards, but these procedures are not mandatory at this time (National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, & The Joint Commission, 2011).

The purpose of this project is to explore nursing practice and perceptions regarding the safe administration of chemotherapy and establish whether a knowledge deficit is present among outpatient oncology nurses and contributing to workplace hazards. This project aimed to qualify and describe the magnitude of dangers to nurse safety in a select setting associated with any lack of knowledge or other barriers so that suggestions can be made to mitigate correlated risks. This chapter will outline the problem and provide background information related to the safe administration of chemotherapy by nurses in the outpatient setting.

The American Society of Clinical Oncology (ASCO) and the Oncology Nursing Society (ONS) have developed specific safety standards for the administration of chemotherapy. These standards require that each institution utilize a comprehensive educational program and monitor nursing competency at specific intervals (Jacobsen et al., 2012). Unfortunately, most chemotherapy centers require initial education and training programs but have not developed a common method to evaluate nursing competency in regard to safe-handling techniques. Given such, it is imperative that institutions dispensing chemotherapy initially engage staff and develop evaluation and safe-handling strategies that continue over time (Salpaka, 2000).

Although guidelines for chemotherapy administration exist and are maintained by the Oncology Nursing Society and the American Society of Health System Pharmacists, evidence suggests that work environments are still contaminated with chemotherapeutic drugs due in part to poor nursing compliance (Polovich & Clark, 2012). This suggests that a gap may exist between evidence-based recommendations for current practice and what is actually practiced in the clinical setting. According to Martin and Larson (2003), nursing adherence to safety guidelines has often been in question in the past and clear evidence is lacking in regard to nurses' level of knowledge and compliance with existing safe administration practices. Also, it should be noted that in regard to nurse safety and the administration of chemotherapeutic agents only recommended guidelines have been established, not well-recognized, mandatory safety standards.

Studies also conclude that policies for the administration of potentially hazardous medications, such as chemotherapy, may be in place but often do not reflect current standards and/or may not be enforced or monitored by managerial staff (Polovich & Clark, 2012). When

nurses who administer chemotherapy fail to adhere to established policies and/or fail to utilize appropriate personal protective equipment, they place themselves and potentially their patients at risk for untoward outcomes.

Oncology nurses who handle chemotherapy in ambulatory settings often learn early to protect their patients from unnecessary exposure. However, many oncology nurses may not fully understand or appreciate their own health risks when administering chemotherapy in the outpatient setting. Unfortunately, most policies and protocols implemented in practice are developed to improve the safety of patients, not personnel (Salpaka, 2000). In fact, the American Society of Clinical Oncology and Oncology Nursing Society standards for chemotherapy administration focus on patient safety, not nursing exposure (Jacobsen et al., 2012). While patients in these settings experience both the risks and benefits of chemotherapeutic drugs, nurses only experience the potential risks of unintended exposure creating a critical threat to safety (National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, & The Joint Commission, 2011).

The Oncology Nursing Society recommends that in order to provide quality care and maintain safety standards, nurses must be competent in oncology nursing practice and have an awareness of risks amid their workplace. A major facet of this competency is that nurses must be remain educated and regularly engage in mandatory updates (Crannell, 2012).

Polovich and Clark (2012) pose that several barriers may be influencing the practice problem of unintended exposure to chemotherapy and indicate that political factors regarding mandatory national safety guidelines need to encourage employers to acknowledge this safety issue. However, existing studies suggest that despite the existence of policies and procedures, contamination is likely still occurring (Polovich & Clark, 2012). Contamination may be

occurring due to a lack of enforcement of existing policies or the need to update current guidelines posted in the workplace.

An extensive review of comprehensive standards associated with hazardous drug administration and the use of personal protective equipment (PPE) may be necessary to determine if policies and regulations need to be updated to correspond with current evidence (Walton, et al., 2012). In fact, one study explains that nurses in particular are at an increased risk of chemotherapy exposure due to the large amount of hazardous drugs administered in outpatient settings as well as the lack of enforcement of existing policies in the workplace (Fries, Himes-Ferris, Frasier, McCullag, & Griggs, 2011). Minimal medical surveillance of healthcare workers may also contribute to the lack of awareness of this practice problem.

According to the American Society of Health-System Pharmacists (2006), all healthcare workers who may be exposed to chemotherapeutic drugs should be routinely monitored in a surveillance program. Yet, only 46% of outpatient and office-based sites in a recent national survey report that they actually provide medical monitoring (Martin & Larson, 2003). The Occupational Safety and Health Administration mandates periodic surveillance of those that work in specialty practice areas and are at risk for exposure (Salpaka, 2000). However, the National Institute for Occupational Safety and Health (2012) contends that while employers should provide medical surveillance for workers, blood tests and urinalysis are unnecessary. The incongruence between these national organizations charged to support safety in the workplace suggests the need to update guidelines and calls for consistency between organizations.

According to Geiger-Brown and Lipscomb (2011), the condition of the work environment is strongly associated with the quality of care provided and the safety of the patient as well as the health of the workforce. In addition to this, workplace quality is linked to the

health and safety outcomes of nurses (Geiger-Brown & Lipscomb). Friese and his colleagues suggest the overall rate of chemotherapy exposure decreases when oncology nurses report adequate staffing and resources (2011). These data substantiate the need for adequate staffing and resources. The study also recognizes the role of increased staff compliance and the acknowledgment of practice standards regarding the protection of oncology nurses.

The influence of workplace conditions must be included as a factor when exploring occupational safety issues. Other contributing factors to organizational system failures that may result in unsafe work environments include lack of awareness of one's surroundings; poor communication; and direct interruptions and distractions while preparing to administer chemotherapy (Ashley, Dexter, Marshall, McKenzie, Ryan & Armitage, 2011). In addition to these concerns, the majority of research that addresses the work conditions of nurses concentrates on the hospital environment, while 38% of registered nurses do not work in hospital settings (Geiger-Brown & Lipscomb, 2011). This information suggests that the inclusion of more environmental data across ambulatory work settings is necessary.

In addition to the issue of unintended workplace contamination, potential harmful effects are occurring in work settings "despite the reported use of safety practices" or when standards are breached (McDiarmid, Oliver, Roth, Rogers, & Escalante, 2010, p. 1028). This implies that oncology nurses may be at substantial risk when administering chemotherapy to their patients and it calls for a structured evaluation of the nursing role in terms of reducing workplace contamination and improving environmental safety.

Nurses may perceive they are immune to the risks of chemotherapy exposure, as existing research concludes that poor compliance may be associated with a knowledge deficit and/or perceptions of a low probability of immediate injury (Connor & Eisenberg, 2010). Conclusions

from research suggest a lack of appropriate education and experience handling chemotherapeutic drugs can contribute to unnecessary exposure as well (Rizalar, Tural & Altay, 2012).

Chemotherapy exposure and workplace contamination can occur in a variety of forms and health outcomes differ based on the level of contact. Routes of exposure include drug inhalation; direct dermal contact with the drug; indirect contact via contaminated surfaces or bodily fluids; accidental injection via needle stick injury; ingestion of contaminated food or drink; or from hand-to-mouth actions (Polovich & Giesecker, 2011). The most common method of exposure is by way of skin or mucous membrane contact which is why personal protective equipment is highly recommended. However, even nurses that wear recommended protection can be exposed to chemotherapy when unintentionally touching contaminated surfaces with their bare hands. These surfaces often include counters, floors, drug storage areas, waste containers and drug vials (Polovich & Giesecker, 2011).

Exposure to chemotherapeutic drugs is associated with many adverse outcomes for occupationally exposed individuals including but not limited to: contact dermatitis; deoxyribonucleic acid (DNA) damage; chromosomal abnormalities; fetal loss; infertility; preterm births; and an overall increase in one's personal risk for cancer (Polovich & Clark, 2012). Pregnant nurses are at particular risk for chemotherapy exposure and a recent study reports that hazardous drug exposure is associated with an increased risk of spontaneous abortion among oncology nurses (Lawson, et al., 2012). A survey of experienced and certified oncology nurses also suggests that although perceived risk of harm and knowledge of personal protective equipment was high, the total use of precautions was low (Polovich & Martin, 2011). A recent study that explored patterns of personal protective equipment use among oncology nurses, found

that those working in private practices were less likely to adhere to current safety guidelines than those employed elsewhere (Polovich & Martin, 2011).

In summary, the overarching goal of this practice dissertation was to explore nursing practices regarding the safe administration of chemotherapy and identify whether a knowledge deficit was present among outpatient oncology nurses. This information will then be used to develop recommendations for the site of interest that will provide insight into useful interventions to mitigate harm in the future. In order to provide the most successful long term intervention, an assessment of knowledge must be conducted to establish if a knowledge deficit exists so that a site-specific plan can be developed to increase adherence to current safety standards.

This project used an established survey to assess the knowledge of safe chemotherapy administration among oncology nurses employed by a large, multi-site cancer and hematology center that served a large metropolitan area. Collecting data from nurses working in various sites provided valuable information used to determine whether knowledge deficits existed and if they contributed to a lack of safe-handling precaution use. Results of this survey provided information to facilitate the collaborative development of an educational plan with organizational leaders to improve strategies and address deficits. In other words, once the survey identified the presence and degree of knowledge deficit the author had enough information to provide recommendations for a targeted intervention leading to a safer work environment in the future.

## CHAPTER 2

### LITERATURE REVIEW

The purpose of this chapter is to provide an integrative review of literature to facilitate the exploration of nursing practice related to the safe administration of chemotherapy and the identification of possible knowledge deficits. This review will describe the current understanding of chemotherapy safety in the workplace and how it corresponds to recommendations of current evidence. A major focus of this paper is to use the process of evidence-based practice to guide the development of recommendations to improve the safety of oncology nurses.

#### **Background**

Oncology nurses working in ambulatory settings pride themselves in their ability to protect their clients from unnecessary exposure to chemotherapy. However, many health care professionals have misconceptions of the extent of their own risk in this environment (Fuller, Bain, & Sperrazza, 2007). According to Fuller and colleagues, only 54% of surveyed nurses were aware of safe handling programs available in their workplace and only 30% of them actually read the information that was offered. This suggests a potential knowledge deficit and possible lack of compliance with the National Institute for Occupational Safety and Health (NIOSH) recommendations (Fuller et al., 2007) identifying a significant safety concern for employees of oncology centers who administer chemotherapy and the general public.

A lack of education and the inconvenience of safety equipment may prevent many nurses from taking appropriate precautions for themselves (Polovich & Eisenberg, 2009). In a study of inpatient and outpatient nurses, researchers found that only 31% wore protective gowns during the administration of chemotherapy despite the availability of personal protective equipment



(Martin & Larson, 2003). This study also suggests the enforcement of protective equipment use through means of medical surveillance is not occurring in a manner consistent with national recommendations.

In fact, recent studies suggest that although hazardous drug policies are in place in many workplaces, existing practices may not reflect current recommendations for safe chemotherapy handling and are not enforced or monitored by managerial staff (Polovich & Clark, 2012). The major issue of concern is that although these policies are in place and personal protective equipment (PPE) is available, nurses are not consistently taking appropriate action for their protection.

In a recent study of outpatient nurses, participants reported significant unintended skin and eye exposure to chemotherapy (Friese, et al., 2011). In this study, the author concludes that the overall rate of exposure decreases when nurses report adequate staffing and resources (2011). This implies that nurse-patient ratios and workplace demands contribute to the problem of mishandling chemotherapy. Therefore, these results implicate the need for adequate staffing and resources as well as increased staff compliance to established practice standards in order to better protect oncology nurses. Other contributing factors identified in system failures that result in an unsafe work environment include lack of awareness of personal and public risks of exposure, poor communication, and direct interruptions and/or distractions while preparing to administer medications (Ashley, et al., 2011).

Gaguski (2009) provides a clinically relevant intervention related to the development of a chemotherapy council. This council addresses delays in medication delivery and nurse unfamiliarity with certain regimens of therapy (2009). The intervention gives staff the opportunity to identify current safety concerns and contribute to potential breaches in standards

as well as provide an opportunity to evaluate present administration methods. This allows the council to develop an environment of shared governance that facilitates the development of team goals, identification of barriers to safe chemotherapy administration, areas needing improvement and prioritization of needs in the workplace (2009).

Other studies imply that lack of an appropriate education and lack of experience handling hazardous drugs also play a role in unnecessary chemotherapy exposure (Rizalar, Tural, & Altay, 2012). Recent literature suggests that an extensive review of comprehensive standards related to personal protective equipment and hazardous drug administration may be necessary to determine whether policies and regulations need to be updated to correspond with current evidence (Walton, et al., 2012). This includes the utilization of evidence-based practice to fulfill their commitment to safety in the workplace (2012). In this study, authors compared their institution's policy, determined areas of improvement and implemented necessary changes related to education, use of appropriate gloves and safe disposal of hazardous drugs (2012).

Significant misconceptions regarding the level of chemotherapy exposure and associated risks continue to affect the awareness of oncology nurses (Fuller, Bain, & Sperrazza, 2007). In fact, the actual implementation of safe-handling strategies is described to be low despite the accounts of nurses reporting high levels of knowledge, self-efficacy related to administration, and perceptions of harm related to chemotherapy exposure (Polovich & Clark, 2012). To enforce the use of recommended safe-handling techniques, medical surveillance may prove vital in the protection of oncology nurses. However, one survey reports that only 46% of outpatient and office-based sites maintain that they provide medical monitoring (Martin & Larson, 2003). This correlates with other research that suggests that although the use of protective equipment

and its availability has increased, medical surveillance is still not consistent with national guidelines (Polovich & Clark, 2012).

The scope of this practice problem outlines the need for more information regarding the outpatient incorporation of chemotherapy safe-handling practices. While several barriers may influence the unintended exposure to hazardous drugs, the presence of a knowledge deficit must first be documented and addressed prior to intervening further. This practice problem appears multi-factorial and current evidence must be reviewed to determine the best possible course of action.

## **The Review**

### **Project Aim**

The aim of this integrated review was to explore the state of evidence relative to safe chemotherapy administration in the outpatient setting as it applies to nursing knowledge and practice.

### **Objectives**

The objectives of this review were to (1) identify published accounts of safety interventions, surveys of knowledge, and risk factors for chemotherapy administering nurses; (2) conduct an appraisal of studies of safety interventions, surveys of knowledge, and risk factors; and (3) identify underlying themes in the studies that advance nursing knowledge of the application of safety techniques to oncology practice.

### **Design**

In order to explore the current state of knowledge relative to the safe handling of chemotherapy and to provide an appropriate integrated review of the literature, the five stages of Whittemore and Knafl (2005) were used. These stages include clear identification and

articulation of the problem; retrieval of relevant literature through a systematic search; evaluation and analysis of data using defined criteria; and presentation of the findings (Whittemore & Knafl, 2005). This review served as a framework for the organization of information throughout this paper. Similarly to a recent integrative review by Stubbings, Chaboyer and McMurray (2012) the headings were renamed to reflect common elements in the research process for clarity. In the initial review, the potential risk among oncology nurses who administer chemotherapy in outpatient settings was identified and relevant information was included. This information includes variables of interest, concept, target population, and the clinical problem (Stubbings, Chaboyer, & McMurray). In this case, the problem to be addressed by the integrative literature review has been identified as the utilization of chemotherapy safety techniques among oncology nurses.

### **Search Methods**

The literature search was conducted using the databases of PUBMED, PROQUEST and the Cumulative Index to Nursing and Allied Health (CINAHL). The university medical librarian was also utilized as a resource during the review. To gather information reflective of the current state of knowledge relative to the safe handling of chemotherapy, materials published earlier than 1990 were excluded from the search. This resulted in the inclusion of relevant data that represent the current state of science regarding this practice problem.

Key words utilized to yield results included: “oncology nursing safety,” “risks of chemotherapy exposure,” “chemotherapy safe handling,” “chemotherapy safety,” “chemotherapy competency,” “hazardous drugs and nurse safety,” “antineoplastic safety,” “chemotherapy protective equipment,” “occupational safety,” “hazardous drug exposure,” “medical monitoring of hazardous drug exposure,” “hazardous drug contamination,” “national chemotherapy safety

recommendations,” “national safety standards,” as well as “personal protective equipment guidelines.”

### **Search Outcome**

As in Whittmore and Knafl’s review (2005), data evaluation was performed on all articles collected as a result of the aforementioned search methods. Several articles were deemed irrelevant and removed following the evaluation. Studies were dismissed if the variables of interest, concept, target population and clinical problem were not applicable to the purpose of the review (Stubbings, Chaboyer, & McMurray, 2012). Literature was included if the articles were written in the English language and if they were qualitative, quantitative, mixed-method research or systematic reviews. Topics related to chemotherapy safety, safe-handling guidelines, personal protective equipment utilization and nursing knowledge were included if methodology was clear and framework appropriate.

### **Appraisal**

Using the five phases for integrative review (Whittemore & Knafl, 2005), the retrieved articles were appraised. Literature was included if findings contributed an understanding to the concept of chemotherapy safety among oncology nurses and if the methodology utilized was evidence based. Although five of the articles were descriptive studies and involved self-reporting surveys and telephone interviews, these were deemed appropriate due to their provision of extensive information that added to the existing body of knowledge regarding unnecessary exposure to chemotherapy. For this same reason, two systematic reviews of literature were also included. No randomized control trials were found in this review of evidence.

## **Data Abstraction and Synthesis**

To demonstrate data abstraction and synthesis, Whitemore and Knaff's (2005) process was used to develop a synthesis table of evidence. This table provided a summary for the purpose, design, sample, measurement tools and results of each retrieved study. Arranged in this way, the research was easier to interpret and compare historically. It also allowed the author to organize the data according to topic and to identify underlying themes. The established themes were utilized to further analyze the studies in the discussion of results.

## **Results**

Of the twenty articles reviewed, all identified staff safety as an objective of their study. Five of the studies evaluated oncology staff exposure to hazardous drugs (Connor, Anderson, Sessink, Broadfield, & Power, 1999; Connor, et al., 2010; McDiarmid, Oliver, Roth, Rogers, & Escalante, 2010; Sessink, Boer, Scheefhals, Anzion, & Bos, 1992; Vandenbroucke & Robays, 2001). Four used the collection of surface wipe samples to measure environmental contamination (Connor, et al., 1999; Connor et al., 2010; Sessink, et al., 1992; Vandenbroucke & Robays, 2001), while three collected urine specimens from healthcare workers to assess personnel exposure (Connor, et al., 2010; Sessink, et al., 1992; Vandenbroucke & Robays, 2001) and one study used air samples (Sessink, et al., 1992). Another study utilized blind fluorescent in situ hybridization (FISH) blood specimen analysis to determine the frequency of chromosomal abnormalities among healthcare workers (McDiarmid, et al., 2010) whereas a different study used gas chromatography and mass spectroscopy to determine if there is a difference in workplace contamination when comparing open and closed systems for the preparation of hazardous drugs (Vandenbroucke & Robays, 2001).

Of these five publications (Connor, et al., 1999; Connor et al., 2010; McDiarmid, et al., 2010; Sessink, et al., 1992; Vandembroucke & Robays, 2001), countries of origin were the Netherlands (N = 1), Germany (N = 1), USA (N = 2), and multinational Canada and USA (N = 1). Four studies assessed a sample of both nursing and pharmacy staff, while one study limited its population to only pharmacy personnel. Of the research that included nurses, samples sizes ranged from 25-121 healthcare workers. An additional USA publication, surveyed 1,339 nurses in the state of Michigan (Friese, Ferris, Frasier, McCullagh, & Griggs, 2012). This survey examined organizational structures and care processes that may be associated with hazardous drug exposure.

Four publications assessed safety, two of which sought to determine effective ways to prevent medication errors. One of these two articles reviewed handwritten and electronic medication orders (Gahndi, et al., 2005), while the other simulated rates of errors related to administration (White, et al., 2010). The remaining two studies sought to enhance the quality and safety of hazardous drug administration by using failure mode and effects analysis (Ashley, et al., 2011; Markert, Thierry, Kleber, Behrens, & Engelhardt, 2008). Of these studies, the countries of origin were Canada (N = 1), United Kingdom (N = 1), Germany (N = 1) and the USA (N = 1). Two of these utilized multidisciplinary teams, while the others strictly worked with a sample of oncology nurses. Of the research done with nurses, the sample size ranged from 10-13 participants.

Three studies evaluated the use of personal protective equipment among oncology nurses (Martin & Larson, 2003; Polovich & Martin, 2011; Rizalar, Tural, & Altay, 2012). Countries of origin were Turkey (N = 1) and the USA (N = 2). One of these articles also assessed the knowledge of national safety guidelines among participants (Polovich & Martin, 2011). All of

these researchers used various forms of questionnaires or mailed surveys to collect their data. The sample size ranged from 73-500 nurses.

Four of the twenty studies, evaluated knowledge and explored nursing perception of exposure risks. One study utilized focus groups and the application of content-analysis framework (Schwappach, Hochreutener, & Wernli, 2010), while another used a hazardous drug competency assessment with pre and post intervention surveys (Crannell, 2012). A third article utilized a hazardous drug questionnaire (Fuller, Bain, & Sperrazza, 2007), whereas another publication used both mailed surveys and telephone interviews (Polovich & Clark, 2012). Of these four studies, countries of origin were Switzerland (N = 1) and the USA (N = 3). All of them assessed samples of oncology nurses and nurse managers from both inpatient and outpatient cancer centers. Sample sizes ranged from 11-400 participants.

To add to the existing knowledge base for this concept of chemotherapy safety, two systematic reviews were included in the synthesis of evidence. One publication used a meta-analysis of 14 studies to determine whether oncology personnel are at risk for reproductive complications and other adverse outcomes (Dranitsaris, et al., 2005). A second review was conducted to develop a set of recommendations for the safe-handling of hazardous drugs in Canada (Green, et al., 2009). Researchers surveyed practitioners as well to approve recommendations once developed by the panel of experts. In addition to these reviews, a descriptive study that surveyed 44 cancer centers in the USA was also included. This survey assessed the actual implementation status of national chemotherapy administration safety standards (Weingart, et al., 2012).



## **Defining Themes**

The general findings of this integrative review were consistent across disciplines and revealed four fundamental themes. These include (1) the evaluation of hazardous drug exposure, (2) assessment of safety and the detection of medication errors, (3) the use of personal protective equipment and (4) nursing knowledge as it relates to the use of safe-handling precautions, national safety recommendations and the awareness of personal risk.

### **Hazardous Drug Exposure**

Unnecessary exposure to chemotherapy can occur through a variety of methods, including inhalation, skin contact and workplace contamination (McDiarmid, et al., 2010). This contamination occurs rapidly and is very difficult to eradicate once it exists (Vandenbroucke & Robays, 2001). This finding implies that oncology nurses are at risk for exposure and the safety threat may extend to the general public as well. In fact, Connor and colleagues (2010) found that despite the reported use of safety precautions, hazardous drug contamination is still present on surfaces in the workplace as well as in the urine of staff. These results are consistent with previous findings that hazardous drug contamination of the workplace is widespread despite the use of recommended safety measures and workers are at risk for unintentional exposure (Connor, et al., 1999; McDiarmid et al., 2010; Rizalar, Tural, & Altay, 2012; Sessink, et al., 1992).

By means of blood specimen analysis, McDiarmid and colleagues (2010) have established that the frequency of handling hazardous drugs directly correlates to the number of chromosomal abnormalities found in staff. Furthermore, nurses report a considerable amount of unintentional eye and skin contact when working with chemotherapy and identify that staffing and non-compliance to recognized practice standards may inhibit protection (Friese, et al., 2012).

Dranitsaris and colleagues (2005) have concluded that exposure to hazardous drugs is also associated with an increased risk of spontaneous abortions among female healthcare workers.

### **Safety Assessment**

A variety of safety assessments have been implemented to examine the quality and potential for errors in cancer treatment. Gandhi and colleagues (2005) have determined that the potential for serious patient harm is present after reviewing handwritten and computer-entered medication orders. This is consistent with other research that has identified a need for interventions to prevent errors in the chemotherapy process (Markert, et al., 2008; Ashley, et al., 2011; White, et al., 2010). These actions include the implementation of explicit checklists (White et al., 2010) and surveillance systems (Markert et al., 2008) to ensure medications are delivered without error to patients.

### **Personal Protective Equipment**

Unfortunately, employers do not consistently have appropriate protective equipment available for staff use when handling chemotherapy (Polovich & Martin, 2011). However, it has been implied that nurses are not fully compliant with safe-handling rules and regulations in terms of personal protective equipment use (Rizalar, Tural, & Altay, 2012) and major concerns still exist in regard to the management of chemotherapy spills (Martin & Larson, 2003). Additionally, Martin and Polovich (2003) have found that medical monitoring is not consistent with the Occupational Health and Safety Administration's guidelines. Of 44 cancer centers surveyed, only 4 report the full implementation of hazardous drug safety standards as recommended by the Oncology Nursing Society and American Society of Clinical Oncology (Weingart et al., 2012).

## **Knowledge**

Fuller, Bain, and Sperrazza concluded that there are significant misconceptions regarding the hazards of unintentional chemotherapy exposure (2007). According to Polovich and Clark (2012), self-efficacy for the use of personal protective equipment is high as well as the perceived risk of harm among oncology nurses. Despite these findings, the actual utilization of safe-handling techniques is still reported to be quite low (Polovich & Clark, 2012). When studied, nurses report considerable variations regarding barriers to the safe administration of chemotherapy (Schwappach, Hochreutener, & Wernli, 2010). Additionally, while safe-handling policies are often present, many are outdated and few managers consistently monitor the use of hazardous drug precautions in the workplace (Polovich & Clark, 2012). Furthermore, it has been found that nurses lack awareness of current safety guidelines (Polovich & Martin, 2011). This literature review identifies gaps that suggest research is lacking in regard to the knowledge of oncology nurses and specific barriers to the safe-handling of chemotherapy (Martin & Larson, 2013).

## **Summary**

This literature review suggests that hazardous drug exposure and workplace contamination is occurring despite the reported use of safe-handling precautions. This brings attention to national safety concerns and discrepancies within current oncology practices. Evidence further supports the assumption that a knowledge deficit may be present among oncology nurses in regard to the safe administration of chemotherapeutic agents. Conclusions from this review suggest there are gaps in practice relative to chemotherapy safety. The reviewed literature has been categorized into four common themes that include: the evaluation of hazardous drug exposure; the assessment of safety; the use of personal protective equipment; and

the measurement of knowledge. This literature review based on Whitemore and Knaf's (2005) framework has facilitated the establishment of a scientific foundation for the selected practice problem and serves as an important aid in the exploration of oncology nursing practice and the identification of potential knowledge deficits.

## CHAPTER 3

### CONCEPTUAL FRAMEWORK

The purpose of this chapter is to explore the conceptual basis for the development, implementation, and evaluation of this practice inquiry. To examine healthcare services and assess quality of care, Donabedian's theoretical framework was employed to drive the intervention. Donabedian's model initially focused on the evaluation of patient care (Donabedian, 2005) but his later work provided a more comprehensive examination of healthcare quality (1990) and even the application of science and technology (1993). The chief elements of his model include the assessment of structures, processes and outcomes. Exploring these components of Donabedian's framework is imperative to exploring oncology nurse practices associated with the safe-handling of chemotherapeutic agents.

According to Donabedian, the concept of structure is associated with the organizational properties of the physical healthcare setting. This involves elements that include workplace supplies, human resources, management and the mission and values of the organization. As it relates to nursing and chemotherapy safety, Donabedian's structure highlights features that are linked to the outpatient oncology clinic such as leadership, skill and knowledge levels of personnel, existence of workplace distractions, staffing ratios and patient population. In this case, the structure also involves the presence and availability of material supplies related to the safe administration of chemotherapy including personal protective equipment, hazardous waste containers and spill kits.

Donabedian's concept of process is associated with the actual service being provided in the healthcare setting or the main variable of interest. This represents the intervention that has an impact on outcomes. In this case, it is the physical handling of chemotherapeutic agents by

outpatient oncology nurses. Process as defined by Donabedian, involves various policies and procedures related to nursing safety when performing this task. It incorporates the implementation of evidence-based practice guidelines and the enforcement of any standards or recommendations aimed at increasing nurse safety when administering chemotherapy and the management of this issue. If chief structural components do not support the aims of the process or are lacking altogether, outcomes will be adversely affected. The application of Donabedian's model in this case suggests the main objective of quality improvement is to perfect the concepts of structure and process in order to mitigate the risk of adverse effects related to the mishandling of chemotherapeutic agents.

Conceptually, outcome is the end product of both the structure and process. Therefore, a favorable outcome would be associated with supporting structures and processes, while adverse outcomes may be linked to poor components or the failure to be compliant. While evaluating outcomes, one must always account for external influencing variables including those that may arise from society (Donabedian, Wheeler & Wyszewianski, 1982; Donabedian, 1996). That is, contributing factors outside the intervention that may manipulate outcomes, like the availability of material resources, financial affairs, conflicts of interest and the culture of safety in the outpatient oncology clinic. The assessment of outcomes is crucial to prevent the undesirable effects associated with the mishandling of chemotherapy by nurses. These events may include workplace contamination and the unnecessary chemotherapy exposure of staff and the general public with accompanying biological consequences.

Donabedian's model provides a methodical basis for the examination of the structure, process and outcomes that are fundamental to the provision of safe, quality cancer care and the establishing of opportunities to mitigate superfluous risks related to the mishandling of

chemotherapy in the outpatient environment. Donabedian's model facilitated the driving of the intervention of this practice inquiry, however, the use of multiple perspectives are important to guide the process of knowledge translation (Estabrooks, Thompson, Lovely & Hofmeyer, 2006) so the PARIHS (Promoting Action on Research Implementation in Health Services) framework was also utilized.

The PARIHS framework was employed to drive the implementation phase of this practice inquiry. In order to successfully implement evidence to practice, knowledge gaps must first be identified (Kitson & Straus, 2010). Within this framework, successful implementation occurs as a function of evidence, the context of the evidence, and the facilitation of the process (Kitson, Rycroft-Malone, Harvey, McCormack, Seers & Titchen, 2008). This model was originally formulated as a result of practice development, quality improvement, and research work, although it has been refined over time to assess validity (Melnyk & Fineout-Overholt, 2011). The main components of this model include evidence, context and facilitation.

This model involves evidence retrieved from research, clinical experience, patient and caregiver experience, and local context (Melnyk & Fineout-Overholt, 2011). Relevant evidence for the purpose of this practice inquiry may involve clinical research regarding hazards of exposure to chemotherapeutic agents, safety assessments of oncology nursing knowledge and skill sets, and recognized chemotherapy handling guidelines and recommendations. Important local information to obtain includes workplace policies and procedures of the outpatient oncology clinic.

The contextual element refers to the specific setting in which the proposed intervention is to be implemented (Melnyk & Fineout-Overholt, 2011). This environment is an outpatient oncology clinic in a metropolitan area with multiple regional clinics. The culture of safety,

characteristics of leadership and methods of workplace evaluation in this site will affect the context. Settings that have “transformational leaders, features of learning organizations, and appropriate monitoring, evaluative, and feedback mechanisms” are more effective in providing the context for the successful implementation of evidence than others without these key attributes (Kitson et al., 2008).

Facilitation is the process that enables the transition from evidence into practice (Melnik & Fineout-Overholt, 2011). Facilitators often depend on the institution of interest as well as the individuals and context involved. This phase of the model is conducted by individuals with appropriate skills and knowledge to assist the application of evidence into practice. It is important for these facilitators to be flexible so they are capable of adjusting their role as needed during the various stages of implementation. These individuals also evaluate the elements of evidence and context to assess the current state of the organization and its readiness for change (Kitsen et al., 2008).

The PARiHS framework identifies elements that may warrant attention throughout the implementation phase and acts as a reliable instrument during and at the conclusion of the practice project to evaluate progress and outcomes. This framework provides a conceptual basis for which the evidence, contextual setting, and potential facilitators can be reviewed in regard to the safe handling practices of outpatient oncology nurses to guide the successful translation of evidence.



## CHAPTER 4

### METHODS

The purpose of this chapter is to delineate the project plan, identify methodology and timeline, as well as explore potential outcomes. Additionally, an in-depth examination of the target population, instrument of measurement, and procedures of this practice dissertation will ensue. Throughout the development of this practice project, communication with key stakeholders has occurred to facilitate the identification of potential barriers and to enhance the acceptance of the intervention.

#### **Design**

In order to collect data for this practice project, an established survey instrument was selected to gather information directly from respondents. The survey method is a common and effective approach to gathering data relative to experience, perceptions, attitudes and behaviors.

#### **Sample**

Participants for this intervention included all registered nurses who administer chemotherapy for a large cancer and hematology center at one of its multiple ambulatory clinics. The inclusion criterion for participation included current full and or part time employment at the organization, licensure as a registered nurse, working in a position that includes chemotherapy preparation, administration, disposal, and or potential exposure to contaminated patient excrements via the emptying of bedpans, urinals or emesis basins. Registered nurses who had not yet completed their orientation at the time of project implementation and were practicing under the instruction of a mentor were excluded from participating in the study.

## **Terminology**

For the purposes of this practice project, administration of chemotherapy was defined as the dispensing of medication to patients via intravenous, intramuscular, subcutaneous, or enteral routes. Disposal was distinguished as the discarding of all paraphernalia associated with the preparation or administration of chemotherapy. It should be noted that pharmacy personnel prepare all chemotherapy at the organization of interest. While the implemented survey collected data regarding the preparation of chemotherapy it was not applicable to the oncology nurses that chose to participate.

## **Organizational Assessment**

The location for this project was a large, ambulatory cancer and hematology center in a Midwestern city. This organization is made up of six satellite clinics that provide outpatient oncology treatment for adults in both rural and urban settings. The location was chosen based on its convenient location and its association with the topic of interest. Treatment services are provided for a variety of oncology and hematology diseases by a number of specialists and sub-specialists. The team consists of 21 physicians, 9 nurse practitioners, 10 physician assistants and 68 registered nurses. Within the organization there are also a number of medical assistants, social workers, financial coordinators, lab technicians, pharmacists, dieticians and front office staff. Members of this group work collaboratively to meet the demanding needs of their patients. In addition to this, the organization has partnered with multiple local hospitals and healthcare providers to facilitate better transitions of care.

## **Procedures**

A packet that included a color-coded survey as well as a postage-paid, return envelope was mailed to the home address of all staffed registered nurses (N = 68). The survey was color-

coded based on the participants' primary site worked allowing for further analysis of responses and comparison among clinics. Participation was entirely voluntary and involved no out-of-pocket expenses. The surveyed nurses were informed that they could opt out at any time without penalty.

Participants were instructed to return the survey to the university address of the dissertation chairperson within two weeks of its receipt. No personal identifying data were collected and data were only reported in aggregates. It should also be noted that demographic items (i.e. gender or ethnicity) that allowed for the indirect identification of a participant were removed from the survey prior to its distribution.

In employing this self-administered, mailed survey, the sample was not restricted in size or to a specific geographic location. This also allowed for the completion of the survey in one's own home where respondents may provide more accurate and comprehensive information on a potentially sensitive topic. Mailed surveys are also reportedly easier to implement than other means of gaining information and require fewer personnel to put into action (Bourque & Fielder, 2003). Applying the survey in this way allowed for consistent stimuli among participants and the potential to study a widely represented sample (2003).

According to Bourque and Fielder, a single mailing questionnaire will likely produce a response rate no greater than 20% of the sample (2003). However, mailed surveys produce better responses than those conducted online, although they are still lower than telephone and in-person interviews. To increase the response rate for this study, initial contact was made with the participants to thank them for their participation and to make them aware that a parcel was to be mailed to them as outlined earlier in this chapter.

For the purposes of this practice inquiry a response rate of 30% was desired. After the initial mailing a response rate of 29% was obtained. At this time the Dillman method was employed to increase the return rate of the surveys (Hoddinott & Bass, 1986). An additional packet was again sent to all participants to maintain privacy and confidentiality. This parcel contained an additional copy of the color-coded survey and a letter to follow up with all participants to address questions or concerns, encourage them to submit their surveys if they had not already done so, and thank them again for their participation. After the second mailing the overall response rate increased to 53% and was deemed acceptable for the purposes of this project. Demographic data was monitored closely to ensure no duplicate surveys had been submitted.

### **Implementation**

This project was implemented using an established survey. Average completion time for the survey was approximately 20-30 minutes. This tool was used to evaluate the knowledge of safe chemotherapy administration among outpatient oncology nurses employed by a large, multi-site cancer and hematology center. In collaboration with this organization's administrative staff, a list of the number of nurses working at each site was obtained. To maintain privacy and confidentiality, all correspondence and communication from the project manager was sent via the organization's human resources staff. Approximately one week prior to mailing out the surveys, an information letter was sent to nursing staff to inform them that they would soon receive a parcel by mail and to explain the goals of the project. At that time, the project manager's contact information was provided so that participants could contact the manager directly with any questions or concerns.

Facilitators of this practice project included the active participation of administrative staff who were willing to allow the use of their organization as a project site. Permission was granted to utilize a user-friendly, established survey that has been previously deemed both reliable and valid. With permission from Dr. McCullagh to adapt her Farmers Social Norms and Social Modeling scales, Dr. Polovich developed the aforementioned survey to further explore chemotherapy safety among nurses (Polovich & Clark, 2012). Permission was granted by both of these experts to employ the survey in its entirety for the purposes of this project (M. McCullagh, personal communication, April 4, 2014, M. Polovich, personal communication, March 26, 2014).

The survey utilized in this intervention was developed in 2003 and consisted of twenty questions on chemotherapy handling. The tool was then revised in 2011 and again in 2012 to remain consistent with changing guidelines. The survey as implemented for this project included questions to represent the following scales: exposure knowledge, self-efficacy for using PPE, barriers to using PPE, perceived risk of chemotherapy exposure, workplace safety climate, conflict of interest, interpersonal norms and interpersonal modeling. The most recent revision was utilized for the purpose of this study with reliability and validity previously confirmed via testing by its author, Dr. Martha Polovich (M. Polovich, personal communication, April 12, 2014).

Content validity for the *Chemotherapy Handling Questionnaire* was assessed using a universal agreement method whereby three nurses with experience in chemotherapy administration and occupational safety described common practices related to chemotherapy handling (M. Polovich, personal communication, April 12, 2014). The evaluation scale ultimately included options of four responses dichotomized from “relevant” to “not relevant.”

Several items were modified after the first appraisal due to low content validity index. During the second evaluation all items had a content validity index of 1.0 which is appropriate when less than five experts assess an instrument. For reliability, Dr. Polovich constructed a pilot study using a non-random sample of 20 oncology nurses who completed the survey on two separate occasions, two weeks apart. Cronbach's alpha was calculated for each scale represented in the survey and ranged from .70-.925 (M. Polovich, personal communication, April 12, 2014). In social science research situations, a value of .70 or higher is considered satisfactory or good (Tavakol & Dennick, 2011).

Statistical values reported for the *Chemotherapy Handling Questionnaire* include: sample size, scale range, observed range, mean and standard deviation for each of the scales previously mentioned. Additionally, the mean and standard deviation for nurses' use of safety precautions when handling chemotherapy were also noted. This data was not recorded for each clinic due to the low response rate of some locations. To maintain the privacy and confidentiality of the participants that did respond, data was only analyzed for the entire sample.

To assure accuracy, double data entry was performed and data were compared. Errors were corrected prior to analysis. Spearman's rank correlation coefficient was calculated to evaluate relationships between participant demographics, survey variables and the overall use of chemotherapy safe-handling precautions. A significance value of 0.05 was used for all data analysis.

After analysis, the results of the survey were communicated to key stakeholders so that an action plan could be collaboratively discussed to improve nursing safety associated with the safe administration of chemotherapy. Potential outcomes include educational interventions resembling mandatory in-services, competency testing and/or the development of a

chemotherapy safety council. Dependent upon the goals of the organization, outcomes may consist of workplace alterations (i.e. minimizing distractions) and/or modifications to chemotherapy safe-handling policies. Program and process evaluation occurred throughout the project to establish a foundation for future efforts and the results of the survey have encouraged the course of action.

The timeline for the project was developed to allow maximum participation from respondents. This involved four months with ample time to distribute the survey in two mailings and allow the return of complete responses. Issues commonly associated with surveys were identified and a second mailing was required to obtain an adequate response rate. Program and process evaluation as well as the ongoing development of recommendations for an action plan occurred throughout the implementation of the practice project.

Project barriers to implementation were recognized and included the expenses associated with mailing surveys, although these costs are actually 50% less than those associated with in-person or telephone interviews (Bourque & Fielder, 2003). Barriers may have also included a fear of being associated with the results, especially since the information was obtained with the assistance of the participants' employer. Another disadvantage of a mailed survey is that it is self-administered and an obvious lack of control exists over who responds. Therefore, the survey must stand alone. Mailed surveys are reportedly notorious for having low response rates as well, especially with no offered incentives.

### **Evaluation**

In summary, the *Chemotherapy Handling Questionnaire* proved to be a usable method to collect data on nursing practice and establish their behavior and attitudes regarding safe chemotherapy administration in an outpatient, Midwest oncology clinic. Indicators that

determine the success of the project included a good response rate and the return of several complete surveys. The survey facilitated the capturing of a large portion of the sample population (53%) when the desired response rate was 30%. The level of responses in this practice project far exceeded expectations suggesting the successful utilization of the survey to assess the nursing perceptions of chemotherapy administration and PPE use in this practice setting.



## CHAPTER 5

### RESULTS

The purpose of this chapter is to describe the results obtained from the *Chemotherapy Handling Questionnaire* developed by Dr. Martha Polovich (2012) and distributed to registered nurses employed by a multi-centered, outpatient chemotherapy clinic. This survey assessed personal demographics of respondents related to the practice of nursing as well as individual practices and behaviors linked to the administration of chemotherapeutic agents in the outpatient setting. The organization of interest has multiple satellite clinics that were contacted to collect data for the purposes of this practice inquiry.

#### **Responses**

A total of 40 completed surveys were returned from an eligible population of 68 registered nurses employed by one of six satellite clinics. The initial mailing yielded 20 completed surveys with a response rate of 29%. Three weeks later, a second survey was mailed and an additional 16 surveys were returned for a total response rate of 53%. Four completed surveys were returned after the established deadline and were not included in final tabulations. Among respondents, 15 of the returned surveys were from Clinic A (51.2% of those surveyed from this location); 8 surveys from Clinic B (72.7% of those surveyed); 6 from Clinic C (66.7% of those surveyed); 5 from Clinic D (45.5% of those surveyed); 1 from Clinic E (20% of those surveyed) and 1 from Clinic F (33.3%). All participants reported that their position required they handle chemotherapy via administration, chemotherapy disposal or the handling of potentially contaminated excreta.

For clarity, survey responses were categorized into four main topics: descriptive characteristics of the sample; results of the survey by scales (self-efficacy for using personal

protective equipment, perceived barriers, perceived risk, interpersonal modeling, interpersonal norms, conflict of interest and workplace safety climate); frequency of use of safe-handling precautions during select activities required during chemotherapy administration, and significant relationships established among variables.

### **Missing Data**

To address missing data, a formula for single-value, personal mean imputation was utilized. A missing data method was necessary to support the accuracy and completeness of individual responses that were missing at random (Osborne, 2013). Since empirical evidence verifying the randomness of missing data may be difficult to obtain, researchers often have to explore potential causes to justify whether the data is indeed random (Pigott, 2001). Possible explanations for individual missing data in this study may include: less involved staff; little interest in the topic of chemotherapy safe-handling; confusing survey items; controversial questions regarding one's place of employment; fear of identification; individual survey questions did not apply to the respondent; and/or respondents wished to remain neutral when it was not an option.

According to Osborne (2013), if 20% or more of a participant's response is missing, substituting scores for such a large portion of their individual data can artificially reduce the overall variance of the variable within the study. Thus, if 20% or greater of a participant's response for a given scale was missing, a mean was not imputed and the data were not utilized for scoring purposes for that particular variable. However, if at least 80% of the scale responses were available, the participants' personal scores were averaged to impute a mean that replaced the missing data.

Within the study, the survey scales that assessed the participants' perception of risk, interpersonal modeling, interpersonal norms, and conflict of interest had no missing data. Two participants missed questions on the chemotherapy knowledge scale that were averaged and imputed. Two participants missed questions regarding their self-efficacy for PPE use, while one nurse did not complete the scale in its entirety. Thus, the latter data was not utilized for scoring purposes and only two personal averages were imputed for the self-efficacy scale. Three participants' responses were replaced for the perceived barriers scale and one participant's response was imputed for the scale that measured the climate of workplace safety for the organization of interest.

### Characteristics of the Sample

Table 1 <i>Sample Characteristics</i>		
	<i>M</i>	<i>SD</i>
Age (years)	44.0	14.0
Experience (years)		
Nursing	19.0	13.4
Oncology	14.0	10.1
	<i>M</i>	<i>Mdn</i>
Treatment Volume Patients per nurse per day	10.0	10.0
	<i>%</i>	<i>N</i>
Education		
Diploma	8.3	3
Associate's degree	19.4	7
Bachelor's degree	63.9	23
Master's degree	8.3	3
<i>Note.</i> <i>Mdn</i> – median, <i>SD</i> – standard deviation, <i>M</i> - mean, % - percent		

Overall, respondents reported considerable experience as registered nurses as well as experience in oncology and the administration of chemotherapy. Most participants were middle-

aged (range = 25-68,  $SD = 14$ ) with an average age of 44 years. Responses were received from all six of the organization's clinics in varying geographic locations within the Midwestern state. The majority of nurses had earned the designation of Oncology Certified Nurse (OCN) (80.6%) and reported that they were a member of the Oncology Nursing Society (ONS) (69.4%). Of the 36 respondents, 33 were also ONS certified to administer chemotherapy and biotherapy (91.7%). Most staff typically worked 10 hour days and the average case load managed per day for chemotherapy treatment was 10.0 (range = 5-12,  $SD = 1.84$ ). Table 1 summarizes the descriptive statistics for characteristics of the sample population.

### **Descriptive Statistics for Survey Scales**

Table 2 displays the descriptive statistics for each of the scales present in the *Chemotherapy Handling Questionnaire* that were utilized for the purposes of this project. In regard to chemotherapy exposure knowledge, the item most often answered incorrectly (22 out of 36 nurses, 61.1%) was "A surgical mask provides protection from chemotherapy aerosols" (correct answer: false). "Chemotherapy can more easily enter the body through damaged skin" (correct answer: true) was answered incorrectly by seven nurses (19.4%) and "Alcohol hand sanitizer is as effective as soap and water in removing chemotherapy residue" (correct answer: false) was answered incorrectly by eight participants (22.2%). In contrast, seven participants answered all items correctly (19.4%), while 13 answered only one question wrong (36.1%), and 10 nurses answered two items incorrectly (27.8%). In general, nurses were knowledgeable about chemotherapy exposure as they averaged 10 correct of the 12 items on this portion of the survey earning higher scores, indicating higher levels of knowledge.

Nurses reported moderate levels of both self-efficacy ( $M = 15.6$ , possible range = 7-28) for using personal protective equipment (PPE) and perceived barriers ( $M = 25.2$ , possible range

= 13-52) to PPE use for safe chemotherapy administration. On these portions of the survey, higher scores suggest higher levels of both self-efficacy and perceived barriers to PPE use. In regard to perceived barriers, items with the highest ratings were related to PPE being unavailable, the lack of a policy that requires PPE use, nurses feeling too hot when wearing PPE, and coworkers observed not using personal protective equipment. Participants identified the difficulty in obtaining chemotherapy-designated PPE as an additional barrier to their use of safety precautions.

Variable	<i>M</i>	<i>SD</i>	Observed Range	Possible Range
Chemotherapy exposure knowledge (N = 36)	10.4	1.4	5 - 12	0 - 12
Self-efficacy for using PPE (N = 35)	15.6	4.0	8 - 23	7 - 28
Perceived barriers (N = 35)	25.2	8.3	13 - 41	13 - 52
Perceived risk (N = 36)	1.9	0.6	1 - 4	1 - 4
Interpersonal modeling (N = 35)	2.8	0.6	0 - 3	0 - 3
Interpersonal norms (N = 35)	1.7	0.4	0 - 2	0 - 2
Conflict of interest (N = 36)	10.7	3.5	6 - 17	6 - 24
Workplace safety climate (N = 36)	70.4	15.6	32 - 102	21 - 105

In regard to perceived risks, Table 2 displays a lower average suggesting this sample of nurses perceives a low risk of harm from chemotherapy exposure. Nurses also reported a low conflict of interest between the need to protect themselves and at the same time care for patients while handling chemotherapy. This is evidenced by lower scores on this section of the survey suggesting lower levels of conflict of interest. Conflict of interest items with the highest scores were associated with the inability to meet patient needs when using safe-handling precautions and that patient care and associated interruptions interfere with the ability to comply with the use of precautions. In addition to these items, participants often perceived that wearing PPE made their patients feel uncomfortable.

High average scores for the interpersonal scales (see Table 2) suggest that nurses perceived that in general coworkers valued and used safety precautions when handling chemotherapy. However, nurses reported only moderate scores for the scale of workplace safety climate and the variability among answers was quite high ( $SD = 15.6$ ), suggesting opinions on the climate of safety within the workplace vary considerably. For this scale, higher scores indicate perceptions of a better safety climate, therefore the items with the lowest scores were examined to assess the participant's concerns with the organization's climate of safety. The items with the lowest scores were associated with limited accessibility to chemotherapy gloves in the work area; conflict within the work area; minimal support from members of the work area; a lack of open communication between supervisors and staff; and some nurses reporting they are not expected to comply with safe-handling policies and procedures within the work area.

### Frequency of Use of Safe-Handling Precautions

Table 3 describes the frequency of precaution usage reported by nurses when handling chemotherapy during various activities including administration, disposal, and the handling of excreta. No participants reported that they prepare chemotherapy ( $N = 0$ ) so these data were omitted from the table. The reported use of chemotherapy-designated gloves was high and reported gown use was low for all of the handling activities. Double gloving, the use of eye protection and respirators were reported as rarely used by participants from this organization. Overall reported precaution use was highest for the handling of contaminated excreta and disposal of chemotherapy ( $M = 1.2, SD = 0.8, M = 1.2, SD = 0.7$ ) and slightly lower for the administration of chemotherapy ( $M = 1.1, SD = 0.8$ ).

	Administration (N = 33)		Disposal (N = 34)		Handling Excreta (N = 28)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Gloves (chemotherapy- designated)	3.7	2.0	4.1	1.8	4.1	1.8
Double Gloves	0.5	1.3	0.4	1.1	0.2	0.8
Gowns	0.9	1.9	1.4	2.2	1.8	2.3
Eye Protection	0.3	0.9	0.1	0.2	0.2	1.0
Respirator	0.2	0.7	0.0	0.2	0.2	1.0
Overall Precaution Use	1.1	0.8	1.2	0.7	1.2	0.8

*Note.* Response options were 0 = never, 1 = 1%-25% of the time, 2 = 26%-50%, 3 = 51%-75%, 4 = 76%-99%, 5 = always.

## Relationships among Variables

Spearman's rank correlation coefficients ( $r_s$ ) were calculated to evaluate relationships between scale variables, nurse demographics and the overall use of safe-handling precautions

Table 4  
*Spearman's Correlation Coefficients ( $r_s$ ) among Scale Variables, Nurse Demographics and Use of Safe-Handling Precautions*

	Age (N = 35)	Nursing Experience (years) (N = 35)	Oncology Experience (years) (N = 35)	Education (N = 36)	Treatment Volume (per nurse per day) (N = 36)
Chemotherapy exposure knowledge (N = 36)	0.29 (.09)	0.23 (.12)	0.15 (.40)	0.0 (1.0)	0.14 (.41)
Self-efficacy for using PPE (N = 35)	-0.22 (.21)	-0.18 (.29)	-0.14 (.42)	-0.08 (.64)	-0.44**
Perceived barriers (N = 35)	-0.12 (.28)	-0.12 (.49)	-0.20 (.25)	-0.14 (.41)	0.32 (.06)
Perceived risk (N = 36)	0.04 (.82)	0.12 (.48)	0.06 (.75)	-0.02 (.89)	-0.08 (.64)
Interpersonal modeling (N = 35)	0.08 (.66)	-0.02 (.92)	-0.02 (.91)	0.12 (.50)	-0.08 (.65)
Interpersonal norms (N = 35)	0.10 (.57)	-0.02 (.92)	0.01 (.93)	0.07 (.68)	-0.28 (.10)
Conflict of interest (N = 36)	0.10 (.59)	0.06 (.74)	0.06 (.73)	-0.29 (.09)	0.37* (.03)
Workplace safety climate (N = 36)	0.20 (.25)	0.14 (.44)	0.14 (.43)	-0.05 (.76)	-0.21 (.21)
Overall precaution use (N = 33)	0.14 (.43)	-0.24 (.16)	-0.36* (.04)	0.17 (.34)	0.11 (.53)

*Note.* For each calculation the lesser N was used as the testing required matched pairs. Corresponding  $p$  values are denoted in parentheses after each coefficient.  
(\*  $p < 0.05$ ; \*\*  $p < 0.01$ )



(see Tables 4 and 5). Statistically significant correlations of varying strengths ( $p < 0.05$  and  $p < 0.01$ ) were found between several of the sample traits and scale variables. An inverse relationship was found between years of oncology experience and the overall use of safety precautions. That is, the more years of oncology experience nurses had, the less likely they were to use personal protective equipment ( $r_s = -0.36, p = .04$ ). Higher treatment volume was affiliated with lower levels of self-efficacy for PPE use ( $r_s = -0.44, p = .01$ ) and an increase in perceived conflicts of interest between PPE use and the provision of patient care ( $r_s = 0.37, p = .03$ ). Overall precaution use was not associated with age, education, treatment volume or years of nursing experience.

The potential relationships among scale variables and the overall use of safety precautions were also examined using Spearman's rank correlation coefficient. Chemotherapy exposure knowledge and perception of exposure risks were not significantly associated with any other variable. Higher perceived barriers and conflicts of interest were related to lower levels of self-efficacy for the use of PPE ( $r_s = -0.66, r_s = -0.46$ ) and lower safety climate scores ( $r_s = -0.76, r_s = -0.44$ ). Higher levels of self-efficacy were associated with perceptions of a better workplace safety climate ( $r_s = 0.80, p < 0.01$ ).

Higher conflict of interest scores were associated with increased perceived barriers to PPE use and more negative interpersonal influences ( $r_s = 0.70, r_s = -0.42, r_s = -0.39$ ). Positive interpersonal norms for PPE were associated with a better climate of safety ( $r_s = 0.71, p < 0.01$ ) as well as more positive interpersonal modeling ( $r_s = 0.64, p < 0.01$ ). Of the scale variables included in the survey, only interpersonal modeling was associated with total precaution use. Positive interpersonal modeling was related to an increased overall use of chemotherapy safety precautions ( $r_s = 0.41, p = .02$ ).

Seven participants provided answers to the final open-ended survey question that solicited ideas for chemotherapy safety practice improvement. Three responses described access issues to appropriate PPE, specifically disposable gowns; two reported concerns related to environmental safety and the cleaning of workstations and equipment; and two identified a need for further education and training.

Findings from the *Chemotherapy Handling Questionnaire* point to important discrepancies and gaps in practice related to nursing perceptions of chemotherapy safety and PPE use. Although nurses reported higher levels of exposure knowledge and moderate levels of self-efficacy for using personal protective equipment, they perceived low risks of harm from chemotherapy exposure and the overall reported use of precautions was low. Results also suggest moderate levels of perceived barriers and participants only scored their organization moderately (with wide variation in responses) for workplace safety. In summary, the *Chemotherapy Handling Questionnaire* revealed multiple opportunities for quality improvement and mitigation of safety hazards in the outpatient workplace. The survey proved to be an integral part of the environmental assessment and has the potential to contribute to future work in order to improve the quality and safety of chemotherapy administration.

Table 5

*Spearman's Correlation Coefficients ( $r_s$ ) among Scale Variables and Nurses' Use of Safe-Handling Precautions*

	Chemotherapy exposure knowledge (N = 36)	Self-efficacy for using PPE	Perceived barriers	Perceived risk	Conflict of interest	Interpersonal norms	Interpersonal modeling	Workplace safety climate
Self-efficacy for using PPE (N = 35)	0.09 (.63)							
Perceived barriers (N = 35)	0.09 (.59)	-0.66**						
Perceived risk (N = 36)	0.03 (.86)	-0.01 (.94)	0.14 (.42)					
Conflict of interest (N = 36)	0.27 (.11)	-0.46**	0.70**	0.12 (.49)				
Interpersonal norms (N = 35)	0.11 (.52)	0.11 (.53)	0.17 (.33)	-0.06 (.75)	-0.42**			
Interpersonal modeling (N = 35)	0.14 (.43)	0.21 (.23)	0.11 (.53)	-0.03 (.87)	-0.39* (.02)	0.64**		
Workplace safety climate (N = 36)	0.11 (.52)	0.80**	-0.76**	-0.02 (.93)	-0.44**	0.71**	0.46**	
Overall precaution use (N = 33)	0.09 (.61)	-0.06 (.75)	-0.12 (.49)	0.04 (.84)	0.04 (.83)	0.15 (.42)	0.41* (.02)	-0.20 (.26)

*Note.* For each calculation the lesser N was used as the testing required matched pairs. Corresponding  $p$  values are denoted in parentheses after each coefficient. (\*  $p < 0.05$ ; \*\*  $p < 0.01$ )

## CHAPTER 6

### DISCUSSION

The purpose of this chapter is to provide a discussion of results obtained from the implementation of the *Chemotherapy Handling Questionnaire* (Polovich, 2012) in a large, outpatient oncology practice with multiple satellite clinics. Additionally, this chapter will highlight the role of the DNP-prepared clinician as it relates to the application of this practice improvement process.

#### **Application of Findings to Existing Evidence**

Although the toxicity of chemotherapeutic agents is well documented, the nurses that participated in this survey reported a low overall use of safety precautions when administering chemotherapy. These findings are consistent with previous literature as they reinforce that recommended practices are not always followed, despite the availability of safety guidelines developed by professional practice organizations (Boiano, Steege & Sweeney, 2014; Martin & Larson, 2003; Polovich & Clark, 2012; Polovich & Eisenburg, 2009).

Consistent with other findings in the literature, the use of double gloving, eye protection and respirators were rarely used by respondents of this oncology group. These findings are similar to those of a recent National Institute for Occupational Safety and Health (NIOSH) study where 80% of nurses reported they do not always use the recommended two pairs of gloves when handling chemotherapy (Marcus, 2014). In the 2014 NIOSH study, nurses cited the use of personal protective equipment (PPE) was not required as part of their protocol or always provided by their employer (2014). This is also consistent with the findings of this dissertation inquiry as participants reported barriers to using safety precautions that included unavailability of PPE; difficulty in obtaining chemotherapy-designated PPE; the lack of a policy that required its

use; nurses feeling physically uncomfortable (too hot) when wearing PPE; and coworkers around them not using protective equipment.

Although the samples are unequal, the examination of Polovich's previous research is important for this inquiry as the same instrument of measurement was utilized and some comparisons can be made. Polovich implemented this tool in a national sample consisting of Oncology Nursing Society members. For this project the instrument was used in a single organization at each of its clinical sites. Despite the differences among size and sampling of the cohorts, certain similarities were observed. The characteristics of the current sample were comparable when reviewing the average age and years of experience of the cohort studied by Polovich and Clark (2012).

In Polovich and Clark's study (2012), nurses reported high levels of exposure knowledge, self-efficacy for the use of PPE, and perceived risk of harm from chemotherapy exposure. Despite these outcomes, Polovich and Clark noted that the total use of safety precautions for their population was quite low (an average of 1.9 in a range of 1 to 5). These findings are similar to the responses of oncology nurses surveyed for the purposes of this practice project. However, this cohort reported low levels of perceived risk to chemotherapy exposure and only moderate levels of self-efficacy for PPE use.

For this project, the cohort showed an inverse relationship ( $p < 0.05$ ) between years of oncology experience and overall PPE use, not seen in the Polovich study (2012). The results of this project suggest that the more years of oncology experience a nurse has the less likely he or she is to use personal protective equipment. This may be explained somewhat by the evolution of PPE and fairly recent mandated compliance that may not be an established practice in older staff. Nurses participating in this survey reported treating an average of 3 more patients (nearly

33% more) per nurse per day when compared to Polovich's sample. Higher treatment volumes were associated with both lower self-efficacy for PPE use and more conflicts of interest in the workplace, remaining consistent with Polovich's previous findings. However, in this study, data was not collected regarding the extent or duration of treatment that patients received, so specific nurse-patient ratio recommendations cannot be suggested until further information is gathered.

When comparing the current work to Polovich's study, certain relationships among variables were as expected. That is, fewer perceived barriers and conflicts of interest, along with positive interpersonal influences were associated with perceptions of a better workplace safety climate and higher levels of self-efficacy regarding PPE use. Of the scale variables, Polovich and Clark's research (2012) linked all but chemotherapy exposure knowledge to total precaution use, while the results of this project only found significant relationships between overall precaution use and interpersonal modeling. Overall, many important similarities were observed between the groups despite their differences in composition. Most of the findings of this project were consistent with previous literature (2012), although some relationships between variables that Polovich previously identified were not found to be statistically significant among survey respondents for this project.

### **Application of Findings to Theoretical Frameworks**

The PARiHS framework facilitated the implementation of this project by acting as a reliable foundation to evaluate the progress and outcomes of the study (Kitson & Straus, 2010). Conceptually, context was explored by completing an assessment of the organization to investigate potential contributors to the practice problem and fully interpret the culture of safety in this setting. Current evidence was reviewed to determine its applicability to this practice and key stakeholders within the organization were identified to act as project facilitators and

advocates. The PARIHS framework provided an exemplary conceptual basis for reviewing evidence, context, and facilitators of safe chemotherapy handling practices of outpatient oncology nurses as well as guiding the successful translation of evidence in this setting.

Donabedian's model was employed to examine healthcare services and assess quality of care issues for this project. In this study, exploring the components of this framework led to a better understanding of the implications of the project's results and influenced potential recommendations for the organization. Again, in Donabedian's framework, the concept of structure is associated with the organizational characteristics of the physical healthcare setting, while process involves the actual service provided. The outcome is the end product.

Structurally, the *Chemotherapy Handling Questionnaire* explored the availability of material supplies, patient volume, and characteristics of staff including education and years of experience. Relative to participants, most were middle-aged, certified in oncology nursing, and possessed a Bachelor's Degree in Nursing. Respondents worked typical 10 hour days and saw an average of ten patients in that period of time. The cohort had on average 19 years of nursing experience and 14 years specialized in oncology nursing.

In general, this population was knowledgeable about chemotherapy exposure and reported moderate levels of self-efficacy for using personal protective equipment (PPE). However, they reported that chemotherapy-designated PPE was difficult to obtain and PPE was not always readily accessible. These findings suggest that the presence or absence of these material supplies may be influencing perceived barriers to the safe administration of chemotherapy in this setting.

In regard to the process of chemotherapy administration, nurses reported moderate levels of perceived barriers to the use of PPE citing that it is physically uncomfortable (too hot), they

do not observe coworkers wearing PPE, and there is no policy that requires its use. They also reported some conflict of interest associated with their inability to meet the needs of patients when using PPE and that patient care actually interferes with their ability to be fully compliant. The nurses also indicated they perceived a low risk of harm from chemotherapy exposure.

When exploring the outcomes of the structures and process, it was noted that the use of chemotherapy-designated gloves was high; however, double gloving, the use of eye protection, and respirators were rarely utilized. Despite high to moderate levels of education, self-efficacy, and years of experience of nursing staff, these variables did not impact their practice behavior. Thus, when applying Donabedian's theoretical framework to this practice project, the outcome was affected and the overall use of safety precautions was low. Data analysis provided insight regarding Donabedian's concept of outcome, in that it was most impacted by years of oncology nursing experience (structure) and interpersonal modeling (process). Although some variables did not have direct relationships with total precaution use, they did appear to influence each other and impact the overall perceptions of the workplace safety climate.

### **Sustainability of the Project**

Despite the availability of chemotherapy administration safety recommendations and the guidelines developed by professional organizations, best practice does not always produce optimal levels of adherence. This truly highlights the importance of training and education for employers and workers, as well as the need for policy changes both nationally and locally. Workplace policies must be up to date and easily accessible to oncology nurses, while national safety guidelines need to become mandatory so they can be enforced in various health care settings.



This practice project has served as a pilot study to explore the safe-handling practice and knowledge levels of oncology nurses in a Midwest ambulatory care setting. The findings have been effective in pointing to a multitude of direct education methods that may be implemented in the future to mitigate unnecessary chemotherapy exposure and improve the overall safety climate in this organization. As the results of this project are generally consistent with previous research, it is presumed that it should be replicated with larger samples to gather further data regarding the safe administration of chemotherapy.

After reviewing the data with managerial staff, the future direction that is taken with these results will depend on the mission and values of the organization and evolving national trends. Key stakeholders will choose which recommendations to execute based on their feasibility and how they align with the organization's long-term goals. This dissertation inquiry has provided a foundation for future efforts and provided a plethora of information to facilitate the development of further quality improvement projects to be determined by the organization.

### **Doctor of Nursing Practice (DNP) Roles**

The roles of the DNP have been significant in regard to the successful implementation of this project and the analysis of its findings. The DNP as a clinician has had a distinct role in recognizing evidence based-practice guidelines and how they influence various aspects of care in the clinical setting. Through leadership the DNP has established various relationships with key stakeholders and facilitators to enable the progression of this project and emphasize its importance. The DNP as an advocate has a responsibility to improve the quality of care and safety of outpatient oncology nurses that are so often forgotten.

Through scholarship, the DNP reviews existing literature for applicability to the practice problem, identifies gaps between research and practice, and explores potential interventions. As

an innovator, the DNP is required to evaluate the organization and implement the practice improvement process in a manner that corresponds to the needs, mission, and values of the site of interest. The role of the DNP as an educator is to teach others about the significance of the practice problem and the need for change. The educator role also develops appropriate educational recommendations for the clinic based on the results of the *Chemotherapy Handling Questionnaire*.

### **Limitations**

There were a number of limitations to this early, feasibility study. The survey used a convenience sample of a single population in one organization and access to staff was through mailed communication. The survey took approximately 20-30 minutes to complete and then needed to be mailed back to the primary investigator. This may have been a barrier for individuals whose situation, for a variety of reasons, does not support access and response to mail. The time needed to fill out the questionnaire may have been a deterrent as well. To clarify the language of work status and eligibility a second mailing was sent to the entire sample. This additional mailing was consistent with the Dillman method (Hodding & Bass, 1986), yet may have confused some respondents. Furthermore, the sampling may have involuntarily solicited responses from only the more involved staff.

An additional limitation to this study was the previously established reliability and validity of the *Chemotherapy Handling Questionnaire* as related testing was not repeated for this study. This may have resulted in some participants finding one or more questions unclear. This is especially significant since the clinic uses non-disposable cloth lab coats rather than disposable gowns. The survey contained multiple questions that asked whether the nurses wear „gowns“ for chemotherapy handling activities and it did not distinguish between two common types of

gowns. As a result, this may have unintentionally confused respondents relative to questions associated with gown-use.

The Hawthorne effect may have also influenced the results of the study (2007). This effect may have manifested by participants changing their safe-handling behavior and compliance to standards simply because a questionnaire related to this topic was distributed. Other limitations of the study may have unintentionally encouraged participants to access evidence-based resources to better address survey questions and/or discuss the survey and its components with one another for comparison.

Lastly, while personal mean imputation is the most common imputation method utilized to address missing data, in some cases this technique can produce bias by artificially improving the psychometric qualities of survey scales (Hardouin, Conroy & Sebille, 2011). In other words, personal mean imputation may influence results related to the participants' skills, knowledge, abilities and attitudes associated with the safe handling of chemotherapy.

### **Recommendations**

This safety improvement project has multiple implications for future research. Information associated with personal motivation for compliance with safe-handling standards needs to be evaluated. This is especially significant, since project findings suggest that despite a high overall level of exposure knowledge and high perceived risk of exposure, total precaution use of outpatient oncology nurses may still be low.

Clinically, chemotherapy administration procedures need to be assessed to determine which barriers to safety can be minimized or eradicated and whether treatment volume may be reduced to improve outcomes and decrease the risk for unnecessary chemotherapy exposure. The organizational leaders need to ensure that appropriate PPE is readily available, and in

addition, improve communication regarding chemotherapy safety and organizational expectations for compliance.

Many participants perceived the lack of a safe-handling policy as a critical need in their work setting. National chemotherapy administration guidelines should be reviewed in order to develop an appropriate work place policy based on current safety standards. This policy should outline expected administration and disposal procedures and must be easily accessible to nursing staff. The implementation of the *Chemotherapy Handling Questionnaire* and review of its findings should support the need for an ongoing evaluation of the safety climate in this organization and foster a culture that supports nurses and advocates for their needs in addition to their patients and the greater public.

### **Conclusion**

In 2012, Polovich and Clark published a study that evaluated the safe-handling practices of oncology nurses in a variety of clinics and hospitals across the United States. Their research suggested that although nurses were well educated, experienced, and even certified in oncology their overall use of chemotherapy safety precautions was low. Study outcomes also concluded that nurses employed by private, outpatient clinics had greater patient volumes than other settings (2012) and were less likely to use personal protective equipment when administering chemotherapy (Polovich & Martin, 2011). The findings of this pilot study are consistent with previous research.

As the population of cancer patients and survivors grow, outpatient oncology clinics will be challenged to focus on the quality and safety of their work environments, patients, and the greater public; and surely not least of all, their nursing staff. The DNP-prepared nurse is equipped to lead clinical safety improvement projects in the ambulatory care setting. The

process of practice improvement has required the evolving abilities of the nurse as a clinician, leader, advocate, scholar, innovator and educator to lead important and necessary changes in the workplace.

A knowledge deficit may contribute to current discrepancies in recommended practices, lack of compliance with chemotherapy administration standards, or contribute to poor overall awareness of one's personal risk for exposure and adverse outcomes. Because of the significant risks, it is imperative that certain precautions are taken to reduce the risk of occupational injuries. This may involve altering work environments to improve safety, the use of necessary protective equipment, and modifying work place policies as needed. This clinical problem demonstrates an opportunity for knowledge translation as there is an apparent gap between what is recommended for safe chemotherapy administration and what is actually practiced in the workplace.

## APPENDIX A

### Letter of Permission – Polovich

**From:** Martha Polovich <martyp21@bellsouth.net>  
**Sent:** Wednesday, March 26, 2014 at 8:04 AM  
**To:** bouwkach@mail.gvsu.edu  
**Subject:** Re: Chemo safety

Cheryl,

I received your e-mail while I was away at a hazardous drug safe handling conference. I have read your prospectus. I have a few comments.

1. “This project will explore whether this may be a result of a knowledge deficit, a lack of medical surveillance or other unforeseen impediments.” I don’t think medical surveillance has any influence on use of precautions. Do you have literature to support that?
2. The ASCO/ONS Chemotherapy Safety Standards focus on patient safety and not related to occupational nurse exposure. There are currently no standards related to HD safety—only guidelines.
3. Environmental contamination is not necessarily the result of nursing non-compliance with precautions.

I am sending you the questionnaire used in my studies. Only one scale measures hazardous drug knowledge, and it is specific to chemotherapy exposure. The other scales measure variables identified in my literature review that are expected to influence HD precaution use. Precaution use is measured as the outcome variables. You have my permission to use the instrument except for one section. The interpersonal influence scales (Section 11) are adapted from Marjorie McCullough’s Farmers Social Norms and Social Modeling scales with permission. If you use them, you will have to obtain permission from her.

Please cite the source of the instrument and share any reliability data. I hope that this is helpful to your project.

Sincerely,

Martha Polovich, PhD, RN, AOCN  
Clinical Associate Professor  
Byrdine F. Lewis School of Nursing and Health Sciences  
Georgia State University  
mpolovich2@gsu.edu  
404-408-3890

## APPENDIX B

### Letter of Permission – McCullagh

**From:** Marjorie McCullagh [mailto: [mcculla@umich.edu](mailto:mcculla@umich.edu)]

**Sent:** Friday, April 04, 2014 at 3:12 PM

**To:** [bouwkach@mail.gvsu.edu](mailto:bouwkach@mail.gvsu.edu)

**Subject:** consent to use instruments to measure factors influencing use of personal protective equipment

Thank you for contacting me regarding use of my instruments. I am pleased to provide you with consent to use this in the way you have described, with acknowledgement in future presentations and publications. Of course, I would be happy to answer any questions you might have about their use. Best wishes on your project.

Marjorie McCullagh, PhD, RN, PHCNS-BC, COHN-S  
Associate Professor and Director  
Occupational Health Nursing Program  
University of Michigan School of Nursing  
400 N. Ingalls St., Ste. 3182  
Ann Arbor, MI 48109  
Voice 734.763.3450  
Email [mcculla@umich.edu](mailto:mcculla@umich.edu)

## APPENDIX C

### Information Letter for Participants #1

Dear [REDACTED] Nursing Colleagues,

**Thank you** for taking the time to read this letter. I am writing to ask your help in a study of oncology nurses being conducted for my doctoral dissertation. This study is designed to explore the practices of outpatient oncology nurses in regard to the safe-handling of chemotherapy.

In the next two weeks you will receive a parcel by mail. The packet will contain a survey along with a postage-paid envelope. Please take 20-30 minutes to complete the enclosed survey and return it by mail within 2 weeks of receipt.

Your responses will be confidential and will be released only in summaries so that no individual's answers can be identified. No personal identifying data will be collected. This survey is completely voluntary. You can help me greatly by taking a few minutes to share your knowledge and experiences. You can also let me know if you do not wish to participate by mailing back the uncompleted survey in the provided stamped envelope.

All information collected by the survey will be password protected and stored in an electronic file at GVSU to maintain the protection of participants. Results of the study will be available upon request following the completion of the project. Participation in the survey will serve as your consent.

If you have any questions or concerns about my research, please contact me either by phone or email and I will be happy to address your inquiries.

Thank you for your time and participation,

Cheryl Ann VerStrate, BSN, RN, OCN®

Grand Valley State University

Kirkhof College of Nursing

[REDACTED]  
[REDACTED]  
[REDACTED]



## APPENDIX D

### Information Letter for Participants #2

Dear [REDACTED] Nursing Colleagues,

**Thank you** for taking the time to read this letter. I am writing to ask your help in a study of oncology nurses being conducted for my doctoral dissertation. This study is designed to explore the practices of outpatient oncology nurses in regard to the safe-handling of chemotherapy.

Please take 20-30 minutes to complete the enclosed survey and return it by mail within 2 weeks of receipt in the postage-paid envelope provided.

Your responses are completely confidential and will be released only in summaries so that no individual's answers can be identified. No personal identifying information is to be collected. This survey is voluntary. You can help me greatly by taking a few minutes to share your knowledge and experiences. You can also let me know if you do not wish to participate by mailing back the uncompleted survey in the enclosed stamped envelope.

All information collected by the survey will be password protected and stored in an electronic file at GVSU to maintain the protection of participants. Results of the study will be available upon request following the completion of the project. Participation in the survey will serve as your consent.

If you have any questions or concerns about my research, please contact me either by phone or email and I will be happy to address your inquiries. If you have further questions regarding your rights as a participant contact the Human Research Office at GVSU via 616-331-3197 or email [hrrc@gvsu.edu](mailto:hrrc@gvsu.edu).

Thank you for your time and participation,

Cheryl Ann VerStrate, BSN, RN, OCN®  
Grand Valley State University  
Kirkhof College of Nursing

[REDACTED]  
[REDACTED]

## APPENDIX E

### Letter of Clarification for Participants

Dear [REDACTED] Nursing Colleagues,

**If you have taken the time to complete and return your survey, thank you for participating and please disregard the following communication to avoid the collection of duplicate data.**

If you did not complete the survey because you thought that only newly-hired nurses should participate, please review the packet and complete the corrected survey as appropriate. Return your responses in the postage-paid return envelope within 1 week of receipt.

Once again, you can help me greatly by taking a few minutes to share your knowledge and experiences. You can also let me know if you do not wish to participate by mailing back the incomplete survey in the enclosed stamped envelope.

All information collected by the survey will be password protected and stored in an electronic file at GVSU to maintain the protection of participants. Results of the study will be available upon request following the completion of the project. Participation in the survey will serve as your consent.

If you have any questions or concerns about my research, please contact me either by phone or email and I will be happy to address your inquiries. If you have further questions regarding your rights as a participant contact the Human Research Office at GVSU via 616-331-3197 or email [hrrc@gvsu.edu](mailto:hrrc@gvsu.edu).

Thank you again for your time and participation,

Cheryl Ann VerStrate, BSN, RN, OCN®  
Grand Valley State University  
Kirkhof College of Nursing

[REDACTED]

## APPENDIX F

Approval from Grand Valley State University Human Research Review Committee

DATE: September 29, 2014

TO: Cheryl VerStrate, BSN, RN, OCN  
FROM: Grand Valley State University Human Research Review Committee  
STUDY TITLE: [638635-1] Exploration of Chemotherapy Safe-Handling Practices and Identification of Knowledge Deficits among Oncology Nurses in the Ambulatory Care Setting

REFERENCE #: 15-036-H  
SUBMISSION TYPE: New Project

ACTION: APPROVED  
EFFECTIVE DATE: September 29, 2014  
REVIEW TYPE: Exempt Review

Thank you for your submission of materials for your planned research study. It has been determined that this project: IS COVERED human subjects research\* according to current federal regulations and MEETS eligibility for exempt determination under category 45 CFR 46.101(b)(2).

**We do not have a letter of permission from the [REDACTED]; nor is there any discussion about IRB review from them (are they affiliated with any IRB? Do they hold an FWA?). Please clarify. If they do not hold an FWA then the HRRC review and approval applies only to our DNP student.**

Exempt protocols do not require formal approval, renewal or closure by the HRRC. Any revision to exempt research that alters the risk/benefit ratio or affects eligibility for exempt review must be submitted to the HRRC using the Change in Approved Protocol form before changes are implemented.

Any research-related problem or event resulting in a fatality or hospitalization requires immediate notification to the Human Research Review Committee Chair, Dr. Paul J. Reitemeier, 616-331-3417 AND Human Research Protections Administrator, Mr. Jon Jellema, in the Office of the Provost, 616-331-2400. See HRRC policy 1020, Unanticipated problems and adverse events.

Exempt research studies are eligible for audits.

If you have any questions, please contact the Research Protections Program, Monday through Thursday, at (616) 331-3197 or rpp@gvsu.edu. The office observes all university holidays, and

does not process applications during exam week or between academic terms. Please include your study title and reference number in all correspondence with our office.

\*Research is a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (45 CFR 46.102 (d))

APPENDIX G

Letter of Approval from Immersion Site

August 28, 2014

Grand Valley State University IRB  
RE: Review of Cheryl Ver Strate Dissertation Project

To Whom It May Concern:

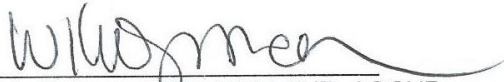
[REDACTED] may rely on the  
Grand Valley State University IRB for the review of:

Name: ***"Exploration of Chemotherapy Safe-Handling Practices and  
Identification of Knowledge Deficits among Oncology Nurses in the  
Ambulatory Care Setting."***

Author: Cheryl Ver Strate

Grand Valley IRB will perform initial review, continuing review, amendments or  
decision of whether project is exempt.

[REDACTED]



Wendy Koopman, RN, MSN, FNP, AOCNP  
Sr. Director of Clinical Operations

## APPENDIX H

### Chemotherapy Handling Questionnaire

### Chemotherapy Handling Questionnaire

**Thank you** for agreeing to participate in this study of nurses who handle chemotherapy. “Handling” refers to chemotherapy preparation, administration, disposal, and coming into contact with patient’s excreta that may be contaminated with chemotherapy.

- By **preparation**, we mean transferring chemotherapy drugs from vials or ampoules to syringes or IV containers.
- By **administration**, we mean giving chemotherapy to patients by IV, injection, orally, etc.
- By **disposal**, we mean discarding equipment used in chemotherapy preparation or administration.
- By handling **excreta**, we mean emptying bedpans, urinals or emesis basins.

Do you personally handle chemotherapy at work, either chemotherapy **preparation** or **administration**?

Yes

No → If you answered “No” **STOP HERE** and return the questionnaire in the enclosed postage-paid return envelope.

---

Are you currently undergoing **new-hire orientation**?

Yes → If you answered “Yes” **STOP HERE** and return the questionnaire in the enclosed postage-paid return envelope.

No

---

Before you proceed:

1. Please read each item carefully.
2. Please clearly mark your responses (as appropriate) from the options provided.
3. Please respond to each question to the best of your ability describing your personal practice regarding chemotherapy administration.

## **Section 1**

Select one answer to each of the following statements about chemotherapy **exposure**.

---

	True	False	Don't Know
1. Chemotherapy can enter the body through breathing it in	1	0	3
2. Chemotherapy can enter the body through ingesting it	1	0	3
3. Chemotherapy cannot enter the body through contact with contaminated surfaces	1	0	3
4. Chemotherapy can enter the body through contact with spills and splashes	1	0	3
5. Chemotherapy gas and vapor in air can enter the body through skin and mucous membranes	1	0	3
6. Oral forms of chemotherapy do not have the potential to be absorbed	1	0	3
7. Chemotherapy in liquid form can be absorbed through the skin	1	0	3
8. A surgical mask provides protection from chemotherapy aerosols	1	0	3
9. All types of gloves provide the same level of protection	1	0	3
10. Chemotherapy can more easily enter the body through damaged skin	1	0	3
11. Alcohol hand sanitizer is as effective as soap and water in removing chemotherapy residue	1	0	3
12. Chemotherapy can enter the body through contaminated foods, beverages, or cosmetics	1	0	3

---

## **Section 2**

Indicate your level of agreement with each of these statements about using personal protective equipment (PPE) when handling chemotherapy.

**SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree:**

---

**SA A D SD**

---

1. I am confident that I can use PPE properly	1	2	3	4
2. I am confident that I can protect myself from chemotherapy exposure	1	2	3	4
3. I am given enough information on how to protect myself from chemotherapy exposure	1	2	3	4
4. My supervisor goes out of his/her way to make sure I am protected	1	2	3	4
5. Reuse of disposable PPE makes me feel less protected	1	2	3	4
6. I am provided with the best available PPE	1	2	3	4
7. My supervisor goes out of his/her way to make sure I am provided with proper fitting PPE	1	2	3	4

### **Section 3**

Does your workplace have written policies and/or procedures for handling chemotherapy?

Yes

No

Where is chemotherapy prepared in your workplace?

Pharmacy	1
Drugs are delivered to the infusion area (prepared in an off-site location)	2
Specially designated <b>room</b> separate from the patient care area	3
Area within the patient treatment area / room	4
Other (specify)	5

What personal protective equipment is **available** for performing the following chemotherapy handling activities? Check all that apply.

	<b>Gloves</b>	<b>Gowns</b>	<b>Eye Protection</b>	<b>Respirator/ Mask</b>
Preparation	1	2	3	4
Administration	1	2	3	4



Handling Excreta	1	2	3	4
Disposal	1	2	3	4
Cleaning Spills	1	2	3	4

## **Section 4 Chemotherapy Preparation:**

Are you responsible for preparing chemotherapy?

Yes       No → If you answered “No” **proceed to Section 5.**

**Complete this section ONLY if you prepare chemotherapy drugs.**

What type of gloves do you wear while preparing chemotherapy?

None	<input type="checkbox"/>
Chemotherapy designated gloves	<input type="checkbox"/>
Vinyl (polyvinyl chloride, PVC)	<input type="checkbox"/>
Latex examination gloves	<input type="checkbox"/>
Sterile surgical gloves	<input type="checkbox"/>
Other (specify) _____	<input type="checkbox"/>

What type of protective clothing do you wear while preparing chemotherapy?

**(Check all that apply.)**

None	<input type="checkbox"/>
Chemotherapy-designated gown	<input type="checkbox"/>
Personal lab coat	<input type="checkbox"/>

Lab coat provided by office

Cloth gown

Isolation gown

Other (specify) \_\_\_\_\_

Please indicate how much of the time you use the following while **preparing chemotherapy**:

	Always	76-99%	51-75%	26-50%	1-25%	Never
Biological Safety Cabinet	5	4	3	2	1	0
Closed system transfer device	5	4	3	2	1	0
Gloves labeled for use with chemotherapy	5	4	3	2	1	0
Other gloves (e.g. vinyl)	5	4	3	2	1	0
Double gloves	5	4	3	2	1	0
Gowns labeled for use with chemotherapy	5	4	3	2	1	0
Other gowns (e.g. cloth)	5	4	3	2	1	0
Do you re-use disposable gowns?	5	4	3	2	1	0
Eye protection	5	4	3	2	1	0
Respirator/mask	5	4	3	2	1	0

## **Section 5 Chemotherapy Administration:**

Are you responsible for administering chemotherapy?

Yes  No → If you answered “No” **proceed to Section 6.**

**Complete this section ONLY if you administer chemotherapy.**

What type of gloves do you wear while administering chemotherapy?

None	<input type="checkbox"/>
Chemotherapy designated gloves	<input type="checkbox"/>
Vinyl (polyvinyl chloride, PVC)	<input type="checkbox"/>
Latex examination gloves	<input type="checkbox"/>
Sterile surgical gloves	<input type="checkbox"/>
Other (specify) _____	<input type="checkbox"/>

What type of protective clothing do you wear while administering chemotherapy?

**Check all that apply.**

None	<input type="checkbox"/>
Chemotherapy-designated gown	<input type="checkbox"/>
Personal lab coat	<input type="checkbox"/>
Lab coat provided by office	<input type="checkbox"/>
Cloth gown	<input type="checkbox"/>
Isolation gown	<input type="checkbox"/>
Other (specify) _____	<input type="checkbox"/>

Please indicate how much of the time you use the following while **administering chemotherapy**

	Always	76-99%	51-75%	26-50%	1-25%	Never
Closed system transfer device	5	4	3	2	1	0
Gloves labeled for use with chemotherapy	5	4	3	2	1	0
Other gloves (e.g. vinyl)	5	4	3	2	1	0
Double gloves	5	4	3	2	1	0
Gowns labeled for use with chemotherapy	5	4	3	2	1	0
Other gowns (e.g. isolation)	5	4	3	2	1	0
Do you re-use disposable gowns?	5	4	3	2	1	0
Eye protection	5	4	3	2	1	0
Respirator/mask	5	4	3	2	1	0

## **Section 6 Chemotherapy Disposal:**

Are you responsible for disposing of chemotherapy?

Yes       No → If you answered “No” **proceed to Section 7.**

**Complete this section ONLY if you dispose of chemotherapy.**

Please indicate how much of the time you use the following when **disposing of chemotherapy:**

	Always	76-99%	51-75%	26-50%	1-25%	Never
Gloves labeled for use with chemotherapy	5	4	3	2	1	0
Other gloves (e.g. vinyl)	5	4	3	2	1	0
Double gloves	5	4	3	2	1	0
Gowns labeled for use with chemotherapy	5	4	3	2	1	0
Other gowns (e.g. isolation)	5	4	3	2	1	0
Do you re-use disposable gowns?	5	4	3	2	1	0
Eye protection	5	4	3	2	1	0
Respirator/mask	5	4	3	2	1	0

## **Section 7 Handling Contaminated Excreta:**

Are you responsible for handling chemotherapy-contaminated excreta?

Yes       No → If you answered “No” **proceed to Section 8.**

**Complete this section ONLY if you handle chemotherapy-contaminated excreta.**

Please indicate how much of the time you use the following when **handling excreta:**

	Always	76-99%	51-75%	26-50%	1-25%	Never
Gloves labeled for use with chemotherapy	5	4	3	2	1	0
Other gloves (e.g. vinyl)	5	4	3	2	1	0
Double gloves	5	4	3	2	1	0
Gowns labeled for use with chemotherapy	5	4	3	2	1	0
Other gowns (e.g. isolation)	5	4	3	2	1	0
Do you re-use disposable gowns?	5	4	3	2	1	0
Eye protection	5	4	3	2	1	0
Respirator/mask	5	4	3	2	1	0

**Section 8**

Are chemotherapy **spill kits** available in your work area?  Yes  No

During the most recent chemotherapy spill in your workplace, did you use the materials in the spill kit?  Yes  No  N/A

**Please write the name of three chemotherapy drugs that you handle most frequently:**

Drug1 \_\_\_\_\_

Drug2 \_\_\_\_\_

Drug3 \_\_\_\_\_

**Section 9**

Indicate your level of agreement with each of the following statements.

**SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree:**

<b>Some reasons that I may not wear PPE regularly when handling chemotherapy are:</b>	<b>SA</b>	<b>A</b>	<b>D</b>	<b>SD</b>
1. I don't think PPE is necessary	4	3	2	1
2. I don't think PPE works	4	3	2	1
3. I don't have the time to use PPE	4	3	2	1
4. I was not trained to use PPE	4	3	2	1
5. PPE is uncomfortable to wear	4	3	2	1
6. PPE makes it harder to get the job done	4	3	2	1
7. PPE is not always available	4	3	2	1
8. Others around me don't use PPE	4	3	2	1
9. There is no policy requiring PPE	4	3	2	1
10. People would think I am overly cautious	4	3	2	1
11. It is hard to get chemotherapy-designated PPE	4	3	2	1
12. PPE is too expensive to use it all the time	4	3	2	1



	important	important	important	apply
Your co-workers	0	1	2	3
Other nurses you know	0	1	2	3
Your supervisor or manager	0	1	2	3
Your employer	0	1	2	3

## **Section 12**

Indicate your level of agreement with each of the following statements.

**SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree:**

	SA	A	D	SD
1. Personal protective equipment keeps me from doing my job to the best of my abilities.	4	3	2	1
2. Wearing personal protective equipment makes my patients worry.	4	3	2	1
3. Patient care often interferes with my being able to comply with using precautions.	4	3	2	1
4. I cannot always use safe handling precautions because patient's needs come first.	4	3	2	1
5. Sometimes I have to choose between wearing PPE and caring for my patients	4	3	2	1
6. Wearing personal protective equipment makes my patients feel uncomfortable.	4	3	2	1



## **Section 13**

Indicate your level of agreement with these statements regarding safety in your work place:

**SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree:**

	<b>SA</b>	<b>A</b>	<b>N</b>	<b>D</b>	<b>SD</b>
1. Chemotherapy gloves are readily accessible in my work area	5	4	3	2	1
2. Chemotherapy gowns are readily available in my work area	5	4	3	2	1
3. The protection of workers from occupational exposure to chemotherapy is a high priority with management where I work	5	4	3	2	1
4. On my unit, all reasonable steps are taken to minimize hazardous job tasks	5	4	3	2	1
5. Employees are encouraged to become involved in safety and health matters	5	4	3	2	1
6. Managers on my unit do their part to insure employees' protection from occupational exposure to chemotherapy	5	4	3	2	1
7. My job duties do not often interfere with my being able to follow chemotherapy safe handling precautions	5	4	3	2	1
8. I have enough time in my work to always follow chemotherapy safe handling precautions	5	4	3	2	1
9. I usually do not have too much to do so that I can follow chemotherapy safe handling precautions	5	4	3	2	1
10. On my unit, unsafe work practices are corrected by supervisors	5	4	3	2	1
11. My supervisor talks to me about safe work practices	5	4	3	2	1
12. I have had the opportunity to be properly trained to use personal protective equipment so that I can protect myself from chemotherapy exposures	5	4	3	2	1
13. Employees are taught to be aware of and to recognize potential health hazards at work	5	4	3	2	1
14. In my work area, I have access to policies and procedures regarding safety	5	4	3	2	1
15. My work area is kept clean	5	4	3	2	1
16. My work area is not cluttered	5	4	3	2	1
17. My work area is not crowded	5	4	3	2	1
18. There is minimal conflict within my work area	5	4	3	2	1
19. The members of my work area support one another	5	4	3	2	1
20. In my work area, there is open communication between supervisors and staff	5	4	3	2	1
21. In my work area we are expected to comply with safe handling policies and procedures	5	4	3	2	1

**Section 14**

**What is your highest level of NURSING education?**

- (1) Diploma
- (2) Associate degree
- (3) Bachelor's degree
- (4) Masters degree
- (5) Doctoral Degree

**Are you a member of the Oncology Nursing Society (ONS)?**

- (1) Yes
- (2) No

**Are you ONS certified to administer chemotherapy and biotherapy?**

- (1) Yes
- (2) No

**Are you certified in nursing?**

- (1) Not certified
- (2) OCN<sup>®</sup>
- (3) AOCN<sup>®</sup>
- (4) AOCNS<sup>®</sup>
- (5) NP
- (6) AOCNP<sup>®</sup>
- (7) Other \_\_\_\_\_

**Please enter the number requested:**

Your age in years:

Years of nursing experience:

Years of oncology nursing experience:

Years of chemotherapy handling experience:

Number of patients for whom you personally administer chemotherapy per day:

Number of patients receiving chemotherapy per day at your work place:


**Is there anything else you would like to tell us about safe handling in your work place?**

**Thank you for participating in this study!**

Please Note: This survey was originally developed by Dr. Martha Polovich. The instrument was used and adapted with permission for the purposes of this practice inquiry.

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