THE CHEMO COLLABORATE:

IMPROVING THE PROCESS OF CHEMOTHERAPY ADMINISTRATION IN THE INPATIENT SETTING

A DOCTOR OF NURSING PRACTICE PROJECT SUBMITTED TO THE OFFICE OF
GRADUATE EDUCATION OF THE UNIVERSITY OF HAWAI’I AT MĀNOA IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF NURSING PRACTICE

May 2016

By

Elizabeth C. Blasiak

Committee:

Debra D. Mark, Chairperson
Randal K. Wada
Brigitte McKale
Amy Thomas
DEDICATION

To Matt, ever since Neff field you have been by my side. Without you, this wouldn’t be possible.

And to my sons, Lucas and Jacob, who made me laugh when I needed a break, taught me how work should never be done in silence, and inspired me to finish. In the future, I hope to do the same for you.

May you never stop learning, laughing, and loving.
ACKNOWLEDGEMENT

I would first like to take this opportunity to thank the dedicated nurses, physicians, and pharmacists of Pali Momi Medical Center. Your commitment to the patients who entrust us with their care is unmatched. I am especially grateful for the 5th floor nursing staff and leadership team who provide expert care to patients every day, are always willing to learn, and inspire me to work harder. Thank you for all you do.

I would also like to extend my sincerest thanks to Dr. Debra Mark, my committee chair. Your encouragement and assistance through this entire process has been instrumental. Also, I would like to recognize, Amy Thomas, Dr. Brigitte Mckale, and Dr. Randy Wada who provided much needed guidance and support along the way.
ABSTRACT

Introduction

The lack of a standardized chemotherapy and biotherapy administration process in the inpatient setting of Pali Momi Medical Center (PMMC) led to variations in practice and resulting patient safety concerns. The Iowa Model of Evidenced-Based Practice to Improve Quality Care framework was the conceptual framework for this evidenced-based practice project. The purpose was to improve the inpatient intravenous chemotherapy and biotherapy administration process to impact patient care by increasing positive patient outcomes post-chemotherapy.

Methods

A quality improvement design was used to implement this project. The innovation of this project included a new policy and procedure, multiple methods of training and education, and the implementation of a detailed communication process prior to chemotherapy administration.

Data collection was primarily grounded in chart reviews of all patients who received intravenous chemotherapy and or biotherapy at PMMC. The results of intensive staff education and training was collected from documentation of competencies from the electronic staff training record. Staff surveys were completed to evaluate staff perceptions of project impact.

Results

The new chemotherapy and biotherapy policy was successfully adopted at PMMC and included details of the administration process, safety standards, and minimal requirements to be considered a chemotherapy competent nurse. A total of 12 nurses had training and chemotherapy education during the intervention period.

Adoption of the policy and the new communication process was measured by nurse, physician, and pharmacist compliance related to chemotherapy ordering, review and release; at last measure,
compliance rates for each role was 100%, 100%, and 75%, respectively. Additionally, patient initial and ongoing education occurred 100% of the time in the last 10 months of the project.

A multidisciplinary survey revealed that all responders (n=16) found an improvement in the chemotherapy and biotherapy administration process at PMMC, noted staff satisfaction, and a perceived increase in safety measures.

**Discussion**

The Chemotherapy Collaborate resulted in safer and higher quality care for patients receiving chemotherapy and biotherapy in the inpatient setting at PMMC and successfully impacted the development of nursing staff. Furthermore, staff identified a perceived improvement in safety, efficiency, quality, and process of intravenous chemotherapy administration.
TABLE OF CONTENTS

DEDICATION .................................................................................................................................................. ii

ACKNOWLEDGEMENT ............................................................................................................................... iii

ABSTRACT ..................................................................................................................................................... iv

CHAPTER ONE ............................................................................................................................................... 1
Executive Summary ........................................................................................................................................ 1
  Methods ..................................................................................................................................................... 2
  Results ....................................................................................................................................................... 2
  Discussion .................................................................................................................................................. 3

CHAPTER TWO .............................................................................................................................................. 5
Introduction .................................................................................................................................................. 5
Background and Problem ............................................................................................................................. 5
Conceptual Model .......................................................................................................................................... 7
  Triggers ..................................................................................................................................................... 8
    Problem-Focused Triggers ....................................................................................................................... 8
    Knowledge-Focused Triggers .................................................................................................................. 10
  Form a Team ........................................................................................................................................... 10
  Assemble Relevant Research & Related Literature .................................................................................. 12
  Critique & Synthesize Research for Use in Practice ................................................................................ 13
    Chemotherapy Prescribing and Orders ................................................................................................. 15
    Verification and Administration ........................................................................................................... 16
    Nursing Education and Training ......................................................................................................... 19
    Safety Precautions .............................................................................................................................. 22
Safety Precautions by Practicing Nurses ................................................................. 22
Safety Precautions by Nurse Managers ................................................................. 22
Safety Precautions by Patients ............................................................................... 23
Error Prevention ....................................................................................................... 23
Non-Oncology Setting ............................................................................................. 24
Oncology Emergencies ............................................................................................ 25
Conclusion ................................................................................................................ 25
Innovation in Practice ............................................................................................... 26
Standardization of Chemotherapy Verification and Administration ..................... 26
Education and Training ........................................................................................... 26
Interdisciplinary Communication ............................................................................. 27
Summary .................................................................................................................. 28
CHAPTER THREE ..................................................................................................... 29
Introduction .............................................................................................................. 29
Objectives ................................................................................................................ 29
Design ....................................................................................................................... 29
The Practice Change ................................................................................................. 30
Pilot the Change in Practice ..................................................................................... 30
Characteristics of Practice Change ......................................................................... 30
Relative Advantage .................................................................................................. 31
Compatibility ........................................................................................................... 31
Complexity ............................................................................................................... 32
Trialability ................................................................................................................. 32
Observability ................................................................................................. 32
Operational Definitions .................................................................................. 32
Sample Plan .................................................................................................... 34
  Setting .......................................................................................................... 34
  Sample ........................................................................................................ 35
    Patient Sample .......................................................................................... 35
    Healthcare Provider Sample .................................................................... 36
Marketing and Recruitment Plan ................................................................... 38
  Mass Media ................................................................................................. 38
  Interpersonal Channels ............................................................................... 39
Evaluate the Practice Change ....................................................................... 40
  Data Collection Procedures ....................................................................... 40
  Pre and Post Implementation Data Collection .......................................... 40
  Event Reports ............................................................................................. 41
Monitor and Analyze Structure, Process & Outcome Data ............................ 41
  Program Evaluation Plan .......................................................................... 41
  Inputs .......................................................................................................... 42
    Budgetary Inputs ...................................................................................... 43
      ONS Chemotherapy and Biotherapy Certificate Course ....................... 43
  Human Resource Inputs ........................................................................... 44
    Chemotherapy Skills Course .................................................................. 44
Activities ....................................................................................................... 45
  Chemotherapy and Biotherapy Verification and Administration Policy ....... 45
<table>
<thead>
<tr>
<th>Level 1 Heading</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education and Training</td>
<td>46</td>
</tr>
<tr>
<td>Standardized Method of Nursing Documentation</td>
<td>49</td>
</tr>
<tr>
<td>Physician Education</td>
<td>50</td>
</tr>
<tr>
<td>Interdisciplinary Communication</td>
<td>50</td>
</tr>
<tr>
<td>Outputs</td>
<td>51</td>
</tr>
<tr>
<td>Nursing Outputs</td>
<td>51</td>
</tr>
<tr>
<td>Pharmacy Outputs</td>
<td>52</td>
</tr>
<tr>
<td>Medicine Outputs</td>
<td>52</td>
</tr>
<tr>
<td>Patient Outputs</td>
<td>53</td>
</tr>
<tr>
<td>Hospital Administration and Leadership Outputs</td>
<td>53</td>
</tr>
<tr>
<td>Outcomes</td>
<td>53</td>
</tr>
<tr>
<td>Instruments</td>
<td>54</td>
</tr>
<tr>
<td>Human Subjects Considerations</td>
<td>55</td>
</tr>
<tr>
<td>Limitations</td>
<td>55</td>
</tr>
<tr>
<td>Timeline</td>
<td>56</td>
</tr>
<tr>
<td>Plan for Sustainment</td>
<td>58</td>
</tr>
<tr>
<td>Summary</td>
<td>58</td>
</tr>
<tr>
<td>CHAPTER FOUR</td>
<td>59</td>
</tr>
<tr>
<td>Results</td>
<td>59</td>
</tr>
<tr>
<td>Patient Sample</td>
<td>59</td>
</tr>
<tr>
<td>Intravenous Chemotherapy Doses</td>
<td>59</td>
</tr>
<tr>
<td>Short-Term Outcomes</td>
<td>60</td>
</tr>
<tr>
<td>Nursing Competency</td>
<td>60</td>
</tr>
</tbody>
</table>
Nurse 2nd Checks ........................................................................................................ 62
Nurse Documentation Compliance .............................................................................. 63
Patient Education by Nurses ....................................................................................... 66
Specialized Nurse Assessment Completion ............................................................... 67
Emergency Medication Availability ............................................................................. 68
Hospital Event Reports ............................................................................................... 69
Intermediate Outcomes ............................................................................................... 70
Order Compliance ........................................................................................................ 71
Physician Order Entry Compliance ............................................................................ 72
Physicians Consenting Patients .................................................................................. 73
Pharmacist Compliance ............................................................................................... 74
Nurse Compliance with Order Release .......................................................................... 75
Staff Perception Survey .............................................................................................. 76
Staff Roles .................................................................................................................. 77
Impressions of BEACON ............................................................................................ 77
Communication ........................................................................................................... 80
Workflow ...................................................................................................................... 81
Program Evaluation ..................................................................................................... 82
Nursing ......................................................................................................................... 83
Survey Summary ......................................................................................................... 86
Evolution of Project ..................................................................................................... 87
Expected Versus Actual Findings ................................................................................ 87
Facilitators .................................................................................................................... 87
Barriers ............................................................................................................................. 88
Summary ............................................................................................................................. 88
CHAPTER FIVE .................................................................................................................... 90
Discussion ........................................................................................................................... 90
  Interpretation of Findings ............................................................................................... 90
    Short-Term Outcomes ................................................................................................. 90
      *Nursing* ....................................................................................................................... 90
      *Pharmacy* .................................................................................................................... 92
      *Communication and Workflow* ................................................................................. 92
      *Event Reporting* ........................................................................................................ 93
    Intermediate Outcomes ............................................................................................... 93
      *Medicine* ..................................................................................................................... 93
      *Communication and Workflow* ................................................................................. 94
    Long-Term Outcomes ................................................................................................. 94
      *Patients* ....................................................................................................................... 94
      *Summary* .................................................................................................................... 95
Implications and Recommendations for Practice ......................................................... 95
Essential I: Scientific Underpinnings for Practice .......................................................... 95
Essential II: Organizational & Systems Leadership for Quality Improvement & Systems
  Thinking ........................................................................................................................... 96
    Program Oversight ......................................................................................................... 96
    Return on Investment .................................................................................................... 96
Essential III: Clinical Scholarships and Analytical Methods for Evidence-Based .............. 97
<table>
<thead>
<tr>
<th>Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care</th>
<th>98</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Medical Record Systems</td>
<td>98</td>
</tr>
<tr>
<td>Documentation</td>
<td>98</td>
</tr>
<tr>
<td>Essential V: Health Care Policy for Advocacy in Health Care</td>
<td>99</td>
</tr>
<tr>
<td>Essential VI: Inter-professional Collaboration for Improving Patient and Population Health Outcomes</td>
<td>99</td>
</tr>
<tr>
<td>Essential VII: Prevention and Population Health</td>
<td>99</td>
</tr>
<tr>
<td>Essential VIII: Advanced Nursing Practice</td>
<td>100</td>
</tr>
<tr>
<td>Plans for Dissemination</td>
<td>100</td>
</tr>
<tr>
<td>Summary</td>
<td>100</td>
</tr>
<tr>
<td>Appendix A. Literature Matrix</td>
<td>102</td>
</tr>
<tr>
<td>Appendix B. Chemotherapy and Biotherapy Administration Policy</td>
<td>134</td>
</tr>
<tr>
<td>Appendix C. Algorithm</td>
<td>161</td>
</tr>
<tr>
<td>Appendix D. Chemotherapy Checklist</td>
<td>163</td>
</tr>
<tr>
<td>Appendix E. Pharmacy Checklist</td>
<td>165</td>
</tr>
<tr>
<td>Appendix F. Exempt from IRB Review</td>
<td>168</td>
</tr>
<tr>
<td>Appendix G. Chemotherapy Competency</td>
<td>170</td>
</tr>
<tr>
<td>Appendix H. Staff Survey</td>
<td>173</td>
</tr>
<tr>
<td>References</td>
<td>182</td>
</tr>
</tbody>
</table>
List of Tables

1. *Search Results Categorized by Mosby’s Level of Evidence* ........................................................... 14

2. *Chemotherapy and Biotherapy Provider Education and Training Costs* ...................................... 44

3. *Timeline* ......................................................................................................................................... 57

4. *Event Reports* ................................................................................................................................... 70
# List of Figures

1. *Inpatient Chemotherapy and Biotherapy Administration PMMC: Logic Model* ........................................ 42
2. *Chemotherapy Doses per Month* ................................................................. 60
3. *Nursing Competency* .................................................................................. 62
4. *Chemotherapy Nursing Administrations by Dose* .................................. 63
5. *Nursing Documentation: DAR and Plan of Care* ..................................... 64
6. *Chemotherapy Patient Education and Re-Education* ........................................ 67
7. *Specialized Assessment Completion* ............................................................ 68
8. *Emergency Medication Availability* ............................................................. 69
9. *Percentage of Patient Treatments on the Fifth Floor or ICU with Chemotherapy Competent RN* .... 71
10. *Individual Drug Orders by Physician* .......................................................... 72
11. *Use of Beacon and MD Compliance with Prescribing Policy* .................. 73
12. *Order Review by Oncology Pharmacist* ....................................................... 75
13. *Order Review by Oncology Pharmacist and Release by Oncology Nurse* ............. 76
14. *Staff Roles* .................................................................................................. 77
15. *When did you learn about BEACON?* ......................................................... 78
16. *How did you learn about BEACON?* ............................................................ 79
17. *Nursing Release* .......................................................................................... 79
18. *Methods of Communication* ...................................................................... 80
19. *Most Reliable Method of Communication* .................................................. 81
20. *Improvement of Process* ............................................................................. 82
21. *Satisfaction with Process* ............................................................................ 83
22. *Satisfaction with ONS Chemotherapy Certificate Course* ....................... 84
23. Preparation after ONS Chemotherapy Certificate Course .......................................................... 84
24. Preparation after HPH Chemotherapy Skills Course ................................................................. 85
25. Comfort with Skills ....................................................................................................................... 85
26. Nurse Resources .......................................................................................................................... 86
CHAPTER ONE

Executive Summary

There are many treatment modalities for managing cancer. One commonly known modality is treatment with systemic chemotherapy or biotherapy. Indications for the use of chemotherapy and or biotherapy in the non-oncology setting have also continued to grow. Chemotherapy and biotherapy are considered hazardous drugs as their use can result in a wide variety of risks to the patient and healthcare provider. The administration of chemotherapy or biotherapy can be safe, but requires the use of a standardized and systematic workflow executed by a team of competent health care providers to prevent medication errors, incidental exposure, and/or therapy related adverse events.

Pali Momi Medical Center (PMMC) offers patients with cancer comprehensive care by providing diagnostics, treatments, and holistic symptom management in both outpatient and inpatient settings. Many patients receive treatments of chemotherapy or biotherapy in the inpatient setting. Due to the inherent risk of these treatments, resources must be carefully allocated to ensure safe and best practices. In addition, a knowledgeable and experienced staff is essential to make certain practice is based on evidence and delivered in a manner consistent with standardized recommendations from the American Society of Clinical Oncology and the Oncology Nurses Society (Neuss et al., 2013). However, prior to this project, cancer care for patients admitted to the hospital was often not standardized, leading to variations in practice and potentially resulting in medication errors. Nursing involvement in order review and release occurred 0% of the time during the baseline data collection period. Similarly, the oncology pharmacist was never involved in inpatient chemotherapy order review during the baseline period as well.

The purpose of this evidenced-based practice project was to improve the intravenous chemotherapy and biotherapy administration process and impact patient care by increasing positive patient outcomes post-chemotherapy in the inpatient setting. The steps of this project followed the
Iowa Model of Evidenced-Based Practice to Improve Quality Care framework (Titler, Steelman, Budreau, Buckwalter, & Goode, 2001). Literature has identified safety standards and guidelines related to chemotherapy and biotherapy administration that will be standardized, models of training and education will be implemented to ensure competency, and standardized methods of interdisciplinary communication will promote best practices. Interventions that are supported by literature findings will improve the intravenous chemotherapy and biotherapy administration process in the inpatient setting at Pali Momi Medical Center.

Methods

A quality improvement design was used to implement this project. The innovation of this project included implementation of safety measures that followed outlined policy and procedures. In addition to a new policy, project interventions included multiple methods of training and education to improve nurses’ chemotherapy competency, development of a detailed communication process prior to chemotherapy administration, and utilization of an existing part of the medical record.

Data collection was primarily grounded in chart reviews of all patients who received intravenous chemotherapy and or biotherapy at PMMC. Staff education and training data was collected from documentation of competencies from the electronic staff training record found in the Hawaii Pacific Health Learning Center and by tracking on-unit competencies. Throughout the project, feedback and outcomes were regularly obtained and shared to ensure the project was evolving towards intended outcomes. Staff surveys were done to evaluate perceptions post project implementation.

Results

The Oncology Practice Council, a system-wide multi-disciplinary team, drafted a new chemotherapy and biotherapy policy that was successfully adopted at Pali Momi Medical Center on May 20, 2015. This policy entitled, “Chemotherapy and Biotherapy Administration Policy”, details the administration process, safety standards, and minimal requirements to be considered a chemotherapy...
competent nurse. Currently, this policy has also been adopted at all four hospitals of Hawaii Pacific Health (see Appendix B).

Adoption of the policy and the new communication process was measured by nurse, physician, and pharmacist compliance related to chemotherapy ordering, review and release; at last measure, compliance rates for each role was 100%, 100%, and 75%, respectively. Additionally, patient impact measures showed an increase as well. For example, patient education and ongoing education occurred 100% of the time in the last 10 months of the project. Intravenous chemotherapy was successfully limited to the dedicated unit 100% over the last 7 months of the project.

A total of 12 nurses had training and chemotherapy education during the intervention period meeting the project goal of 10. Five of these nurses are currently fully trained, have completed all elements of competencies and are serving as unit mentors. Eleven nurses completed the ONS Chemotherapy and Biotherapy Certificate course and ten nurses attended the HPH Chemotherapy Skills Course during the project.

A multidisciplinary survey revealed that all responders found an improvement in the chemotherapy and biotherapy administration process at PMMC. Of these improvement ratings, 62% gave the highest rating of improvement “very improved”. Moreover, all responders noted that they are satisfied with the current process. Most importantly, all survey responders (n=16) found an increase in safety measures for patients receiving inpatient intravenous chemotherapy and biotherapy at PMMC.

Discussion

The Chemotherapy Collaborate resulted in safer and higher quality care for patients receiving chemotherapy and biotherapy in the inpatient setting at Pali Momi Medical Center. The Chemotherapy Collaborate successfully impacted the development of nursing staff ensuring a competent team is established in the inpatient setting to administer chemotherapy and biotherapy safely. Furthermore, staff surveys identified a perceived improvement in safety, efficiency, quality, and process. Nursing staff
identified increased perception of preparation and comfort as related to the administration of chemotherapy and biotherapy. Nurses developed from novice nurses to experienced oncology nurses over the course of this project. Communication and process improvements between physicians, nursing, and pharmacy allowed for a safer and more efficient patient experience while receiving chemotherapy or biotherapy in the inpatient setting at Pali Momi Medical Center.
CHAPTER TWO

Introduction

At Pali Momi Medical Center (PMMC), many inpatients are admitted with primary or secondary diagnoses of cancer. Cancer care requires specialized nursing skills to administer chemotherapy and manage side effects effectively to ensure safe, quality care. However, there is often a low volume of patients requiring chemotherapy and biotherapy, leading to skill degradation. Without the requisite knowledge and experience with chemotherapy administration, there is also often limited currency with the latest evidence and practice recommendations. This chapter will present the background and significance of this problem and the conceptual model that will guide this evidence-based practice project to address this problem. A review of current literature related to safe chemotherapy administration and training of nurses who administer chemotherapy will be presented. Upon conclusion, project objectives and interventions will be provided.

Background and Problem

In the past 20 years, medication errors in health care facilities and outpatient settings have continued to receive national attention in the media and health administration circles. The extent of the problem took center stage in 1999, when the Institute of Medicine’s (IOM) report, “To Err is Human – Building a Better Health System”, was published. The report estimated that between 44,000 and 98,000 Americans die of medical errors each year in hospitals. A follow-up report, “Preventing Medication Errors”, revealed errors specifically related to medications harm 1.5 million people per year. Also, 400,000 preventable adverse drug events occur every year in hospitals (IOM, 2006). In addition, the United States Food and Drug Administration (FDA) reported that since 2000, it has received more than 95,000 reports of medication errors (FDA, 2013).

Four years prior to the initial IOM report, medication errors related to chemotherapy were examined when national media coverage was given to chemotherapy overdoses that led to patient
deaths (Knox, 1995; Smaragdis, 1995). At this time, many facilities and cancer centers across the country began to assess and thoroughly evaluate their policies related to chemotherapy administration due to these highly publicized cases at well-known and respected hospitals. Chemotherapy administration standards began to take shape and nurses held an import role in the implementation of safe procedures since they serve as the last line of defense against errors.

Since these events, many error prevention strategies have been published. Strategies have included chemotherapy order forms, systems to support calculating and verifying doses, standardizing prescribing vocabulary and dosage writing, requiring nursing certification for chemotherapy administration, and improving communication between physicians, nurses, and pharmacists (Cohen et al., 1996; Fischer, Alfano, Knobf, Donovan, & Beaulieu, 1996; Kohler et al., 1998; Olsen, 1997; Schulmeister, 1997; 1999). Most importantly, The Oncology Nursing Society (ONS) (Brown et al., 2001), Infusion Nursing Society (INS) (2000), and the American Society of Health-System Pharmacists (ASHP) (ASHP, 2002) were all prompted to release recommendations and guidelines related to chemotherapy preparation, handling, and administration that can be used by facilities to frame their procedures.

Since 2002, these guidelines have been revised and revisited numerous times to address the changing climate of healthcare including the advent of the electronic medical record, increased use of oral chemotherapy, development and use of biotherapy in cancer care, expanding application of antineoplastic drugs in the non-oncology setting, use of chemotherapy software programs, and standardized electronic order-sets or protocols. The most current guidelines were recently updated by the American Society of Clinical Oncology (ASCO) and the Oncology Nursing Society (ONS) in a joint effort (Neuss et al., 2013). In addition, ASHP released standards in 2014 (ASHP, 2014). These guidelines identify current challenges, such as the administration of oral chemotherapy, the education and preparation of chemotherapy providers, and the appropriate procedures for ordering, preparing, and administering chemotherapy. To stay up-to-date with the ever-changing health care environment and
current challenges faced by health care workers, hospitals and all settings where chemotherapy is being administered must continue to evaluate and improve procedures and practices to ensure patient safety and best outcomes.

**Conceptual Model**

In order to base practice on research or other evidence, it is imperative to utilize a model that will guide team members through a process of change. The Iowa Model of Evidenced-Based Practice to Improve Quality Care (Iowa Model) is just one of the many models or methods available (Titler, Steelman, Budreau, Buckwalter, & Goode, 2001). The Iowa Model facilitates team clinical decision-making and evidence-based practice (EBP) implementation, addressing not only the bedside nurse perspective, but also the perspectives of other multidisciplinary team members (Titler, Steelman, Budreau, Buckwalter, & Goode, 2001). Currently, the use of the Iowa Model is preferred by both the Hawaii State Center for Nursing (HSCN) and Hawaii Pacific Health (HPH) (HSCN, 2014). In addition to remaining consistent with both organizations, the Iowa Model offers a systematic approach to applying evidence-based care. It is for all of these reasons the Iowa Model has been selected for the conceptual model of this project.

The steps of the Iowa Model include and are summarized below.

1. Identifying a problem through triggers
2. Determining the prioritization of this problem for the setting
3. Developing a team to evaluate the problem
4. Evaluation of related evidence
5. Determining if there is sufficient evidence
6. Piloting the change in practice
7. Evaluating the appropriateness and adoption into the practice setting
8. Ongoing assessment of care quality and innovative knowledge
**Triggers**

Initial triggers can facilitate nurses to critically evaluate both clinical and operational efficiency and effectiveness (Titler, Steelman, Budreau, Buckwalter, & Goode 2001). The trigger can be problem- or knowledge-based, but both lead to an assessment of current systems and practices that may require necessary adaptations in order to provide evidence-based care. In addition to a national awareness and identification of the importance of safety measures while administering chemotherapy, multiple hospital-based triggers initiated selection of this EBP project to address chemotherapy administration at Pali Momi Medical Center (PMMC).

**Problem-focused triggers.** Problem-based triggers for this project for chemotherapy administration at PMMC included potential medication errors, administration of oral chemotherapy by untrained staff nurses, prescriptions for chemotherapeutic agents by non-trained physicians, and post chemotherapy complications miss-managed by non-chemotherapy trained staff. As with other medication errors, it was also suspected that there was underreporting of near misses or actual errors due to failure to acknowledge or recognize gaps in practice.

A recent patient case presented a knowledge gap that depicted this suspicion. In this situation, a patient experienced normal post-chemotherapy complications including severe neutropenia. Neutropenic fever is noted to be a life-threatening complication related to chemotherapy administration. A chart review revealed that the patient experienced a febrile event that was not identified in a timely manner. Experienced and trained nurses in chemotherapy administration are prepared to recognize this complication and address it promptly with evidence-based interventions (National Comprehensive Cancer Network (NCCN), 2014).

The current procedures followed at PMMC include those as outlined by Lippincott (2014). In the management of neutropenic fever, Lippincott states that patient assessment, pan-cultures, and broad-spectrum antibiotics should be completed and administered within one hour of the febrile event (2014).
The time that lapsed for this patient was greater than one hour and it is probable that the time would have been longer if the chart review did not occur. The patient remained an inpatient for over a month, was admitted to the Intensive Care Unit, and received multiple high strength antibiotics due to continued fevers and signs of infection.

Although all nursing staff is educated in the safe handling cytotoxic medications, they potentially are unaware of the patient-related risks associated with chemotherapy. In a past fiscal year (July 2013 – June 2014), a total of 314 doses of chemotherapy were ordered in the inpatient setting to patients at PMMC. Only 50 doses of chemotherapy were administered on the unit with nurses who maintain current ONS chemotherapy and biotherapy provider cards. Nurses who were not chemotherapy-trained administered oral chemotherapy agents. However, the current policy did not clarify that this is an acceptable practice, nor did it distinguish oral chemotherapy from other routes.

In addition, 266 of the total 314 doses of chemotherapy by any route were ordered by non-oncologists; many of these doses were prescribed by appropriate specialists. Significantly, 102 doses of oral chemotherapy were prescribed by Hospitalists. It is suspected that most of this chemotherapy was a continuation of a home medication while admitted to the hospital.

Physician appropriateness is not limited to medical oncology, but rather the specialty that is knowledgeable in the treatment of the underlying disease process. Other specialists included Rheumatology and Neurology physicians. Baseline data revealed some specialists were not utilizing BEACON order entry. During this time period, it was found that a dose of drug with high risk for anaphylaxis was ordered via epic and due to this the total dose was separated into two separate orders, but the drug was prepared in one bag. In addition, there was no body surface area used to calculate the dose, nor was there a reference indicating this flat dosing process. The BEACON system allows orders to be directly connected with approved protocols and the underlying reference.
**Knowledge-focused triggers.** Knowledge triggers also impacted the decision to move forward with the project as there are well known standards and guidelines for chemotherapy administration provided by both the America Society of Clinical Oncology and the Oncology Nursing Society and current practice was not in alignment with these standards (Neuss et al., 2013). Furthermore, PMMC had a Chemotherapy and Biotherapy Administration Policy that followed the ASCO/ONS guidelines, but existing processes, knowledge gaps, and practices did not ensure nursing adherence to EBP methods. To further compound the issue, there were inconsistent methods for the training and education of staff.

Lastly, the process of chemotherapy administration varied within PMMC from the outpatient infusion center to the inpatient care units. An existing barrier was that the electronic medical record was being utilized differently across inpatient and outpatient treatment areas. It was vital to ensure consistency of practice across all care settings. Inpatient nurses were not being trained in the electronic medical record related to the chemotherapy ordering platform, BEACON.

Leadership at PMMC, including both mid-level management and nurse executives, recognized the care of patients receiving chemotherapy as a high organizational priority due to patient safety concerns and potential risk for errors. The problem that existed was a poorly defined and non-standardized chemotherapy process where practice was not consistent with recommended guidelines and current policy statements. Ultimately, improving knowledge and systems promotes safer care and improved outcomes for patients receiving chemotherapy and biotherapy across all settings.

**Form a Team**

Once triggers have been recognized, and before teams are formed, the Iowa model acknowledges the importance of considering organizational priorities. PMMC leadership confirmed the significance of the identified problem and the project’s alignment with overall strategic goals.

Pali Momi Medical Center (PMMC) is one of four hospitals of Hawaii Pacific Health (HPH). Two interdisciplinary teams were established to determine interventions. First, a system-wide team of
nursing and pharmacy leaders (Team One) addressed the standardization of chemotherapy verification, administration, and required training for nursing. This team is formally known as the Oncology Practice Council. Team members created a charter and identified key concepts.

Although this project was piloted and implemented at PMMC, changes needed to occur at the system level to ensure standardization of policies and procedures and sustainability was possible across HPH. For example, any changes that impact documentation in the medical record system, EPIC, must occur at the system level. In addition, a goal of standardizing education requirements across HPH was established by nursing executives. Beginning this practice change with oncology leaders from all four hospitals allowed interventions to be applied not only at PMMC, but potentially all four of the hospitals of HPH.

Second, a PMMC interdisciplinary team (Team Two) was established to determine site-specific interventions. These members included the members who represent PMMC in Team One and additional members from PMMC, such as the system-wide pharmacist, but expanded membership to include the on-site oncologists, the PMMC Director of Pharmacy, the PMMC oncology pharmacist, nurse managers, outpatient nursing staff, and inpatient nursing staff. The inclusion of all disciplines ensured effective communication as interventions were determined by this team. This team addressed the implications of a new standardized policy, identified site-specific interventions, created an education plan, and assessed current workflow gaps that needed to be addressed in order to be aligned with current evidence and expert recommendations.

Pharmacists, including the lead pharmacist who is responsible for oncology system-wide, were active members of both Team One and Team Two. In addition, a pharmacist with extensive experience in oncology and responsibility for BEACON, the oncology application in the electronic medical record system, EPIC, was included in this workgroup.
Pali Momi Medical Center has one employed oncologist responsible for the majority of inpatient admissions requiring chemotherapy. This primary physician was made aware of project progress and included in all communication. Other adult medical oncologists across Hawaii Pacific Health were updated at their bi-monthly cancer meetings about the progress and interventions proposed by the Oncology Practice Council.

**Assemble Relevant Research & Related Literature**

After team formation, the group began to evaluate the current literature pertinent to this problem. It is vital to include all types of literature in an evidence-based practice project such as evidence-based guidelines, systematic reviews, meta-analyses, and clinical studies on the topic (Titler, Steelman, Budreau, Buckwalter, & Goode, 2001).

The purpose of the project is to improve the current system and process for chemotherapy administration resulting in safe and evidence-based care for inpatients actively receiving chemotherapy in the inpatient setting. Chemotherapy administration is a complex skill that incorporates many concepts. In order to fully understand the scope of the problem and potential solutions, a thorough review of the literature was completed. Initial literature searches were directed at determining standardized methods for chemotherapy verification and administration, chemotherapy nursing education and training, and chemotherapy administration safety precautions. In addition, chemotherapy-related error reduction and chemotherapy administration in the non-oncology setting were also included in the search strategy.

Databases used for searches included CINAHL, PubMed, the Cochrane Library, and the National Guideline Clearinghouse. The bulk of applicable results were from CINAHL and PubMed. Some examples of key terms used were: chemotherapy, safety, administration, verification, medication errors, cancer nursing, oncology, and antineoplastic agents. Both PubMed and CINAHL techniques such as
truncation, Boolean operators, and MeSH were applied to both limit and expand search results as needed.

Overall, hundreds of articles were initially rendered. Year limits were set to the past 10 years to ensure current research was evaluated. The oldest study assessed was from 2005 and the majority of research was from the last four years. After initial evaluation of searches, briefs, opinion-based articles from non-experts, and commentaries were discarded as they were not appropriate references for this project. These limitations left over 130 articles to be read and evaluated. After further evaluation, a total of 56 journal articles and guidelines were utilized for this project and organized using Excel (see Appendix A).

**Critique & Synthesize Research for Use in Practice**

Using a systematic approach for critiquing the evidence allows for organization and eventual synthesis to enable reference of findings as the project developed towards implementation (Titler, Steelman, Budreau, Buckwalter, & Goode, 2001). Together, team one performed a critique and synthesis of literature in order to distribute the workload and enable team members to understand the scientific underpinnings. The literature empowered the team to determine the appropriate interventions that needed to be piloted in order to solve the originally stated problems.

Assessment of research and literature was accomplished by using Mosby’s grading tool (Mosby, 2004). The Mosby’s grading tool is a seven-level grading system, with Level I being the highest level of research (see Table 1). In addition to the seven-level grading system, reviews of literature and performance improvement projects are reported in another category, “other” (see Table 1). Due to the nature of the project, there were no level one or two research studies generated through searches. Some research designs, such as randomized controlled trials where subjects are selected to receive or not to receive one or more interventions, are generally not appropriate, since all patients should receive medication safety measures.
The majority of the literature found was Level VI, descriptive studies. An equal number of articles that are categorized as “other” were evaluated and included. Due to their potential value, 10 performance improvement projects and nine reviews of the literature were reviewed (see Table 1). Two guidelines were also critiqued. Although, they are a low level of evidence, they represent expert opinion reports and are currently considered the standard of practice.

Table 1

*Search Results Categorized by Mosby’s Level of Evidence*

<table>
<thead>
<tr>
<th>Mosby’s Level of Evidence</th>
<th>Search Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level I</strong></td>
<td>Meta-analysis</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Level II</strong></td>
<td>Experimental design</td>
</tr>
<tr>
<td></td>
<td>Randomized Controlled Trial (RCT)</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Level III</strong></td>
<td>Quasi-experimental design</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td><strong>Level IV</strong></td>
<td>Case controlled, cohort studies, longitudinal studies</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Level V</strong></td>
<td>Correlation studies</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Level VI</strong></td>
<td>Descriptive studies including:</td>
</tr>
<tr>
<td></td>
<td>surveys</td>
</tr>
<tr>
<td></td>
<td>cross sectional design</td>
</tr>
<tr>
<td></td>
<td>developmental design</td>
</tr>
<tr>
<td></td>
<td>qualitative studies</td>
</tr>
<tr>
<td></td>
<td>21</td>
</tr>
<tr>
<td><strong>Level VII</strong></td>
<td>Authority Opinion or expert committee reports</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>
Due to the many sub-concepts that were searched for, literature varied on emphasis and concepts discussed. Sub-concepts were categorized into chemotherapy verification and administration, chemotherapy nursing education and training, chemotherapy administration safety precautions, chemotherapy error prevention, chemotherapy in the non-oncology setting, and oncology emergencies. Some of the research overlapped into multiple sub-concepts. Processes for ordering chemotherapy were included in the verification and administration category as they are the initial step in order verification. Within each category evidence was synthesized and compared.

Medicine, nursing, and pharmacy all play essential parts in the chemotherapy administration process. Physician orders are the first step, followed by pharmacy verification and preparation, and finally, nursing administration. Interdisciplinary communication throughout the verification and administration process has been reported as a key component to safety (Chung, Collins, & Cui, 2011; Level III). Chung et al. reported that communication led to a reduction of chemotherapy errors by 45% and a cost savings of $120,000 dollars.

**Chemotherapy prescribing and orders.** Ordering procedures do not allow for verbal orders and should ensure that an order form or electronic medical record (EMR) is used (Neuss et al., 2013). One study assessed the impact of the EMR on the chemotherapy ordering process (Levy et al., 2011; Level VII). Despite the improvement in patient safety, there were limitations to this new format that included complications with billing and lack of appropriate alerts. Oncology-specific configuration is required
when using EMR systems. It was also reported that both nursing and pharmacy be integral to designing the EMR chemotherapy-ordering configuration (Levy et al., 2011).

**Verification and administration.** Verification and administration are two distinguishable parts of the chemotherapy process and nursing administration of chemotherapy includes both concepts. These concepts are often used interchangeably to describe the nursing skills applied when administering chemotherapy to a patient. However, for the purposes of this project these concepts will be defined to clarify the difference.

Verification refers to the process of a systematic check of all of the elements of chemotherapy orders and patient assessment prior to the drug preparation (ONS, 2014). Some examples of elements that should be verified prior to preparation of chemotherapy include the patient’s height, weight, drugs, doses, disease, physical assessment, and intravenous access. Prior to drug preparation, chemotherapy orders must also be verified (Neuss et al., 2013). In addition to this pre-preparation verification, two independent verifications must occur prior to administration.

Administration refers to the process of giving the patient the chemotherapy (ONS, 2014). Elements of the administration process include double checks of the drug, dose, rate, access, and patient identifiers after the drug is prepared and again just prior to giving the chemotherapy to the patient. This double check should not be confused with the verification process prior to preparation.

The standards and guidelines for chemotherapy administration provided by both the America Society of Clinical Oncology (ASCO) and the Oncology Nursing Society (ONS) are the most widely used recommendations for chemotherapy administration as they are provided by leading authorities on cancer care (Neuss et al., 2013; Level VII). In 2009, ASCO and ONS published standards for the safe use of parenteral chemotherapy in the outpatient setting (Jacobson et al., 2009). These initial standards focused on orders, preparation, and administration of chemotherapy.
Multiple studies concluded that the ASCO/ONS guidelines should be followed and research related to their implementation is in support of their utility (Pitello, Treon, Jones, & Kiel, 2010 - Review of Literature; Vioral & Kennihan, 2012 - Performance Improvement; Wilkes, 2009 - Review of Literature). These studies include not only the current ASCO/ONS standards, but incorporate previous editions presented in 2009 and 2011 (Neuss et al., 2013; Jacobson et al., 2009; Jacobson et al., 2012). The original 2009 ASCO/ONS standards were updated to include the inpatient setting (Jacobson et al., 2012). In 2012, Weingart et al. evaluated the overall implementation of the 2009 standards. This study concluded that only four of the 55 National Cancer Institute designated cancer centers were compliant with all 31 standards. This exemplified how even the most well-known cancer centers across the country still had room for improvement to achieve full adoption of the 2009 standards.

An earlier study specifically discussed the use of two independent checks conducted by nurses (Friedel & Roberts, 2006; Performance Improvement). This study described a process of chemotherapy administration where the patient was also included in the process. Additional research focused on this concept of involving the patient in the safety process and was supported in another study even though patients felt safe during administration (Schwappach & Wernli, 2010; Level IV). Involving patients in the bedside safety check process increased their awareness of risk and ability to contribute to potential error prevention.

In addition, another ASCO and ONS workgroup concluded that it was essential to add a section about oral chemotherapy. After public comments were received, the workgroup reviewed and approved the additions in 2013. Over 200 public comments were received by ASCO/ONS and the majority, 166, came from nurses. The newly identified oral chemotherapy recommendations included patient and family education, administration schedules, disposal procedures, and aspects of continuity across settings.
At PMMC, the majority of the patients who receive chemotherapy in the inpatient setting receive oral chemotherapy regimens. Based on the new standards and due to the projected increase in oral drug therapy, there is also an eventual need to develop oral chemotherapy processes. One research study that focused on oral administration suggested the creation of a unique nursing position focused on oral administration and adherence and its positive impact on nursing knowledge and on the oral chemotherapy process (Moody & Jackowski, 2010; Level VI).

The ASCO/ONS standards address inpatient and outpatient settings and all modes of administration. Key components of the ASCO/ONS (2013) administration standards state that “the practice/institution has policies, procedures, and/or guidelines for verification of training and continuing education for clinical staff” (ASCO/ONS, p.8). Those standards that impact inpatient care areas are listed in the section entitled, “Safety related to staffing”, and include recommendations related to having appropriate prescribers as deemed by the organization, a comprehensive education plan for nurses who administer chemotherapy, and a standardized competency evaluation with a recommendation for conducting the evaluation on an annual basis. The ASCO/ONS workgroup recommends the ONS chemotherapy and biotherapy provider course as the initial education for nurses who administer chemotherapy (Neuss et al., 2013).

General chemotherapy practice standards also suggest that appropriate references including established protocols, research articles, and/or hospital-approved alternative electronic references or books are readily available to pharmacists preparing and nurses administering chemotherapy. In addition, there should be a set interval of time, determined by the hospital, when laboratory data will be obtained prior to treatment.

Another study discussed the financial impact of chemotherapy administration related to time because nurses have four major tasks to complete when administering chemotherapy (DeRaad, Gool, & Ward, 2010, Level VI). These tasks include patient education, patient assessment, administration, and
patient communication. Although all of these tasks are patient-centered, interdisciplinary communication throughout this process was imperative to providing seamless administration.

To highlight the importance of each discipline, The American Society of Health-System Pharmacists (2014; Level VII) also created a set of recommendations related to chemotherapy administration. The Guidelines on Preventing Medication Errors with Chemotherapy and Biotherapy focused on the role of pharmacy, but also nursing. These guidelines are consistent with those presented by ASCO/ONS (2013). Future synthesis of these two guidelines has the potential to improve communication and clarify recommendations across all interdisciplinary team members.

Lastly, the Ohio State Board of Nursing has prepared a statement related to nurses who administer chemotherapy that echo those set forth by ASCO/ONS (2008; Level VII). They determined that only registered nurses are allowed to administer chemotherapy, competency evaluation is the responsibility of the agency, and all written policies and procedures should be reviewed annually (2008). No other state was found to have a similar statement related to chemotherapy administration competency.

In summary, the literature about verification and administration practices supports adherence to all elements and guidelines set forth by ASCO and ONS. Providing systems that enable these practices and policies to guide interdisciplinary team members in chemotherapy verification and administration will promote safe patient care.

Nursing education and training. Education and training is a vital component to the preparation of nurses who administer chemotherapy and biotherapy. The rapid growth of the use of chemotherapy in the 1960s resulted in the advancement of the oncology nursing specialty (Haylock, 2011; Review of Literature). In order for nurses to comply with standards and recommendations as discussed in the previous section, they need to be educated prior to implementation of recommendations. Numerous studies discussed not only methods, but also the positive impact of education and training on patient

ASCO/ONS recommendations suggest standardized initial education and ongoing competency for all nurses who administer chemotherapy or biotherapy (2013). Specifically, the ONS Chemotherapy and Biotherapy course is recommended for initial education and competency. However, this course is recommended to nurses with a minimum of 6 months in providing cancer care. Some studies have suggested that this course is not appropriate for the oncology-naive nurse (Yu, Yu, Chen, Wang, & Tang, 2013; Level VI). In addition to this course, the ongoing competency provided by organizations should be completed on an annual basis (Neuss et al., 2013; Level VII). Although initial training and competency may be the ONS course, other concepts beyond chemotherapy administration should be presented to nurses new to oncology (Mota, Corcoran, & Reid, 2007; Performance Improvement). A study in one setting revealed that despite the recommendation for ongoing competency, 55% of respondents of 123 nurses indicated that there was no competency monitoring for nurses on an ongoing basis (Kim et al., 2011; Level VI).

The "Bridge to Oncology" program was designed for educating new graduates and oncology-naive nurses for practice in the cancer treatment setting (Mota, Corcoran, & Reid, 2007; Performance Improvement). This program presents concepts in a progressive approach, increasing difficulty over the course of the program. In addition, it offers many options such as online learning, classroom instruction, and observational experiences. Providing nurses with a clear orientation pathway is essential to success for a new nurse in the oncology setting (Mota, Corcoran, & Reid, 2007).

A similar study described the role of an orientation for new nurse practitioners in the oncology setting (Rosenzweig, Giblin, Morse, Sheehy, & Sommer, 2012; Level VI). This cross sectional study evaluated the impact of lack of training on nurse practitioners. Despite the assumption that these
Oncology Nurse Practitioners would be prepared, results concluded that, without formal training, they failed to self-report adequate preparation for their role (Rosenzweig et al., 2012).

Education on related topics such as extravasation or hypersensitivity reactions can improve nursing knowledge and impact patient outcomes (Verity, Wiseman, Ream, Teasdale, & Richardson, 2008; Level III). Providing nurses with options such as journal clubs, conferences, simulation experiences, shadowing, and classroom instruction can improve understanding of oncology concepts (Crannell, 2012 - Level III; Mota et al., 2007 – Performance Improvement; Oestreicher, 2007 – Review of Literature; Sheldon et al., 2013 - Level III). Due to increased patient care demands, online learning can be an efficient and effective learning tool in the workplace. In chemotherapy administration, there are many new drugs that emerge requiring continuous ongoing education. To keep up with these demands, Batty, White, & Miller (2011; Performance Improvement) presented a method of online instruction that was without cost and provided nurses with comprehensive education and updates about chemotherapy drugs and practices.

Another method of instruction enrolled interdisciplinary team members in classes to provide consistent education across disciplines (Strother et al., 2012; Level III). A total of 30 healthcare professionals were educated over a 5-day period, including eight pharmacists or physicians. Pre- and post-test comparisons showed an improvement of understanding for all participants. Improvement of inter-professional communication has an increased potential to occur during this format of education. Furthermore, by providing education to all team members simultaneously, clarification of role expectations were accomplished (Stother, et al., 2012).

In summary, despite many studies related to educational and training programs, many lacked rigor and concrete results. Most of the literature was descriptive or performance improvement projects, however they provided potential options for education and training program design. Incorporating the recommended ONS Chemotherapy and Biotherapy course is just the first step in an
educational plan. Providing a sustainable ongoing education program is essential to improve nursing knowledge related to chemotherapy administration.

**Safety precautions.** Adherence to safety precautions is a critical element in chemotherapy administration. Safety precautions refer to safe-handling and methods to decrease accidental exposure to chemotherapy for patients and staff. Chemotherapy safety precautions are outlined in the ASCO/ONS recommendations, specifically related to the process of preparation and administration (Neuss et al., 2013; Level VII). Studies have concluded that following these guidelines is an important part of practice (Pitello et al., 2010; Review of Literature). Complying with preparation standards, such as pharmacy specific procedures, protect the end user and patient (Keat, Sooaid, Yun, & Sriraman, 2013; Level IV).

**Safety precautions by practicing nurses.** Despite nursing knowledge and understanding related to chemotherapy safety precautions, nurses do not always comply with advised precautions. In one study, although 73% of nurses reported knowing the guidelines for safe handling of chemotherapy agents, only 47% were applying these precaution measures during the preparation process and only 26% demonstrated compliance with them during administration (Kampitsi et al., 2012; Level VI). In a similar study, 70 nurses working in different practice settings were surveyed and 63% of these nurses reported a lack of protective systems and equipment (Papa et al., 2010; Level IV). Although these nurses took a special program on chemotherapy handling and administration, only 36% reported taking special precautions (Papa et al., 2010). These alarming findings reveal that nurses may not always adhere to best practices, even if they are known and available.

**Safety precautions by nurse managers.** Another important aspect is nurse manager knowledge and understanding. Although a manager may be experienced in their role, they may have a limited understanding of clinical oncology practice. A manager’s gap in knowledge may result in poor staff
compliance with safety standards if they are not fully aware of recommendations (Polovich & Clark, 2012; Level VI).

**Safety precautions by patients.** Researchers revealed that patients have limited knowledge about their own chemotherapy toxicity and risk (Schwappach & Wernli, 2010; Level VI). In this study, interviews with patients revealed that they underestimated the risk related to chemotherapy exposure. Also, patient engagement in the safety process may increase understanding and knowledge (Schwappach & Wernli, 2010). However, if nurses are not role-modeling best practices, the transfer of the knowledge and behavior to patients may be limited.

**Error prevention.** Errors related to chemotherapy have been reported to occur at least 40% of the time (Bruce, 2013; Review of Literature). High alert medication policies require a defined independent check (Bruce, 2013). In addition, final administration is the component of the medication process that is most vulnerable to error (Bruce, 2013).

Errors may include rate of administration, wrong drug, extravasation, wrong patient, wrong route, and omitted drugs (Ashley, Dexter, Marshall, McKenzie, Ryan, & Armitage, 2011; Performance Improvement; Bruce, 2013; Review of Literature; Gonzalez, 2013; Review of Literature; Nelson, Moore, Grasso, Barbarotta, & Fischer, 2014; Performance Improvement). In addition, dose calculation errors may lead to eventual administration errors (Gaguski & Karcheski, 2011; Review of Literature). Due to the multi-step process required for chemotherapy drug calculations, there are multiple opportunities for errors to occur. Nurses are the last line of defense in drug administration providing one final opportunity for error prevention and improvement in chemotherapy safety (Sheridan-Leos & Hartnaft, 2007; Performance Improvement).

There may be some predictive components of chemotherapy orders that increase errors. For example, one study evaluated 17,150 chemotherapy orders and, of those orders, 540 orders or 3%, contained at least one error (Ranchon et al., 2012; Level V). Additional risk factors for errors included
patients with Body Surface Areas (BSA) greater than 2 m², protocols with more than three drugs, protocols involving carboplatin, protocols with at least one modification by the physician, inpatient care, and prescriptions by resident physicians (Ranchon et al., 2012; Level V).

Although errors are noted throughout the research, underreporting of errors is a concern. Applying methods such as double-checks can decrease or eliminate errors (Spruill, Eron, Coghill, & Talbert, 2009; Level III). After one year of implementation of double-checks, one hospital reported no chemotherapy wrong patient events (Spruill et al., 2009; Level III).

Overall there are many strategies that can be applied to prevent errors. Some of these strategies include nurse checklists, computerized prescription order entry, consistently using a reliable method to verify patient identification, measure height and weight in centimeters and kilograms, use high-visibility tools such as calculators with large numbers, organize the work and workspace, eliminate the use of abbreviations and acronyms, provide and use up-to-date information that is available at the point care, and include the stakeholder with the most to lose (the patient) in chemotherapy prevention (Kullberg, Larsen, & Sharp, 2013; Schulmeister, 2005; Review of Literature). Including patients in the verification and administration process using the double-check procedure may also decrease errors and improve patient understanding of preventable chemotherapy errors (Kvale & Bondevik, 2010; Level VI, Schwappach, Hochreutener, & Wernli, 2010; Level VI, Schwappach & Wernli, 2010; Level VI).

**Non-oncology setting.** It is important to consider administration in the non-oncology setting as well. Chemotherapy in the non-oncology setting can increase potential risk of error and poor patient outcomes due to lack of untrained staff (Geddie, 2008; Review of Literature). There are many strategies to reduce the risk of error and improve patient outcomes in these settings. Interventions such as pager systems or phones that reach an oncology resource nurse can enable non-oncology nursing staff to have increased support for patients that require specialized care (Fradkin, Blasiak, Eder, Pederson & Baraboratta, 2013; Performance Improvement, Maloney et al., 2013; Performance Improvement).
However, it is important to ensure that nurses are provided with adequate time in order to provide quality care to these patients (Smith, 2011; Level VI). Lastly, other methods, such as the ONS Treatment Basics course can be utilized to educate nurses who may administer chemotherapy to a specific population (Muehlbauer, 2012; Level VII).

**Oncology emergencies.** The purpose of this project is not to manage oncology emergencies, but prevent them. However, decreased knowledge related to chemotherapy and its side effects may increase the risk of associated miss-management of oncology emergencies, such as neutropenic fever. Neutropenic fever can be life threatening and very costly for patients and hospitals (Courtney et al., 2007; Level VI). Nurses who are not knowledgeable about the side effects of chemotherapy are not prepared to manage such complications or emergencies.

**Conclusion.** In conclusion, a comprehensive literature review of evidence related to chemotherapy administration yielded many research studies, recommendations for practice, and quality improvement projects that aligned with project goals. Strengths of the evidence discovered included varying levels and was not limited to just case reports, expert opinions or theory. This provided substantial findings to base practice changes upon. Consistent methods related to recommendations for practice, education and training, safety precautions, and error prevention were revealed. Although recommendations for practice as presented by ASCO, ONS, and ASHP are consistent, a definitive method for standardization and adoption of practice has not yet been described. However, descriptive studies related to education and training provide many options. Having more than one method of education for staff administering chemotherapy was effective. With an ultimate goal of patient safety and improved outcomes, efforts related to error prevention should be applied in the practice setting to ensure this goal is achieved and measurable. Following chemotherapy standards of practice established by experts can serve as a foundation for practice and policy. In addition, implementation of practice changes based on these standards will ensure the most evidenced-based practice to date. Application of the best
education methods for staff in the inpatient setting will improve nursing competency and understanding.

**Innovation in Practice**

Multiple evidence-based strategies were applied to address needed improvements in cancer care at PMMC. Strategies that standardize methods of chemotherapy verification and administration, improve education and training for inpatient nursing staff, and increase interdisciplinary communication were utilized to address the problem. The focus of this project was on developing a team to first address intravenous chemotherapy or biotherapy administrations in the inpatient setting. Further opportunities related to other routes of chemotherapy administration will be further presented in the Chapter Five.

**Standardization of chemotherapy verification and administration.** As presented, the chemotherapy and biotherapy guidelines set out by ONS/ASCO are the most widely applied and referenced recommendations throughout the literature. These recommendations serve as the current gold standard. Current policies were assessed and addressed for deviation and gaps from these safety standards. In addition, oral chemotherapy was included into policy, as the most current safety standards given by ASCO/ONS requiring pharmacy review, verification of orders, and nursing double checks. The current standards state that the institution is responsible for providing a policy that clearly defines all aspects of intravenous inpatient chemotherapy administration: ordering, preparation, verification, and administration (Neuss et al., 2013).

**Education and training.** In order to ensure compliance with the ASCO/ONS safety standards, it is important to provide nurses education and competency assessment that follow these standards. The ASCO/ONS (2013) safety standards state:

The practice/institution has a comprehensive educational program for new staff administering chemotherapy, including a competency assessment, or the practice/institution uses an
established educational program regarding chemotherapy administration that ends in competency assessment. Education and competency assessment regarding chemotherapy administration includes all routes of administration used in the practice/institution site (e.g. parenteral, oral, intrathecal, intraperitoneal, intravesicular), and safe handling of hazardous chemotherapy agents. An example of an established educational program is the ONS Chemotherapy and Biotherapy Course. The practice/institution has a standard mechanism for monitoring chemotherapy administration competency at specified intervals. Annual competency reassessment is recommended (p.5).

Not only is it recommended that nurses who administer chemotherapy be trained by a standardized process, The Oncology Nursing Society’s Chemotherapy and Biotherapy Administration course is the most commonly used course nationally with over 7,000 ONS Chemotherapy and Biotherapy Provider Card holders across the country (J. Mills, personal communication, December 27, 2013). These standards were the basis for this project’s education and training methods.

**Interdisciplinary communication.** Interdisciplinary communication is a vital part of the chemotherapy administration process. As presented, communication throughout the verification and administration process has been presented as a key component to safety (Chung, Collins, & Cui, 2011). In addition, as previously noted, studies have shown that the use of communication systems, such as pagers or phones that reach an oncology resource nurse, provide non-oncology nursing staff with the needed support for patients that require specialized care (Fradkin, Blasiak, Eder, Pederson & Baraboratta, 2013; Maloney et al., 2013).

The purpose of this project is to address the nursing administration process, however practice is impacted by physician ordering procedures. In order to ensure consistency and allow communication, physicians were consulted and updated about the project on a regular basis. Oncologists admit patients to PMMC and the other hospitals of HPH, meaning oncology patients are admitted throughout each
hospital and not in one concentrated facility or unique oncology nursing units. This project provided these providers with a standardized process at all of HPH hospitals.

Summary

The purpose of this EBP project was to improve the intravenous chemotherapy and biotherapy administration process and increase positive patient outcomes post-chemotherapy in the inpatient setting at Pali Momi Medical Center. A thorough literature search revealed that safety standards related to chemotherapy and biotherapy administration should be followed, training and education for nurses should result in increased knowledge and competency, and that interdisciplinary communication should exist to ensure best practices. Based on the evidence reviewed, interventions addressing these three areas were implemented and evaluated. Application of evidence resulted in a project design that enabled improvement in the administration process and patient outcomes during and post-chemotherapy.
CHAPTER THREE

Introduction

In this chapter, the methods of this evidenced-based practice project are presented. Sections of this chapter will review the project design, elements of the intended practice change, conceptual and operational definitions, the sampling plan, data collection procedures, methods of evaluation, and human subject considerations. The Iowa Model of Evidenced-Based Practice to Improve Quality Care will be used as a framework for this chapter.

Objectives

A widely known format for developing a clinical question is known as PICO, where P = patient population of interest, I = interventions, C = comparison, and O = outcomes (American Nurses Association, 2016). At Pali Momi Medical Center, the Problem was that the chemotherapy and biotherapy process of administration was not clearly defined in the inpatient setting. In addition, there was a lack of continued education, a perceived low inpatient volume of patients receiving chemotherapy or biotherapy, and inconsistent communication across disciplines related to chemotherapy or biotherapy administrations. The Interventions that were applied included the development and implementation of a standardized policy with a new administration documentation process, provision of consistent chemotherapy education, and facilitation of interdisciplinary communication. The Comparison was historical data with current practice. The intended Outcome or purpose of this evidenced-based practice project was to improve the intravenous chemotherapy and biotherapy administration process in order to increase positive patient outcomes post-chemotherapy in the inpatient setting at Pali Momi Medical Center.

Design

In order to achieve the overall objective of improving the chemotherapy and biotherapy administration process in the inpatient setting at Pali Momi Medical Center while ensuring evidence-
based practice, this project utilized an Action Research Design. This design was chosen because it can focus on finding solutions to practice problems in health care settings (Nieswiadomy, 2011). In this type of research, the implementation of solutions occurs as part of the research process.

**The Practice Change**

The principal practice changes included the development and implementation of: (1) a system-wide chemotherapy and biotherapy verification and administration policy, (2) a comprehensive education plan for nurses who administer chemotherapy, (3) standardized nursing documentation, and (4) communication methods to facilitate the process of chemotherapy and biotherapy.

**Pilot the Change in Practice**

Piloting the evidence-based change in practice is essential before the adoption of the new practice change occurs and requires detailed planning. As the new practice is being carried out, constant assessment and evaluation should be completed by the team. At conclusion of the pilot, if outcomes are achieved as expected, then adoption of the practice will be supported. Subsequently integration into practice will occur. In this section, the operational definitions, sampling plan, and data collection procedures are presented.

**Characteristics of Practice Change**

Rogers (2003), describes adoption of a practice change as a decision of “full use of an innovation as the best course of action available” and rejection is a decision “not to adopt an innovation” (p. 177). The four key components of diffusion that are needed to make change are innovation, communication channels, time, and social systems (Rogers, 2003). Furthermore, the characteristics of innovations or practice changes can be impacted by the perception of individuals and can explain the project’s rate of adoption (Rogers, 2003). There are five characteristics of this project that were evaluated: Relative Advantage, Compatibility, Complexity, Trialability, and Observability.
**Relative advantage.** According to Rogers (2003), relative advantage is the degree to which an innovation is perceived as better than the current state of ideas. The relative advantage of this quality improvement project is directly related to patient safety. Patient safety is a high priority for not only PMMC as an organization, but also for the nurses, physicians and pharmacists who are directly responsible for keeping patients safe. For this reason, the relative advantage is viewed as a great benefit to the organization and to patients.

At this time, there is limited baseline data reflecting documented errors or events related to chemotherapy. However, it is possible that errors or near misses are underreported due to a lack of knowledge or recognition of events. In addition, there is more chemotherapy being administered than what is perceived. Therefore, the relative advantage of this project has increased.

In addition, the hospital has announced a desire to increase their oncology service. This is another advantage of the project. This evidence-based practice project will enhance staff knowledge and understanding prior to this anticipated growth in the cancer population. Most importantly, chemotherapy is inherently a high risk procedure and this project positively influences the safety of chemotherapy administration, thereby improving oncology patient safety outcomes and enhancing the relative advantage of the program. Lastly, from a cost perspective, chemotherapy is a high cost item due to limited reimbursement rates in the inpatient setting and this project has the potential to decrease the use of unnecessary chemotherapy.

**Compatibility.** Rogers (2003) states, “Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters” (p. 590). A key component of this project is standardizing the inpatient process to match existing outpatient methods. The existing BEACON documentation efficiently documents chemotherapy administration. Using the existing inpatient system is highly compatible, as this project will standardize chemotherapy administration.
**Complexity.** Complexity is the degree to which the project is perceived to be difficult to understand and use (Rogers, 2003). The aim of this project is to decrease complexity and streamline workflow; current systems do not support this. The use of an algorithm provides PMMC with a workflow and a process for chemotherapy and biotherapy administration. In addition, there are existing protocols that are not used by all physicians. The work of physicians could be simplified by use of existing protocols. The project itself is complex, in that there are many components to achieving quality improvement. However, for the end user, the process has been designed to be straightforward, clarified, and clear.

**Trialability.** Trialability is the degree to which the project may be experimented with during the pilot period (Rogers, 2003). Due to the current volume of chemotherapy administration, each new order offers the ability to trial the process. In addition, assessment and adjustments were allowed to enhance the new process. Components such as the education and training were also performed in small groups, allowing for on-going analysis and modification of the training using feedback from staff.

**Observability.** The last characteristic described by Rogers (2003) is observability, or the degree to which the results of the project are visible to others. End users, such as staff nurses, pharmacists, and physicians make immediate observations about the impact of the new processes. For others in the organization, such as nursing or pharmacy leadership, data collection allows for observations to be made as part of the evaluation plan.

**Operational Definitions**

1. **Bedside Checks:** This occurs when two chemotherapy-competent staff members (Physicians, Pharmacists, or Nurses) double-check the drug, dose, rate, and diluent with the order. In addition, the drug label is compared to patient identifiers after the drug is prepared and prior to giving the chemotherapy to the patient. This double-check should not be confused with the verification process prior to preparation and should occur in the presence of the patient.
2. Biotherapy or Targeted Agents: Systemic treatments that may modify the patient’s own immune defenses. These agents can be used alone or in combination with chemotherapy. They may be so specific that they target a single receptor on a tumor cell and or an enzyme within in the cell. In addition, they may cause side effects and toxicities different than those of other antineoplastic agents. (ONS, 2014).

3. Chemotherapy: Systemic therapies that are used as single agents or in combination and are limited by toxic effects on normal tissue (ONS, 2014).

4. Chemotherapy Administration: The process of giving the patient the chemotherapy. Elements and steps of the administration process include safe handling, techniques related to the route, and double checks that occur with the patient present. Nurses are not authorized to administer chemotherapy intrathecally.

5. Chemotherapy Competent Nurse: A nurse who has been trained to administer chemotherapy with evidence of completing the ONS chemotherapy and biotherapy certificate course, chemotherapy skills course, initial on-unit competency, and ongoing education as evidence by annual competencies.

6. Chemotherapy Pharmacist: The pharmacist involved in reviewing orders and/or the pharmacist who prepares chemotherapy/biotherapy.

7. Chemotherapy Prescriber: The physician or Licensed Professional who prescribes chemotherapy and or biotherapy.

8. House Supervisor: The house supervisor is responsible for bed management including transferring of patients to patient care areas or assigning patients to patient care areas.

9. Near Misses: Near misses are when errors are mitigated prior to reaching the patient. For example, a near miss would be if there is a failure to order hydration and is rectified.
10. **Releasing Orders:** This is a documentation step where the chemotherapy-competent nurse releases chemotherapy and/or biotherapy orders. It occurs after verification and prior to preparation by pharmacy staff.

11. **Verification of Chemotherapy:** The process of systematic checking all elements of chemotherapy orders and patient assessment prior to drug preparation and administration. Elements such as patient height, weight, drugs, doses, route, disease, physical assessment, and access, should all be verified prior to preparation of chemotherapy.

**Sample Plan**

**Setting.** Hawaii Pacific Health is the largest health care provider in the state of Hawaii. It is a not-for-profit health care network of hospitals, clinics, physicians, and care providers dedicated to the mission of improving the health and well-being of the people of Hawaii and the Pacific Region (HPH, 2015). The hospital system has four major hospitals: Kapiolani, Pali Momi, Straub, and Wilcox. In addition to these hospitals, Hawaii Pacific Health includes more than 50 additional locations and service sites statewide.

This new chemotherapy and biotherapy administration policy was piloted and utilized at all four hospitals and any care sites that administer these agents. Pali Momi Medical Center is the hospital where all other elements of this project were piloted and evaluated i.e., education and training program and inter-professional communication strategies. PMMC is a non-profit, 124-bed medical center located in Leeward Oahu serving the communities of both central and west Oahu (PMMC, 2015). In addition to the inpatient facilities, it offers care in clinic settings such as the infusion center. PMMC currently holds their accreditation by the Commission on Cancer as a Community Cancer Center and recently passed reaccreditation requirements in 2015. PMMC has more than 1,200 employees and 400 participating physicians. It is fully accredited by The Joint Commission on the Accreditation of Healthcare Organizations. The PMMC is planning to build a new cancer center that is set to open in 2017.
The organizational climate and social systems within an organization can impact any new practice change. In addition, organizations create a positive climate for practice change by ensuring that end users find training, technical assistance, and documentation easily accessible (Weiner, Belden, Bergmire, & Johnston, 2011). Team Two at PMMC was responsible for engaging users and providing support during project implementation. There were many opportunities for feedback throughout the project. HPH and PMMC leadership were in support of this project and end users sought guidance and requested education related to chemotherapy administration. The entire organization holds patient safety as one of its highest priorities.

At PMMC, the fifth floor was the designated unit for patients to receive intravenous chemotherapy and biotherapy. This unit served as the primary setting for interventions. However, workflow was also developed for patients requiring chemotherapy while in the intensive care unit.

Sample.

**Patient sample.** The target population for this project is patients who have been prescribed intravenous chemotherapy and or biotherapy for treatment of any disease type. The accessible sample are those patients receiving intravenous chemotherapy and or biotherapy in the inpatient setting (ICU, 4th, 5th, or 6th floors) at PMMC. Patients receiving oral chemotherapy were not included in this project. The sample size was determined by how many patients in the inpatient setting had intravenous chemotherapy and or biotherapy orders. Baseline data included all patients who received intravenous chemotherapy and or biotherapy orders between August 2014 and December 2014; post-implementation data was collected between January 2015 and January 2016.

Inclusion criteria of patients in this project was any patient who was ordered intravenous chemotherapy and/or biotherapy treatments. This included any antineoplastic agent that is listed in the PMMC hazardous drug policy and or biotherapy that requires a dual check. In addition, patients who are continuing with home therapy or starting a new regimen in the inpatient setting was included. Only
the intravenous route of chemotherapy administration was included in this project’s evaluation. No patients receiving intravenous chemotherapy was excluded from data collection. The patient sample included 6 distinct patients in the baseline period and 12 distinct patients in the post-intervention period. However, 2 of these patients were shared between the baseline and post-intervention data periods.

On occasion, one patient encounter would result in the initiation of subsequent regimens. To ensure that data was evaluated in a reliable manner, a cycle of chemotherapy was identified as a regimen. This allowed the project investigator to consistently evaluate chart documentation and further analyze like regimen management. In addition, each cycle/regimen of chemotherapy, was further evaluated for volumes related to individual drugs and doses of these drugs. Patients receiving intravenous chemotherapy or biotherapy for non-oncology reasons were included in data collection. However, all other routes of administration including oral, subcutaneous, or intramuscular were excluded from the patient sample. Lastly, data was separated from month to month to allow for further qualitative trend analysis.

**Healthcare provider sample.** The healthcare providers such as nurses, physicians, and pharmacists are the users of the new practice change. Rogers (2003) categorizes users, or members of the social system, on the basis of innovativeness. All users can be characterized by one of the five user categories: Innovators, Early Adopters, Early Majority, Late Adopter, or Laggards (Rogers, 2003). The laggards bring an important perspective to the project because they typically rely on their past experiences. Some of the laggards were the staff nurses who were learning chemotherapy for the first time. The fear of learning a new skill and the misconceptions related to chemotherapy administration, such as concern for personal exposure and risk, may impact perception about the project. In the past, staff nurses perceived a lack of support in carrying out this skill. This evidence-based project promoted patient safety by ensuring nursing training and best practices and served to decreases nurses’ reliance
on past experiences. However, the previously trained nurses, with some experience, were early adopters due to their baseline knowledge and eagerness to learn.

For this reason, beyond patients, the second main target population for this project is nurses who have been trained to administer chemotherapy and or biotherapy for treatment of any disease type. The accessible sample were those nurses who administer chemotherapy and or biotherapy in the inpatient setting at PMMC. The baseline sample size was three registered nurses who hold their chemotherapy and biotherapy provider card. The post-intervention sample size was 12 nurses.

Some physicians might serve as late adopters. Doctors may have to learn a new process that could pose an initial challenge for them, especially those who have not been utilizing the BEACON system. Identifying physician champions to support the project positively impacts this group. One employed medical oncologist is deployed primarily at PMMC. This physician was included in communication and updates. The emphasis of this project was efficiency and standardization. Both of these elements were utilized to demonstrate to the physicians how this project can not only improve practice, but decrease workload and time. Six different physicians provided orders during the baseline and post-intervention periods. Four of these physicians learned BEACON throughout the post-intervention period.

Only 1 oncology pharmacist was employed at PMMC during the baseline period. She served as an early adopter to the project. This pharmacist remained until she was replaced by a new pharmacist during the post-intervention period. Both the existing and new pharmacists were early adopters due to their willingness to engage nurses in the verification process. Other various pharmacists evaluated chemotherapy orders when covering the sole oncology pharmacist. This data was tracked and will be presented in the results section.
Marketing and Recruitment Plan

Marketing this project to healthcare providers will be vital to its successful implementation. The quality improvement project was grounded in communication between team members. According to Rogers there are two methods of communication that can be utilized, mass media and interpersonal channels (2003).

Mass media. Examples of mass media that were utilized for this project included emails and hospital intranet communication. Communication related to chemotherapy patients was limited to mass emails that were sent to large groups of people. This method of communication is good as initial communication, but did not provide staff and leadership the level of communication that was needed for this project. With each patient admission or new orders, pharmacists would provide an email to unit managers and key staff.

Team two determined that all key pharmacy staff, the 5th floor unit manager, unit supervisor, oncology service line coordinator, and chemotherapy nurses were vital to the success of this project. Initial communication identified patients with anticipated chemotherapy orders as identified by pharmacists. Follow-up responses from the unit manager or supervisor included staffing planning for coverage of patients. With this identification, nurses who were to care for these patients were now included in all communication.

Other mass media included the use of the hospital intranet. An Oncology Service Line platform provided a central place for chemotherapy reference materials that were not used as part of the medical record, but included the most recent addition of the ASCO/ONS Chemotherapy and Biotherapy Guidelines, a chemotherapy checklist that for use by nurses as a reference to ensure all steps of order verification (see Appendix D), a modified pharmacy checklist including all steps to be completed by pharmacists to ensure accurate order verification (see Appendix E), and all reference materials from the
4-hour chemotherapy skills course. Nurses were educated on the Oncology Service Line platform during the on-unit and formal class education sessions.

**Interpersonal channels.** Interpersonal channels of communication were used more frequently as they are efficient and allow for face-to-face conversations. Due to a lack of knowledge related to chemotherapy, it was important that members of the team have time to fully understand the complexity of the project. Monthly meetings were and continue to be held with the Oncology Practice Council. In addition, daily communication occurred between the oncology pharmacist and the primary investigator. This ensured that all chemotherapy administration was being tracked. Frequent meetings will occur with other leaders to ensure the project is continuing. The staff educator also provided on-demand education at the bedside prior to chemotherapy administration, as needed.

In order to share the new process, a series of live in-services were presented to various groups. The inpatient pharmacist, all nursing managers from non-cancer care designated units, house supervisors, and the leadership team were all provided with information about the new process, the algorithm, and their prospective roles in the process. In addition, key stakeholders were provided with education related to the new policy.

Due to the small number of chemotherapy-competent nurses who served as resources to the entire hospital, a running list of experienced and credentialed chemotherapy nurses was maintained by the fifth floor unit manager.

Recruitment of members of the Oncology Practice Council was facilitated by the Director of Education for HPH and PMMC nurse educator. However, development of this group is maintained by the Oncology Service Line Coordinator. After a brief recruitment, managers were excited to be part of this project and began to continue enlisting additional members. For example, clinical nurse specialists, staff nurses, a physician leader, and supervisors joined this team.
Another area of recruitment involved staff nurses from the fifth floor. Nurses who expressed and continue to express interest in pursuing chemotherapy competency continue to be target participants for this project.

**Evaluate the Practice Change**

**Data Collection Procedures**

Data was collected from various sources to evaluate this quality improvement project. Chart reviews, focus groups, and surveys were utilized to evaluate project outcomes. An ongoing detailed chart review was conducted to assess baseline and post-intervention data related to compliance of nurses, physicians and pharmacists. Focus groups and surveys were used to evaluate satisfaction, improvement of workflow, and comfort.

**Pre and post implementation data collection.** In order to collect comparable pre- and post-implementation data, one tool was utilized. The only existing way to track chemotherapy and or biotherapy orders was by to pull drug orders from pharmacy. This data presented patient chart access information, prescriber, drug, date, and verifying pharmacist. This information was regularly retrieved by the system-wide pharmacist for financial review of drugs administered. From this information, an ongoing chart audit will be completed. The chart audit included, but was not limited to, the following parameters: drug, route, administering nurse, validation of nurse competency, prescriber and specialty, documentation of nurse verification (chemotherapy release), documentation of dual nurse bedside checks, consent in chart, reference or protocol used, emergency medications ordered if appropriate, documentation of patient education, chemotherapy flow-sheet completion and/or chemotherapy note, and the documentation of chemotherapy on the care plan.

The chart audit was accomplished by assessing documented information from EPIC (the electronic medical record) and/or BEACON, the chemotherapy and biotherapy ordering system. Chart audits were completed by the principal investigator and system pharmacist. Baseline data collection
was completed by evaluating charts between August of 2014 and December 2014. Post-implementation data collection utilized a retrospective chart review, reviewing all charts from inpatients receiving intravenous chemotherapy from January 2015 through January 2016.

**Event reports.** Although reporting of chemotherapy- or biotherapy-related events are rare, they will be collected during the post implementation period. Part of staff training included the documentation of near misses. The risk manager at PMMC served as the gatekeeper for this information and provided the primary investigator with all event reports.

**Monitor and Analyze Structure, Process & Outcome Data**

**Program Evaluation Plan**

A comprehensive evaluation will be performed to evaluate the overall impact of the Chemotherapy Collaborate program. A comprehensive evaluation involves analyzing needs, process, effect, and cost of a program (Issel, 2015). The goal of this program is to improve the process of chemotherapy and biotherapy administration in the inpatient setting at PMMC. In order to evaluate if this broad goal has been achieved, it is important to determine measurable project objectives. The logic model has been selected as the evaluation framework for this project (see Figure 1).
Figure 1

Inpatient Chemotherapy and Biotherapy Administration PMMC: Logic Model

Inputs

There are many inputs involved in this project. Inputs included nurses who administer chemotherapy and biotherapy; pharmacy staff who verify and prepare chemotherapy and biotherapy; physicians who prescribe chemotherapy and biotherapy; patients who receive chemotherapy and biotherapy; and PMMC leadership, including administration and unit management, who evaluate the hospital’s overall performance outcomes. For successful implementation of this project, resources were required as additional inputs. These resources will be both budgetary resources and human resources.
Budgetary inputs.

**ONS chemotherapy and biotherapy certificate course.** As part of the proposed new chemotherapy and biotherapy administration policy, nurses were and are required to successfully complete the ONS Chemotherapy and Biotherapy Certificate Course. This course is offered online and has a cost of $279 dollars per nurse. Nurses who already held an ONS chemotherapy and biotherapy card were still required to attend this course at a discounted rate of $99 dollars. A total of 15 continuing education credits are received when this course is completed.

The on-line certificate course is a self-paced course that nurses can complete in one month. As a requirement, Chief Nurse Executive approval from the system was granted to not only fund the course, but the hours spent completing the course. Budget requests for this course were approved at the system level. Purchasing of course vouchers from ONS was done through Hawaii Pacific Health at the system level. This budget was approved by the Director of Education at Hawaii Pacific Health. Due to the existing card holders and projected new holders, conversion to the new online course was presented (see Table 2).
Table 2

Chemotherapy and Biotherapy Provider Education and Training Costs

Key Points:
1. Currently the 2013 ASCO/ONS practice standards recommend:
   - Comprehensive initial education program - an example of an educational program is the ONS Chemotherapy and Biotherapy Course.
   - Annual Competency
2. 100% of RNs who administer chemotherapy across HPH currently hold an ONS or APHON provider card - despite not stating as part of policy.
3. Only 1 policy set this as a standard for education in policy. |
4. Both of the ONS/APHON course are reviewed, evidence-based, and standardized.
5. ONS Live course ended in 2013. As of 2014, all nurses, current card holders and new, will need to take the newest version. This course will have one time fee (see below). Renewal structure will be released in mid-2015.
6. It is not required to retrain this course every 2 years — Just a 2-3 hour renewal that provides CEUs. Previous renewal rates were $25/Q 2 years.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Current # of Chemotherapy Provider Card Holders</th>
<th>Due in 2015 New Online Cost</th>
<th>Non-Productive Costs Current Card Holders</th>
<th>Class Tuition Costs (ED Funds) (¢)</th>
<th>Projected New Nurses</th>
<th>Non-Productive Costs New Nurses</th>
<th>Class Tuition Costs (ED Fund) (¢)</th>
<th>Total Tuition Costs 2015 <em>Based as Agreed</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Straub</td>
<td>13 22 35</td>
<td></td>
<td>$18,191.85</td>
<td>$3,197</td>
<td>2</td>
<td>$1,581.90</td>
<td>$558.00</td>
<td>$3,197 c +$558 n = $3,755.00</td>
</tr>
<tr>
<td>Palani</td>
<td>8 5 13</td>
<td></td>
<td>$6451.20</td>
<td>$1,112</td>
<td>5</td>
<td>$4,032.00</td>
<td>$1,395.00</td>
<td>$1,112 c -$1,595 n = $2,587.00</td>
</tr>
<tr>
<td>ONS</td>
<td>5 0 5</td>
<td></td>
<td>$3,102.00</td>
<td>$556.00</td>
<td>2</td>
<td>$1,551.00</td>
<td>$558.00</td>
<td>$556.00 c +$558 n = $1,114.00</td>
</tr>
<tr>
<td>Kapiolani</td>
<td>7 32 39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APHON</td>
<td>5 12 17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>109 47</td>
<td></td>
<td>$36,349.05</td>
<td>$6,533.00</td>
<td>11</td>
<td>$8,598.00</td>
<td>$3,069.00</td>
<td>$9,602.00 +$2,103.00</td>
</tr>
</tbody>
</table>

*Class Tuition: Current Card Holder: $189/Member $139/Nonmember New Card Holders: $199.00/member $279.00/nonmember
* Non-Productive Costs = #RN (15hrs) (Job Rate)

Human resource inputs.

Chemotherapy skills course. Budgeted time was required for each nurse to attend the four-hour PMMMC chemotherapy skills course. The Chief Nurse Executive and fifth floor unit manager approved this expense for non-productive time of nursing staff. A four-hour class was proposed to allow nurses who work a 36 hour work week to attend class and avoid overtime costs. Additional efforts to perform education on an on-demand basis during productive hours were made to ensure cost containment was achieved. The course was offered four times and delivered to a total of 10 nurses. The current nurse job
rate is $53.78 per hour. Total costs for this course attendance cost = 10 nurses X 4 hours X job rate = (10X4) 53.78 = $2151.20.

Activities

**Chemotherapy and biotherapy verification and administration policy.** Existing policies were assessed for deviation and gaps from safety standards as outlined by ASCO/ONS. In order to establish evidence-based policies, Team One was responsible for synthesizing the four separate hospital-based policies into one system-wide policy that confirmed that all of the national safety standards are adhered to and implemented by pharmacy, medicine, and nursing. In addition, this team assessed current practice and recognized areas that differ or do not meet these standards and were responsible for making any practice changes within their hospital. The four Nurse Executives at each hospital reviewed and approved the final draft. In addition, each hospital Pharmacy and Therapeutics committees reviewed the policy and provided edits and feedback.

Once approval was obtained from these sub-committees, the policy was sent to the Hawaii Pacific Health Pharmacuetics & Therapeutics Committee. This committee is comprised of both pharmacy and physician leadership. Pali Momi Medical Center (PMMC) finalized approval of the policy and uploaded to the system intranet on May 20, 2015 (see APPENDIX B).

Once approval of finalized draft was completed, dissemination of the new system-wide policy was accomplished by providing education to staff nurses and pharmacists involved in chemotherapy administration. Education related to the new policy occurred during the Annual Chemotherapy Competency. The annual competency was conducted at all four hospitals in May of 2015. Make-up sessions were completed at one facility to ensure 100% attendance by all adult chemotherapy providers. In addition to chemotherapy order verification, key concepts in management of extravasation and hypersensitivity reactions and a review of the new policy, key changes from previous policies, and a policy scavenger hunt that required nurses to find key components in the policy were reviewed. A total
of 49 nurses across the system attended the competency and both inpatient and outpatient nurses who administer chemotherapy to the adult population attended the annual competency. Documentation of attendance was recorded in the Health Stream Learning Competency Center (HLC).

**Education and training.** Team 1 assessed existing education standards used within each hospital and developed a standardized education and training program to be used throughout the system. The key components of required education to administer chemotherapy or biotherapy in the health system include:

1. Successful completion of the Oncology Nursing Society’s Chemotherapy and Biotherapy Certificate Course

The existing outpatient staff at each of the hospitals previously attended the live ONS Chemotherapy and Biotherapy Provider Card course. This course was recently changed to a certificate course that is now given in an online format (ONS, 2014). Team One was responsible for compiling an active list of nurses who hold either a chemotherapy and biotherapy card or those who have taken the current on-line version of the course. The record of current chemotherapy card hold holders was created by the Oncology Service Line Coordinator.

At Pali Momi Medical Center and at the beginning of this project, all of the existing outpatient nurses had a provider card, but only three inpatient nurses held a current card. Other nurses attended this on-line certificate course at the discretion of their manager. Financial support for this training was provided by PMMC leadership. The HPH Education Director supplied funding for the purchase of ONS certificate course vouchers. Due to the new system-wide requirement of course attendance, as outlined in the new policy, education leadership determined that course tuition should be allocated by the HPH system as a requirement of competency. The primary investigator prepared a budget for bulk course voucher purchase that was approved by the Education Director and Chief Nurse Executives of all four hospitals. Unit managers across the system were responsible for determining those nurses who should
receive this specialized education and for communicating this need to the Oncology Service Line leadership. Specifically, a goal of increasing fifth floor nursing staff to 10 trained nurses was projected for this project.

2. Accomplishment of initial on-unit competency that incorporated assessment of verification and administration techniques

An expectation of three successful order verifications and drug administrations were identified to establish on-unit competency. Education was also provided related to the use of the BEACON order system during training sessions. BEACON training primarily occurred during on-unit chemotherapy competency completion with the assistance of experienced mentors that included the oncology pharmacists, the Oncology Service Line Coordinator, and the three primary inpatient experienced nurses. All new chemotherapy nurses were trained to “release” chemotherapy or biotherapy treatment plans and to systematically check orders according to existing protocols. They were also educated on how to access treatment protocols, how to verify chemotherapy orders, how to release orders to pharmacy, and how to time medications appropriately. The verification component includes 3 independent regimen verifications under the supervision of a chemotherapy competent nurse. Competency standards included an expectation that nurses verify different treatment regimens to demonstrate competency. Each regimen only provides one opportunity to demonstrate this competency, while it may provide multiple administration opportunities. For example, a traditional induction chemotherapy protocol requires only one regimen verification and release, but provides 10 opportunities for administration.

Completing this on-unit competency in the inpatient setting was a priority due to the differences in administering chemotherapy between inpatients and outpatients. Patients receiving chemotherapy in the inpatient setting traditionally receive dramatically different chemotherapy regimens. In addition, inpatients typically require acute medical care that can complicate administration.
The Nursing Education Department was used as the main resource for structuring and documenting competency. Documentation of pre- and post-administration assessment was performed in HPH’s educational software, Health Stream Learning Competency Center (HLC). In order to standardize documentation of competency, the educational software was used upon completion of the on-unit competency. An on-line competency evaluation tool was created and utilized modeled after the Oncology Nursing Society’s standardized competency tool (ONS, 2014) (see Appendix G).

3. Attendance at a 4-hour Chemotherapy Skills Course that reviewed understanding of treatment modalities, safety procedures, safe-handling, administration techniques, available resources, and order verification

Due to the low volume at PMMC, multiple education strategies were used to ensure that nurses were given effective on-unit education. Creative methods such as journal article reviews, in-services, simulation experiences, and shadowing were utilized to increase their understanding of oncology concepts (Crannell, 2012; Mota et al., 2007; Oestreicher, 2007; Sheldon et al., 2013). Case studies, journal articles, and events were included in this education. This four hour course was provided on-site four times and instruction was provided by the project author who is an Oncology Certified Nurse and formerly was a trainer for the Oncology Nursing Society live Chemotherapy Provider Course. Course objectives included a brief review of chemotherapy pharmacology, management of treatment side effects, emergency management including extravasation and hypersensitivity reaction, tools and resources available on-site, BEACON order review and release, calculations including Body Surface Area and Creatinine Clearance, error prevention and near miss reporting.

4. An annual competency evaluation based on identified practice gaps or new knowledge

To ensure an initial on-unit competency evaluation had occurred and to provide nurses with an annual competency, Team One assessed the current state and documentation of initial competency and practicum. An annual competency evaluation was conducted in 2014 with nurses across the system
using an on-line module. The Oncology Practice Council planned and determined key concepts for the 2015 annual competency for nurses who administer chemotherapy and provided a forum for annual competencies moving forward. This annual competency was provided in a live format providing simulation and discussion. An evaluation of the competency session was performed by attendees.

**Standardized method of nursing documentation.** All outpatient infusion areas of HPH utilize BEACON, the oncology application of EPIC, for order entry, release, and verification of chemotherapy and biotherapy orders. Nursing was responsible for the order release function at the PMMC infusion center only. Typically, releasing chemotherapy or biotherapy orders occurs after systematic checking and verification of order accuracy is performed by the nurse. In contrast, nursing was not performing this order release functionality in the inpatient setting. Due to a lack of documentation, it was not evident if nursing was completing all of the required pre-administration verification checks. In addition, in-patient pharmacists were verifying and making chemotherapy and biotherapy medications available on the Medication Administration Record (MAR) prior to a nurse verifying and documentation there verification in EPIC or BEACON.

In order to standardize practice and documentation, nurses in the inpatient setting were educated about the use of BEACON. There was no need for Information Technology leadership to provide security clearance for all nurses who have been deemed chemotherapy-competent as this function is available to all HPH nursing staff. However, staff were unaware of this specialized section of BEACON. Education related to the use of this documentation tool was provided via the Chemotherapy Skills Course and on-demand education that began in February 2015. In addition, nurses were taught standardized chemotherapy pre-assessments and post-assessments. Inpatient nurses were encouraged to utilize existing chemotherapy flow sheets in the electronic medical record. Documentation expectations included acknowledgement in the Nursing Note (DAR note) and in the patient Plan of Care.
Physician education. Physicians who were not currently trained on the BEACON system, were offered and provided education on a one-to-one basis. In the inpatient setting, neurologists, who use biotherapy in the treatment of non-cancer related diseases were provided this information. All other providers who ordered intravenous chemotherapy were knowledgeable in the use of BEACON.

Interdisciplinary communication. Interdisciplinary communication is a vital part of the chemotherapy administration process. Communication throughout the verification and administration process has been presented as a key component to safety (Chung, Collins, & Cui, 2011). A process algorithm from order entry to patient administration was created and utilized (see Appendix C). This algorithm identified the key steps beginning with the initiation or anticipation of a planned chemotherapy or biotherapy order. In addition, the algorithm identified steps for oral chemotherapy, order entry, and pharmacy verification. In order to improve communication across interdisciplinary teams this algorithm also identified responsibilities and was used to instruct team members on the new process.

House Supervisors serve as the gate-keepers to ensure patients are in the correct unit of care. It was expected that all patients requiring chemotherapy would channel through the house supervisor, no matter the unit of initiation, the mode of administration, or the ordering provider. Any staff member from any discipline can reach the supervisor to alert nurses and pharmacists to chemotherapy orders. House Supervisors and their manager were educated on the algorithm. They were also educated on how to access and view chemotherapy and biotherapy orders in order to coordinate care and ensure patients receiving treatment are admitted to the correct unit.

Due to the low volume of patients who receive chemotherapy, the fifth floor at PMMC was selected as the non-oncology setting at initiation of this project. Due to the unit’s mixed model of telemetry and medical surgical patient population, it was decided that this unit would allow for the most comprehensive coverage of patients requiring chemotherapy. Also, previously trained chemotherapy
nurses were already established as fifth floor staff members. The fifth floor is the only unit responsible for training and educating nurses in the skill of chemotherapy administration. The algorithm identified what steps to take if the patient receives care on the fifth floor or in the intensive care unit. If a patient was admitted to or required care by another unit, mechanisms to provide chemotherapy competent nurses to the patient while receiving chemotherapy were clarified. Expectations of unit-to-unit transfers were made to ensure patients received care on the fifth floor while actively receiving chemotherapy.

**Outputs**

**Nursing outputs.** Nurses who administer chemotherapy and biotherapy are key stakeholders of this project. They implemented most of the program’s processes. In addition, nurses are the last line of defense for ensuring safe administration of chemotherapy or biotherapy. The program goals specifically for nurses were to improve nursing knowledge of chemotherapy and biotherapy, to increase volume of nurses who provide chemotherapy and biotherapy, to determine a standardized method of chemotherapy verification and administration documentation, and to establish a designated unit for patient receiving chemotherapy.

Measurement of these outputs is accomplished by assessing nursing documentation. Although there are multiple occurrences of documentation throughout a patient stay and even during one course of chemotherapy, the primary investigator navigated the chart with the understanding that these 3 places may not include complete chemotherapy or biotherapy documentation. For each cycle or regimen, charts were assessed to ensure that documentation reflected the unique needs of the regimen. For example, on a multi-day treatment it was expected that the chart was noted with each day. This however, may not be indicated for each nurse if treatment course does not extend for 24 hours. Also, elements such as positive blood return, volume, and rate are captured in the medical record in additional flowsheets. Also nursing recognition of potential risks associated with infusion was
assessed. Specialized assessments were determined and limited to the treatments that were ordered.

Below is a summary of the assessments evaluated for:

1. **Rituxan**: Frequent Vital Signs
2. **High Dose Cytarabine**: Cerebellar Toxicity Screening
3. **High Dose Methotrexate**: Urine pH and biotherapy.

In addition, preparation to manage a reaction with the standardized emergency medications that should be ordered as part of the regimen was evaluated. It is imperative that emergency medications are released prior to start as availability of drugs on the inpatient units is based on released med.

**Pharmacy outputs.** Pharmacy staff are responsible for the verification and preparation of chemotherapy and biotherapy. Communication between pharmacy and nursing staff is vital for program success. The achievement goals related to nursing will enhance this communication. For example, use of the BEACON, a component of the electronic medical record, allowed for documentation. In addition, verbal communication supported the process and workflow. The pharmacy program activities and outputs are identified in Figure 1.

**Medicine outputs.** Physicians are key stakeholders to this project because they order and prescribe chemotherapy and biotherapy. All oncologist are considered chemotherapy prescribers. However, many non-oncology disease indicators require the use of chemotherapeutic and biologic agents. For this reason, physicians who order intravenous agents should utilize existing systems to ensure safe administration. In addition, physicians should acknowledge and understand the process of chemotherapy and biotherapy verification and administration. The new chemotherapy and biotherapy policy identifies drugs, doses, and indications when non-chemotherapy prescribers is appropriate or where the use of the BEACON ordering system is not indicated, i.e., medications identified as “patient own meds.”
**Patient outputs.** Patient safety is the overall aim of this project. Patient outcomes can be improved if all staff are compliant with all safety measures. In addition, achieving patient understanding prior to chemotherapy and biotherapy can improve outcomes. The activities and outputs related to patients are provided in Figure 1.

**Hospital administration and leadership outputs.** Hospital administration includes managers, supervisors, directors, the Chief Nurse Executive, and the Chief Executive Officer. The goal of the program for leadership is to ensure overall program success and improvement in inpatient care. Leadership facilitated the project by providing the appropriate resources and oversight. This group of stakeholders evaluated the program in all areas. However, in addition, they will be focused on standardization and compliance. Refer to Figure 1 for activities of this group.

**Outcomes**

The success of this program was determined by the outputs described above. Analysis of data was designed to measure the objectives as compared to pre assessments. Many of the objectives have a desired goal of achieving 100% compliance, but this is necessary to meet national standards and ensure safe, quality patient care.

Staff focus groups were convened throughout the process to assess their perception of the project as it moved forward. Specifically, discussions were focused on their evaluation on the project including their comfort level with the new process, their perception of improvements to practice, and their perception of the impact of education and training. The number of chemotherapy nurses expanded during the project period, and for this reason the focus groups were ongoing. Other team members such as pharmacists, physicians, and managers were included in focus group discussions. After complete implementation of the project, a staff survey was performed related to satisfaction and end user ability.
Evaluation of compliance with the chemotherapy and biotherapy policy was performed using a checklist. Data collected from chart audits were evaluated to ensure this outcome has been achieved. Nursing documentation indicated the steps of administration performed. Intermittent clinical observations were also performed to ensure that all policy steps were being followed. In addition, patient outcomes such as effective management of side effects, early recognition and treatment of complications, and length of stay were evaluated. Event reports related to chemotherapy administration are also evaluated and presented.

**Instruments**

The chemotherapy and biotherapy checklist will document the nurses’ completion of steps required for chemotherapy and biotherapy administration (see Appendix D). These steps were delineated from the literature and required that the principal investigator conduct a chart review for the presence of any deviations from these recommendations and potential patient outcomes; the author developed this tool.

The pharmacy chemotherapy and biotherapy checklist was developed by augmenting the nursing checklist to included additional pharmacy steps (see Appendix E). This tool was developed by the oncology pharmacist and was intended to ensure that all pharmacists were knowledgeable of the necessary steps in the event that the oncology pharmacists was not available.

The chemotherapy and biotherapy administration survey will be utilized to assess the staff (Nurses, Physician, & Pharmacists) perceptions of the impact of the quality improvement project (see Appendix H). This survey will be developed by the author.

All instruments were piloted and assessed by Team Two members for their completeness and validity. Feedback related to these instruments was provided to the author for modification prior to project implementation.
**Human Subjects Considerations**

This project was facilitated and completed at Pali Momi Medical Center, a hospital within the Hawaii Pacific Health System. In order to complete this project, review by the Hawaii Pacific Health Project Evaluation Committee was completed. This committee ensured that all procedures were followed throughout the project’s completion. Also a designee of The Institutional Official of Hawaii Pacific Health determined that this was a quality improvement project that did not require Institutional Review Board approval (see Appendix F).

The principal investigator is employed by HPH, but to ensure there was no conflict of interest while accessing medical records for the purpose of this project, student identification was obtained. As required, the primary investigator received appropriate student identification and acquired medical record access under this identity. No consenting procedures were required by patients or staff, as all patients will be included and this project does not impose unintended harm to participants.

This project allows for participant autonomy as staff participants have the right to opt out of any data collection. For example, staff may have chosen at any time to not participate in any staff focus groups or surveys. This project was grounded in patient safety and upholds the concept of non-maleficence by warranting that safety measures were executed with chemotherapy and biotherapy administration at PMMC. The concept of doing no harm was the essence of this project as it had an aim of achieving best patient outcomes and preserving safety for all patients and staff. In addition, beneficence, the act of doing what is best, was the motivation for this project by providing care that meets national standards and educating staff to meet those standards. To ensure justice, or equal treatment, all patients and staff benefited by participating in this project.

**Limitations**

Limitations of this project included system barriers, such as no previously developed system-wide policy development process, time available to implement the program over other priorities, and
use of non-validated instruments. Hawaii Pacific Health had planned an electronic medical record upgrade in April of 2015. This limitation posed a risk to implementation as we onboarded staff to new technologies grounded in the electronic medical record (EMR). As this project identified possible solutions, it was difficult to implement simultaneously with this other system efforts. In addition, other policies and procedures that may impact the project goals will impose additional limitations. Lastly, the survey and chart audits relied on non-validated instruments.

**Timeline**

Foundational work began on the project in January 2015. This included a situational analysis, system-wide and hospital-based team development, and initial informational briefings with facility leadership. Implementation of the interventions began in February 2015 (see Table 3). The specifics of each component of the practice changes were presented earlier in this chapter.
#### Table 3

**Timeline**

<table>
<thead>
<tr>
<th>Problem and Knowledge and Identified</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>System-Wide and PMMIC Teams Formed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare &amp; Submit HPH Project Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess DEACON Capabilities Inpatient</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPH IRB Exemption and Project Approval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Successful Proposal Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brief Key Leaders &amp; Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop Marketing Products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare Instruments for Distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing Education: RN, MD, PharmD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Progress Review:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop Database</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention: Implement Policy at PMMIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collect Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpret Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Written &amp; Oral Defense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare &amp; Submit Dissemination Products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ongoing education included the following:

1. System Wide Chemotherapy and Biotherapy Policy Development and Dissemination
2. Algorithm Development and Dissemination
3. Nurse Training: Chemotherapy and Biotherapy Administration
4. Supervisor Training: Admission/Transfer Process
5. Pharmacy Training: Role in Communication and Verification
6. Physician Training: Offsite and Specialist Beacon Training
Plan for Sustainment

The plan for sustainment was to be determined on an ongoing basis. The teams realized that a continuous resource would be required to ensure that compliance with program objectives continues post-implementation. A succession plan related to ongoing staff training and competency were an integral part of sustainment. In addition, recommendations for system-wide and hospital-specific human resources were made. For example, there was a need to identify an individual or group of individuals who evaluate this project on an ongoing basis.

Summary

The purpose of this EBP project was to standardize the intravenous chemotherapy and biotherapy administration process in the inpatient setting at Pali Momi Medical Center and promote patient safety and best outcomes for patients. In order to achieve these goals practice changes impacted various stakeholders including nurses, pharmacists, and physicians by creating and adopting new policies and procedures, establishing new workflows based on a project-designed algorithm, completing required documentation by all staff, and providing initial and ongoing staff education.
CHAPTER FOUR

Results

After an extensive retrospective chart review, completion of healthcare provider surveys, and collection of all hospital reporting of chemotherapy and/or biotherapy-related events, an analysis was performed. Program objectives were analyzed and organized based on the method of data collection and sample involved.

Patient Sample

The patient sample included 18 patient charts that were evaluated between August 2014 and February 2016. Only 2 of these patients were included in both the baseline and post-intervention data periods. Due to the nature of chemotherapeutic treatment, a patient may experience multiple admissions to receive chemotherapy and/or biotherapy. The multiple encounters by these 18 patients were further delineated by the volume of chemotherapeutic or biotherapy treatment plans (regimens).

During the 5-month baseline period, 8 separate patient encounters resulted in 9 chemotherapy regimen initiations. During the 13-month post-intervention period, 22 patient encounters resulted in 27 distinct regimen initiations and were evaluated regardless of the unit a patient received their agents.

Intravenous Chemotherapy Doses

Since January 1, 2015 until January 31, 2016, 14 patients received a total of 138 individual doses of intravenous chemotherapy or biotherapy in the inpatient setting at PMMC. This averages to 11 doses a month, or 3 a week. As shown in Figure 2, the volume of chemotherapy continues to steadily grow from baseline to the close of data collection in 2016.
Figure 2

*Chemotherapy Doses per Month*

**Short Term Outcomes**

**Nursing Competency**

At the beginning of the project, the 5th floor at PMMC had a total of 4 nurses who had some previous chemotherapy experience. All 4 of these nurses had, at one time, received their ONS Chemotherapy and Biotherapy Provider Card. However, all of these cards were expired and obtained in the non-certificate course edition. In addition, 1 nurse had a card that had expired in 2010 and currently was not recognized as a chemotherapy nurse on the unit. For this reason, the baseline data included just 3 nurses.

Program objectives included training and developing a minimum of 10 nurses by project completion. This competency development included completion of the ONS Chemotherapy and Biotherapy Certificate Course, attendance at the HPH chemotherapy skills class, documentation of the
chemotherapy and biotherapy On-Unit unit competency, including administration of 3 different chemotherapeutic or biotherapy agents and verification of 3 different Treatment Regimens.

As of this writing, a total of 11 nurses in the inpatient setting at PMMC have either completed all elements or are in process of obtaining full competency (see Figure 3). A total of 11 nurses have taken the ONS Chemotherapy and Biotherapy On-Line Certificate course. A total of 10 nurses have taken the HPH Chemotherapy Skills Course.

Unfortunately, one nurse, who was fully trained after project interventions transferred to another setting within Hawaii Pacific Health. However, all 12 nurses who had training during the project period have had multiple opportunities to demonstrate safe-handling and administration standards by hanging various drugs on-unit with the guidance of a previously experienced chemotherapy nurse. Five of the nurses successfully completed both the verification component of the on-unit sign off as shown in Figure 3.

It is important to also note that 1 nurse had already accomplished their Oncology Nursing Certification while employed at a previous facility and served as an additional mentor to new nurses due to her experience and demonstration of knowledge. In addition to this nurse, 2 others with previous experience were deemed mentors based on their demonstration of baseline knowledge and skill.

Developing a novice oncology nurse into a fully competent chemotherapy nurse comes with repetition and experience. Each chemotherapy regimen requires unique understanding as related to the agents being provided. As discussed later, over the course of the project, new opportunities for learning were presented. With the advancement and addition of new agents and treatment protocols, development and training are not ever completely finished. The varying learning experiences provided multiple methods of education to reinforce skills, knowledge, and understanding. Currently, the 5th floor staff has continued to add additional nurses that are beginning the process of achieving their competency and are not captured in these results. As a final note, 2 other nurses hold a chemotherapy
biotherapy card, but one is employed on the 6th floor and the other is a per-diem 5th floor nurse.

Neither of these nurses were included in the results.

**NURSING COMPETENCY**

- ONS Chemotherapy and Biotherapy Certificate Course (15 hrs)
- HPH Chemotherapy Skills Course (4 hrs)
- On-Unit Hang (3)
- On-Unit Verification (3)

![Figure 3](image)

*Nursing Competency*

**Nurse 2nd checks.** More competent nurses or nurses in pursuit of competency allowed for compliance with 2nd checks. Review of each dose charted was evaluated to determine if the nurse administering was competent and if the 2nd check was performed with a chemotherapy competent nurse or one in process of pursuing competency. To assess sustainability, 2nd checks or administrations
performed by the nurse educator or a staff from the outpatient infusion team was also identified to project sustainability with growth as the 5th floor developed more nurses (see Figure 4).

![Chemotherapy Nursing Administrations by Dose](image)

**Figure 4**

*Chemotherapy Nursing Administration by Dose*

**Nurse documentation compliance.** Further patient-related nursing sensitive quality indicators included the measurement of patient assessment and interventions. Documentation was reviewed related to 3 primary sources, the Patient Education Navigator, the DAR (Data/Action/Response Note), and the Plan of Care.
There were instances where Chemotherapy was not found on the Plan of Care. Nursing consistently documented on the plan of care using the “Cancer Chemotherapy” plan. However, on occasion, nurses would identify chemotherapy based on the side effects the patient was experiencing. This was captured and counted as documentation in Figure 5.

Data/Action/Response (DAR) notes were also checked for the time of administration during both the pre- and post-implementation period. Despite this, nursing consistently documented treatments in the DAR note even when there was lack of a problem as shown in Figure 10.

However, anecdotal findings revealed an improvement in comprehension and critical thinking as evidenced by the body of DAR notes. For example, a DAR note from August 12, 2014 written by an untrained nurse while given Rituxan stated:
D: Pt A/Ox3. No c/o pain or discomfort. Lungs clear bilat & O2 sat RA 95%. Abd soft & bs+.
Sl.edema noted to left hand. Pt states numbness to left thumb & index finger & cms intact to both hands. Pt up & about independently.
A: Con’t to assess pain & medicate prn.
R: Pt resting in no distress. Con’t to monitor.

Reviewed med Rituximab with pt & handout given. Pt verbalized no questions & agreed to the treatment. IV site clean & dry with good blood return. Consent placed in the chart. Bp=202/100, p=62. NTP 2” applied & Apresoline given as scheduled. Pt denies any discomfort except drowsiness during benadryl infusion. Pt reports her legs feel "restless." She states she had this sensation before. IV site remains clean & dry. VS bp=175/84, p=83. IV Rituximab infusing well & rate titrated every 30 mins per pharmacy instructions. No apparent reactions noted. Con’t to monitor.

Rituximab infusion completed & pt tolerated well. VS bp=158/74, p=85. Pt denies nausea or vomiting. Pt states legs still feel "restless" Con’t to monitor.

However, in this case, the nurse did not assess temperature as typically indicated during a Rituxan infusion. In contrast, a chemotherapy competent nurse stated the following regarding a Rituxan infusion as part of a regimen on January 8th, 2016:

D: Pt admitted from ACS s/p triple lumen tunneled catheter placement by Dr. K, and LP + MTX administration by Dr. C. Report received from RN Rose. Pt A+Ox4. Denies pain/distress. Lung sounds CTA. Breathing even, unlabored. Denies SOB/cough. Eating with good appetite, 100% of meals. Voiding without difficulty. OOB ad lib with steady gait. Today day 1 of cycle 1 chemo. Consent signed and in chart. All labs WNL per chemo parameters. Pt calm/pleasant, active in plan of care, and using call light appropriately, but appears nervous. Further detailed assessment per flowsheet.
A: Oriented pt to unit/floor. Hourly rounding, chemo, and fall precautions in place. Discussed plan of care with Dr. B and Dr. C throughout shift. Provided pt and pt's daughters with video and educational handouts regarding possible side effects of current chemo regimen. Questions answered. Pt and pt's family demonstrate understanding via teach-back method. VSS and pt appears comfortable, denies chills, pain, N/V, or diarrhea prior to start of Rituxan. Rituxan started and titrated as ordered. Stayed in room with pt during first 45 min of infusion and no s/s of reaction noted. Shortly after Rituxan increased to 150ml/hr, pt reported "having the shivers". Rituxan rate decreased to 100ml/hr and PRN solumedrol given x1, but pt still shivering. Pt placed on 2LNC for comfort and O2 sats 97-99%. Rituxan infusion paused and PRN benadryl given x1. Pt "feeling better" at reassessment, but "more anxious and a little nauseous now". PRN ativan given x1 and pt appears much calmer. Denies further nausea. Rituxan restarted and titrated as tolerated, currently infusing at 100ml/hr. Tmax 102.7 at shift change and PRN Tylenol given x1. Dr. C updated regarding reactions to Rituxan this evening. New orders received and endorsed to NOC RN. See flowsheet for VS trends and shift I/O. UA sent. Continuous reassurance and education regarding plan of care provided to both pt and family. Pt appears in better spirits this evening, sitting at bedside eating dinner, family present. Latest Vitals: Temp: 37.6 °C (99.7 °F) (RN notified), Temp src: Oral, Pulse: 105, BP: 113/74 mmHg, Resp: 20, SpO2: 99 % on 2LNC. Endorsed to NOC RN at change of shift in stable condition.

R: Continue with current plan of care: maintain/monitor comfort level, labs, monitor VS and for s/s of rxn to chemo or TLS, chemo teaching/education, strict I/O, safety.

Patient education by nurses. Also, chemotherapy or biotherapy administration patient education is required when administering treatments to patients. It is also expected that re-education will continue throughout the patient stay. These attributes were measured per regimen versus per
patient or per dose. After project implementation, education was consistently performed by nursing staff. More importantly, beyond one instance of education was also noted in Figure 6.

**Figure 6**

*Chemotherapy Patient Education and Re-education*

**Specialized nurse assessment completion.** To ensure provision of quality, competent care, charts were reviewed for recording of required specialized assessments as indicated by treatment regimens. Prior to project implementation, it was noted that these assessments were not being done but have shown improvement as seen Figure 7. For example, in the previous one patient received Rituxan and some frequent vital signs were done, but they did not include a frequent temperature.
Specialized Assessment Completion

Figure 7

**Specialized Assessment Completion**

*Emergency medication availability.* Another element of the chart reviewed was the availability of emergency medications. The new chemotherapy policy identifies high risk chemotherapy and biotherapy agents. As seen in Figure 8, consistently since February 2015, emergency medications were released by nurses and available during the administration.
Capture of all chemotherapy- and biotherapy-related events was accomplished by getting four detailed reports from the Risk Manager at PMMC. Due to the variability in documentation and the potential events that could occur, the four reports pulled included all medication-related events, all events identified as oncology-related events, all vascular access-related events, and chemotherapy- and hazardous drug-related events. Reports were pulled only for the implementation period between January 2015 and January 2016. Findings revealed a small sample (n = 2) of events directly related to chemotherapy administration. If documentation of events did not include direct reference to chemotherapy or biotherapy, they were excluded from the sample. In addition, only inpatient Pali Momi Medical Center chemotherapy events were included. Both events occurred after project implementation and submitted by the 5th floor staff indicating an increase throughout the time period. Table 4 captures the events reported in the hospital’s electronic event reporting system.
Table 4

Event Reports Directly Related to Chemotherapy Administration

<table>
<thead>
<tr>
<th>Date</th>
<th>Category</th>
<th>Summary</th>
<th>Event</th>
<th>Findings</th>
</tr>
</thead>
</table>
| 04/02/2015 | Near Miss Didn’t Reach Patient        | Dosing Error     | Chemotherapy orders for carboplatin placed on 4/1 based on creatinine clearance of 1.5. During nursing verification, labs assessed and dose calculations revealed a greater than 10% variance. Nurse consulted physician for appropriate change in orders. | • Nursing captured unsafe variance by completing appropriate order verification prior to chemotherapy preparation  
• Communication to provider and pharmacy |
| 07/15/2015 | Harm Reach Patient No Monitoring Required | Chemotherapy Spill | Patient reported “something is leaking” to the nurse. Patient found with a 9cm diameter wet spot on the left side of gown. Chemotherapy was discontinued from central line. Chemotherapy spill only noted on patient’s gown. Linen change done and patient cleansed with chlorhexidine wipes. Both hospitalist and oncologist made aware of the event. | • Nurse noted size and following of chemotherapy spill policy and procedure.  
• Use of chlorhexidine unclear versus the recommended soap and water.  
• Drug not identified - vesicant |

Intermediate Outcomes

Results revealed that standardization of where patients receive chemotherapy was accomplished by 100% of administrations only occurring on the 5th floor or ICU with appropriate deployment of chemotherapy nurses over the last 7 months of data collection as seen in Figure 9.
**Order Compliance**

One physician was responsible for over 75% of all intravenous chemotherapy or biotherapy orders during the entire baseline and post-intervention data collection periods. Figure 10 shows that a total of 6 physicians entered 82 discrete drug orders.
Physician order entry compliance. Chart reviews collected data on physician compliance with existing policies and procedures since some ordering physicians were not using BEACON, the preferred method of chemotherapy or biotherapy order entry. Regimens determined if a physician was an appropriate prescriber.

Physician prescribing was found to be appropriate in both baseline and post-intervention data collection 100% of the time. However, despite this consistency, providers who could suitably order chemotherapy or biotherapy were not reliably using BEACON to place orders. Baseline data revealed that 67% of orders placed between August 2014 and December 2014 were done in EPIC versus BEACON. This significantly increased to an overall average of 89% between January 2015 and January 2016. The trend of this improvement is noted below and most likely related to the on-demand training provided by the oncology pharmacist throughout implementation. Both compliance and use of BEACON has been sustained at 100% since July of 2015 as presented in Figure 11.
Figure 11

*Use of Beacon and MD Compliance with Prescribing Policy*

Findings revealed in cases where orders were not placed in BEACON variances such as a lack of emergency medications when indicated, lack of reference, cases of Telephone-Read-Back-Orders, and in one instance a paper order was accepted and scanned into media. Current standards indicate that these practices are not supported or following current hospital policies.

**Physicians consenting patients.** Obtaining and documentation of informed consent was a physician-driven metric and was required for treatments that included either biotherapy or chemotherapy. Consent is only required on the initiation of first-time regimens. Subsequent cycles of the same treatment modality do not require re-consent unless there are additions to the treatment plan.

Prescribing physicians achieved this metric 100% of the time beginning in March 2015. Baseline chart review also found 100% compliance. However, one time during January 2015, no consent was found in the medical record. During this early implementation period, the same patient was scheduled
for a second treatment with the same drug. Consent was obtained by the provider and signed by the patient following education by project leaders. In addition to this, there were two times informed consent was noted in the physician note, however the document was not found in the medical record by the primary investigator. Consent had multiple searchable titles in the scanned media section making discovery of consents somewhat challenging. It is possible the consent was in the chart, but undiscoverable by the investigator.

**Pharmacist compliance.** Following order entry, pharmacy staff were found to have verified and or reviewed orders 100% of the time. While not all orders were placed in BEACON, existing EPIC workflow supported this consistency in both baseline and posit-implementation chart review.

Further analysis was done to assess the frequency of order reviewing by the oncology pharmacist. The oncology pharmacist is the most competent in chemotherapy verification release due to their primary responsibility of managing all outpatient chemotherapy order review. Early in project implementation, it was discovered that often inpatient orders were not always shared with the oncology pharmacist. Baseline data found that the oncology pharmacist reviewed 67% of orders, unfortunately when compared to the overall post-implementation data, review by pharmacy decreased to 59% as shown in Figure 12.
Nurse compliance with orders release. In addition to pharmacy review, nursing has the capability to release orders in the BEACON application. However, since 2013, when BEACON was first implemented at PMMC, inpatient nursing had not utilized this functionality. As a result, the baseline chart review showed an expected 0% nursing review and release of chemotherapy or biotherapy orders. The release functionality of BEACON documents nursing verification of all elements of an order regimen not only before administration, but also before pharmacy preparation. Results indicate a positive change in practice and nursing workflow as demonstrated in Figure 13.

Pharmacists are able to release orders prior to the nursing review of orders. There currently is not a hard stop deterring a pharmacist from doing this. Improvements in this process were made over the course of this project, but needs further work to ensure it is hardwired in nursing and pharmacy.
A staff survey was deployed to chemotherapy-prescribing physicians, chemotherapy nurses, oncology pharmacists, covering pharmacists, nursing leadership including unit managers, and pharmacy leadership. Due to initial PMMC team size and the limited inclusion of staff involved in this project, 16 responses were collected for an overall 76% percent response rate. The general survey consisted of 12 questions, while the nursing survey consisted of the same 12 questions with additional administration questions. The responders varied by role. The survey was designed so all nurses who administer chemotherapy were prompted to answer more questions, however based on results it is possible that a nurse may only have answered the first 12 questions. The survey was anonymous and administered via email. Responses were captured using an electronic tool to allow for this.
**Staff Roles**  (See Figure 14).

![Staff Roles](image)

**Please indicate your role:**

- Nursing Staff (Administers...): 37.50%
- Nursing Leadership: 31.25%
- Oncology Pharmacist: 12.50%
- Pharmacy Leadership: 6.25%
- Prescribing Physician: 12.50%

Answered: 16  Skipped: 0

---

**Impressions of BEACON**

Respondents were asked when they first learned of BEACON. Survey results revealed that only pharmacy and physician responders learned about BEACON prior to the project timeline as seen below in Figure 15. No responder learned about BEACON during orientation to PMMC. Four responders learned about BEACON at first go-live at Straub Clinic and Hospital in 2012.
When did you learn about BEACON?

The respondents were asked how they learned about BEACON. They were allowed to select multiple places, as they may have learned about the application in many places. Half of the responders learned about BEACON during the training that was provided to them as shown in Figure 16. The other half of respondents were nurses who learned about BEACON during the On-Unit sign off. With one exception, the remaining nurses responded that they learned about BEACON during the Chemotherapy Skills Course that was offered as part of the project. Two additional respondents shared that they learned from the Oncology Nurse Educator or at EPIC status meetings.
How did you learn about BEACON? Check all that apply

Answered: 16  Skipped: 0

Figure 16

How did you learn about BEACON?

In Figure 17, only 5 responders knew nurses could release orders in BEACON, prior to the project.

Prior to this improvement project, were you aware that nursing could release chemotherapy orders?

Answered: 16  Skipped: 0

Figure 17

Nursing Release
Communication

A major goal of this project was to increase communication between the various team members that coordinate and administer chemotherapy and or biotherapy in the inpatient setting. Responders could first identify all of the methods of communication that they utilize. Email and communication was the most selected in Figure 18. However a follow up question further analyzed, by questioning related to their role, what is the most reliable method as shown in Figure 19.

**What are the methods you use to communicate with others related to patients who will require chemotherapy? (check all that apply)**

Answered: 16   Skipped: 0

![Bar Chart]

Figure 18

*Methods of Communication*

It is clear that physicians and pharmacy consider BEACON order entry a key way of communicating, while nursing relied more on email and personal communication and pharmacy
selected a mixture of responses. An additional comment was left by one physician responder stating that BEACON and in-basket messaging are the most useful for his role, but he thinks all methods are appropriate and indicated, especially personal communication related to patient orders.

**Figure 19**

*Most Reliable Method of Communication*

**Workflow**

Hospital and unit leadership determined early on in the project to designate the 5th floor as the oncology inpatient care unit. In order to develop this unit, it was established that all chemotherapy or biotherapy administrations would be limited to the 5th floor or ICU as patient needs require. The question below was to determine understanding of this new expectation. ALL responders chose the 5th floor, and 5 also indicated the ICU with a chemotherapy competent nurse.
Program Evaluation

Responders were asked to rank the program related to satisfaction, improvement, efficiency and safety. Every responder completed the following statement “In my opinion, safety measures for patients receiving chemotherapy have” with increased. Options of decreased and stayed the same were not selected. The improvement of the process of chemotherapy administration was also ranked on a 1-4 scale by responders in Figure 20.

<table>
<thead>
<tr>
<th>In the last year, how would you rate the improvement of the inpatient chemotherapy administration process at PMMC?</th>
<th>Not Improved</th>
<th>Somewhat Improved</th>
<th>Improved</th>
<th>Very Improved</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00%</td>
<td>12.50%</td>
<td>25.00%</td>
<td>62.50%</td>
<td>16</td>
<td>3.50</td>
<td></td>
</tr>
</tbody>
</table>

Figure 20

Improvement of the Process

Satisfaction was assessed by a ranking of the current chemotherapy and biotherapy administration process as seen in Figure 21. The majority of responders were either satisfied or very satisfied. However, all but one responder completed the statement “In the last year, efficiency related to the inpatient chemotherapy administration process has” increased. This one responder that selected decreased and no responders chose stayed the same.
Nursing responders were asked further questions related to their experience related to education and their current comfort level. Only 6 responders were nurses and five of these nurses were day shift nurses. One nurse identified themselves as night shift. Nurses were asked to report prior to February 2015, what education had they received related to chemotherapy or biotherapy administration at PMMC. Two nurses reported they had never had any education while 2 reported they had received other education at PMMC. One nurse had achieved her provider card while employed at another hospital and one had achieved it in the past while employed at PMMC.

Nurses then were asked if they have ever administered intravenous chemotherapy without any formal education, including taking down chemotherapy, at PMMC. One nurse responded yes to this question. The five responders that reported that they had taken the ONS class were asked to rank how satisfied and prepared they felt after taking this course. Below are Figure 22 shows their rankings.
In addition to the ONS Course, five nurses reported that they had attended the HPH Chemotherapy skills course and one nurse skipped the question. The five nurses who reported their attendance, were then asked the same questions related to satisfaction and preparation. In contrast to the ONS course, the majority of nurses reported that they felt prepared following this course as seen in Figure 24. Nurses could then free text responses related to what further education they would like to see. Additional educational opportunities included oncology emergency specific courses, more calculations, and more ongoing courses related to chemotherapy and biotherapy.

<table>
<thead>
<tr>
<th>Unsatisfied</th>
<th>Somewhat Satisfied</th>
<th>Satisfied</th>
<th>Very Satisfied</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am</td>
<td>0.00%</td>
<td>25.00%</td>
<td>50.00%</td>
<td>25.00%</td>
<td>4</td>
</tr>
</tbody>
</table>
| with the ONS
Chemotherapy and
Biotherapy Certificate Course. | 0 | 1 | 2 | 1 | 4 | 3.00 |
Comfort levels related to specific skills were assessed in Figure 25. All nurses responded that their comfort level with chemotherapy and biotherapy has increased in the last year. No nurses selected decreased or stayed the same. Nurses were then asked to rank their current comfort with the following skills:

<table>
<thead>
<tr>
<th>Skill Description</th>
<th>Uncomfortable</th>
<th>Somewhat Comfortable</th>
<th>Comfortable</th>
<th>Very Comfortable</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of BEACON in EPIC (i.e. Protocol review, order releasing, etc.)</td>
<td>0.00% 0</td>
<td>20.00% 1</td>
<td>80.00% 4</td>
<td>0.00% 0</td>
<td>5</td>
<td>2.00</td>
</tr>
<tr>
<td>Administering chemotherapy or biotherapy (i.e. hanging, taking down, etc.)</td>
<td>0.00% 0</td>
<td>40.00% 2</td>
<td>40.00% 2</td>
<td>20.00% 1</td>
<td>5</td>
<td>2.00</td>
</tr>
<tr>
<td>Double Checking at the bedside</td>
<td>0.00% 0</td>
<td>20.00% 1</td>
<td>40.00% 2</td>
<td>40.00% 2</td>
<td>5</td>
<td>3.20</td>
</tr>
<tr>
<td>Overall comfort level regarding chemotherapy and biotherapy administration</td>
<td>0.00% 0</td>
<td>40.00% 2</td>
<td>40.00% 2</td>
<td>20.00% 1</td>
<td>5</td>
<td>2.00</td>
</tr>
</tbody>
</table>
Nurses were then asked to select the resources that they utilize when administering chemotherapy. Nurses could select all of the resources would use in Figure 26.

Figure 26

Nurse Resources

All nurses were aware of resources, but when asked to select the resource they use most in a follow-up question, nursing mentors was selected by 3 of the 5 respondents. The other 2 nurses selected the checklist and the ONS Chemotherapy and Biotherapy guideline book.

Finally, Nurses were asked to openly respond to what resources they would like to see in the future. They responded with more training, more chemotherapy trained nurses, yearly in services, more mentors, chemotherapy gowns and chucks usable for IV pushes.

Survey Summary

All responders were given the opportunity to provide additional comments and feedback related to the inpatient chemotherapy and biotherapy administration process at PMMC. Responses were added by seven participants. Four responders included positive feedback regarding the program
and or the program facilitators. One nurse stated that the unit has been well-staffed to support program efforts. Finally, one responder requested more nursing mentors.

**Evolution of the Project**

Once patient safety risks were identified in the stage of project development, immediate interventions began to ensure patient safety. During the implementation timeline, new issues were revealed and project facilitators adjusted the project focus and interventions, as needed.

**Expected Versus Actual Findings**

Project goals remained consistent throughout the project timeline. Although the data revealed an improvement in process and safety, some unexpected findings were identified. During the pre-intervention data period, while nursing had limited education, documentation revealed a consistent attempt to not only educate patients but to also manage side effects. This showed nursing acknowledgement of needed interventions.

In addition to this, findings revealed that almost no nurses were aware of the functionalities in the medical record. It was surprising to discover such a variance in practice within one facility. However, once aware, team members quickly worked to close this gap.

**Facilitators**

There were many facilitators for this project. Due to the multidisciplinary nature of chemotherapy administration process, an interdisciplinary approach was required for successful implementation. Pharmacy served as a key facilitator of project goals and the oncology pharmacist was primarily responsible for engaging the other pharmacy team members. Due to the hardwired pharmacy-centric process, prior to implementation, without their engagement of project goals, nursing could not only learn the new process, but more importantly be afforded the experiences needed in order to achieve competency goals. In addition, pharmacy continues to participate and serve as an educational resource for nursing staff.
Another facilitator was the engaged management team of the 5th floor. Despite knowledge in cancer care, both the manager and supervisor were extremely engaged in project outcomes primarily serving as the coordinators of the nursing staff as chemotherapy patients were identified.

Lastly, the primary ordering physician was engaged and participated by entrusting admissions to the inpatient area of PMMC. This project serves his patient population and allows him to closely manage patients in the inpatient setting.

**Barriers**

Along with facilitators, there were some barriers to program objectives, data collection, and analysis. However, many of these barriers were overcome. During the project implementation period, the oncology pharmacist changed roles and a new pharmacist was on-boarded. Initially, this served as a barrier, however, the new pharmacist became familiar with the goals of the project and ended up serving as not only primary resource to nursing staff, but also a day-to-day driver of the project.

Utilizing an inpatient unit created inherent challenges, such as a 24-hour schedule, variable skill mix among staff, transfers of staff altering the established skill mix, and, most importantly, the added acute nature of the inpatient population. Additionally, the primary investigator changed roles and left the home base of PMMC. Although the new position afforded continuation of the project, her new role demanded a system-wide, HPH focus. This made driving the project on daily basis very difficult. However, communication processes were developed and frequent, direct communication with chemotherapy nurses and pharmacists overcame this barrier.

**Summary**

The overall program objectives of this quality improvement project were realized. A total of 10 nurses achieved competency in intravenous chemotherapy. Physicians were compliant with ordering and consenting procedures. Pharmacists supported nursing release and transition of inpatient chemotherapy release from the general pharmacy to the oncology pharmacy. Furthermore, staff
surveys identified a perceived improvement in safety, efficiency, quality, and process. Nursing staff identified increased perception of preparation and comfort as related to the administration of chemotherapy and biotherapy. Also, patient impact measures showed recognition and acknowledgement of patient related events.
CHAPTER FIVE

Discussion

Interpretation of Findings

The Chemotherapy Collaborate was a multi-factorial quality improvement project that resulted in positive short-term and intermediate outcomes for nursing, pharmacy, leadership, and, most importantly, patients. Long-term outcomes will have to be assessed in further study and on-going evaluation of project impact. Data revealed not only an improvement in practice and process, but also the steady growth of quality care for the inpatient cancer population at Pali Momi Medical Center (PMMC).

Short-Term Outcomes. Nursing. Short-term outcomes for nursing included improving nursing knowledge of chemotherapy and biotherapy, increasing the volume of nurses who can provide chemotherapy, standardize documentation, and adherence to policies and protocols. Improving nursing knowledge was achieved by providing education related to the complex skill of chemotherapy administration. However, education was much more than teaching the skill of hanging a drug and setting the rate as ordered. Training had to provide nursing with many modes of learning. Despite the intense education that was used during this project, nursing continues to request more learning opportunities. This validates not only the need for education, but the equally important need for continuing education. This project’s progression correlated with more challenging patients requiring more advanced treatment plans. For example, the primary oncologist began to introduce new regimens, such as Hypercvad part A and B. Throughout the project the evolution of the 5th floor from a non-oncology medical unit to a medical oncology unit began to take shape.

Nursing education was grounded in providing fundamentals of practice. However, throughout the project, on-demand education had to be provided to ensure complete education. Examples of this included the teaching of special assessments, such as cerebellar toxicity screening. The project resulted
in not only nursing’s understanding of this needed assessment, but also led to the development of a standardized tool in EPIC. Each chemotherapy agent provides a new set of challenges and requires new understanding. However it was evident that, through the systematic process that was instructed, nursing learned how to manage these new challenges.

Every nurse has not completed all elements of training. However, the short-term outcome of increasing the number of nurses who administer chemotherapy was achieved. The standards of training require course completions and an on-unit experience. The volumes of the experiences were limited by not only the volume of patients, but also the staffing matrix of the unit. However, many times nursing sought out experience, changed their personal work schedule to accommodate patient need, and communicated with project leaders they wanted to learn more. Nurses were not expected to be experts at the completion of this project. However, nurses are now steadily on the trajectory from novice and advancing their skills beyond basic understanding.

The ONS certificate course provided a foundational course that nurses are satisfied with and feel somewhat prepared to care for patients receiving chemotherapy. The HPH chemotherapy skills course was rated high in satisfaction and preparation. However, it is the combination of these two courses that provides the most satisfaction and preparation. In addition, the nurses reported an increase in comfort administering chemotherapy after attending these courses. Additionally, these nurses identified mentors as the most utilized resource, indicating the continued need to develop and retain mentors who can facilitate sustainability of the program. As shown in the data, the use of outside resources, such as the educator, declined overtime and the need for these resources only reemerged with a large spike in chemotherapy volumes.

Finally, nurses were trained to be part of the process of reviewing and releasing chemotherapy orders. When orders were not already released by a pharmacist, nurses performed this process. This supported achieving both short-term outcomes of standardized documentation and policy and
procedure adherence. This was the first time nurses were held to the standard of completing all elements of review. The release of drugs indicates that they have essentially approved the orders. The checklist that was created for nurses reinforced this expectation and most nurses recognized this as a resource they consistently use. While this checklist is not part of the medical record, it guides even the most experienced nurse in the systematic process of verifying the drug, even if the drug is new to them. The release functionality documents this process. Ultimately, engaging nurses in this process provided them with accountability and encouraged them to ensure patient readiness. DAR notes improved related to content demonstrating their competency and critical thinking abilities.

**Pharmacy.** Pharmacy was integral to the project to achieve the short-term outcome of adherence of the protocol and algorithm. Although they had 100% compliance with order review, their release of medications removed nursing from this function and was improved, but not fully accomplished by completion of the project. It is expected that pharmacy will eventually relinquish this task to nursing completely. The pharmacy checklist facilitated covering pharmacists to review orders and the necessary communication steps.

**Communication and workflow.** To successfully support the process of chemotherapy administration in the inpatient setting workflow changes were indicated. Early on the project identified the 5th floor as the unit of choice achieving the short-term outcome. Communication of this workflow change was accomplished meeting the short-term outcome of adherence to the algorithm. Methods such as orders placed by physicians, an email initiated by pharmacists, staffing preparation and communication initiated by unit management, and finally bedside nursing preparation are all needed to ensure all team members are prepared and ready. Safety huddles traditionally never discussed chemotherapy patients; now these patients are regularly discussed in morning hospital-wide safety huddles. Safety huddles are attended by all leaders throughout the hospital. This has broadened
communication outside of those directly involved with the project. In addition, it has helped address staffing and understanding of the resources need to provide safe care.

**Event Reporting.** Event reporting of either near misses or events that reached the patient were assessed. Ultimately, this project improved safety measures for patients receiving chemotherapy and or biotherapy. Chemotherapy and biotherapy are high risk medications that can result in serious harm or even death if administered inappropriately. Only 2 events directly related to chemotherapy were identified in the inpatient setting, it was an increase from the baseline period, where there were no chemotherapy or biotherapy reported event in this setting. Although there was only 2 events reported, they identified critical thinking by nursing, management of safety issues, and prevention of errors. The short-term outcome of increasing the near miss events was accomplished, however further work related to increasing reporting must continue. Currently, PMMC is involved in providing culture of safety education to all staff that may support this on-going effort.

**Intermediate Outcomes.** Intermediate outcomes related to adherence of practice standards, limitation of administration of IV chemotherapy to the 5th floor or ICU when appropriate, use of BEACON for all IV orders, and approved physician prescribing for IV chemotherapy orders were achieved by this project. Policy and procedures were based on the ASCO/ONS guidelines. Compliance with the new policy was measured by documentation by all team members involved in the chemotherapy and biotherapy process. The intermediate outcome of adherence of practice standards from ASCO/ONS was achieved consistently by project conclusion.

**Medicine.** Additionally, the data demonstrated that the physician team is complying with policies and procedures. All physician prescribers appropriately entered IV chemotherapy orders. Early in the project, there were instances where physician non-compliance was most likely due to a lack of knowledge, specifically, order entry in the BEACON system. Physicians who were engaged in learning BEACON order entry did so with ease. A total of four physicians were trained about BEACON by the
pharmacist allowing the achievement of the intermediate outcome of all IV orders being placed in the BEACON system. After training, there orders were consistently entered properly and allowed for improved compliance related to references and components of the order such as emergency medications.

**Communication and workflow.** By project end, patients receiving chemotherapy was limited to the 5th floor or ICU achieving this intermediate outcome. Short-term outcomes related to communication and workflow supported this outcome. Since July of 2015, all patients received chemotherapy or biotherapy in the identified setting.

**Long-Term Outcomes.** Long-term outcomes for this project include decreased patient errors and events related to chemotherapy, improved outcomes for patients receiving chemotherapy and biotherapy, and a cost-savings related to decreased usage of inappropriate of chemotherapy in the inpatient setting.

**Patients.** A long-term outcome of improving patient outcomes was established for this project. Complications of chemotherapy vary by agent. Complications can include fever and neutropenia, associated toxicities, such as neurotoxicity or cardiac toxicity. Patient related outcomes can be further assessed for the management and prevention of complications.

Only 18 patients were admitted to the inpatient areas of PMMC over the course of this project. However, these 18 patients resulted in over 130 doses of chemotherapy and hundreds of patient days. This provides PMMC the opportunity to provide improvements in individualized care and understanding of unique patient needs.

Despite the need for acute admissions, many patients are chronically managing their cancer disease. Improvement in the management of chronic patients was evidenced throughout this project by the documentation related to patient education and plan of care improved. As with other chronic illnesses, re-education is extremely important. Early nursing documentation did not reveal this
consistency. However, as the implementation continued, this education and re-education documentation improved.

This project decreased this risk for patients being cared for at PMMC. Further impact on patient outcomes should be further studied, such as development of neutropenic fever, oncologic emergency management, and management of other chemotherapy-related toxicities. A deeper dive into the existing record could help reveal additional positive outcomes of this quality improvement project.

Summary. The long-term outcome of reduction of chemotherapy errors and events was not established during the project period. Due to the lack of reporting prior to the project, evaluation will continue and further work related to proper identification of chemotherapy or biotherapy related events will be proposed. Additionally, cost-savings outcomes were not recognized during the project period. Further analysis is need related to this potential long-term outcome.

Implications and Recommendations for Practice

Although this project applied many interventions that resulted in positive outcomes for staff and patients, many other needs were identified throughout project implementation. As PMMC prepares to expand cancer services and anticipates an increased cancer volume due to the growing population, preparation for the future of cancer care is indicated. Implications of this project directly relate to the American Association of Colleges of Nursing Essentials of Doctoral Education and will be discussed.

Essential I: Scientific Underpinnings for Practice

Chemotherapy and biotherapy administration is grounded in the science of therapeutics and biology. However, this project is not just based on these principals of science, but how these interventions are carried out in a complex health system. This project revealed that nursing knowledge is essential in these areas in order to provide safe care to patients.

Nurses who were educated throughout this project were provided continuing education related to the pharmacology of the chemotherapy they were administering, the risks related to toxicities, and
the appropriate patient assessments that are indicated to not only reduce risks, but proactively care for patients.

While this project addressed intravenous administrations, future work related to oral chemotherapy and other modes of administration need to be realized. This project was done to develop a team of nurses. With a foundational team, further work can be done to improve the quality and safety for all chemotherapy administrations.

**Essential II: Organizational & Systems Leadership for Quality Improvement & Systems Thinking**

**Program oversight.** Pali Momi Medical Center is a Commission on Cancer Accredited hospital. Currently, all four hospitals of Hawaii Pacific Health are accredited by the Commission on Cancer. Requirements of the accreditation include an engaged cancer committee that is currently chaired by physician leadership. This acknowledgement requires ongoing quality improvement performed by the multi-disciplinary cancer center. However, prior to this project, inpatient nursing had not been represented as part of the cancer care team at PMMC. Recommendations following this project are to engage inpatient nursing and nursing leadership in the ongoing quality improvement as directed by the cancer committee in not only the outpatient, but also the inpatient setting. Current work of the cancer committee will be to include a quality study evaluating sustainment of this project.

The Oncology Practice Council that was first established for this project and will continue to serve as a multi-disciplinary forum to carry out the work of the cancer committees across the system. This forum will continue to evaluate chemotherapy and biotherapy practices across Hawaii Pacific Health. In addition, this group will provide the annual competencies required by nurses and ensure the program’s sustainability.

**Return on investment.** Length of stay was captured during data collection was not analyzed for this project. It is recommended that an in-depth analysis be performed related to inpatient chemotherapy administrations. Many patients had a length of stay that far exceeded guidelines. For
example, some patient stays varied from 71 days to 28 days. In addition, it was noted that, the
admission- to-chemotherapy start times were as short as 90 minutes. Further evaluation of the financial
implications need to measured including cost of care, cost of drugs, and reimbursement qualifications in
the inpatient setting. The cost of a sentinel event or inadvertent harm to a patient was not discussed in
this manuscript. Further evaluation related to the cost of education versus the cost of harm to a patient
should be pursued.

It is known that typically inpatient chemotherapy can be very expensive and sometimes
uncovered by insurance. However, in one instance a pharmacist stopped the inadvertent administration
inpatient. The patient was discharged and received care in the outpatient setting. This is a fiscally
responsible way to manage inpatient chemotherapy admissions and should be further evaluated.

**Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice**

This project was initiated to ensure evidenced-based practice. The use of a nationally
recognized course was to provide a consistent evidence-based educational experience for nursing staff.
The use of the American Society of Clinical Oncologists and the Oncology Nursing Society practice
guidelines for chemotherapy and biotherapy administration continue to be the gold standard for
practice. Not only did these guidelines serve as the basis for policy, but other evidenced-based practices
discovered in the literature search of this project guided process and practice decisions.

Nurses who learned BEACON also learned about the locations of the protocols and associated
references, including the NCCN guidelines that ground chemotherapy ordering. Continued monitoring
of both inpatient and outpatient cancer care practices will be necessary to stay relevant to new
treatments and other cancer care approaches. In addition, the 2013 ASCO/ONS standards are under
review with an expected update to be revealed in 2016. The current cross-walk for the new 2015
guidelines has revealed an even closer look at practice (ONS, 2015). This project has set the foundation
for being compliant with new guidelines.
Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

**Electronic medical record systems.** An important part of this project was optimization of the current EMR and associated platform for chemotherapy ordering, BEACON. Costs related to the EPIC and BEACON had already been realized, while the systems safety mechanisms had never been utilized by inpatient staff. During initial BEACON implementation, a long term plan had been established to train in not only the inpatient setting, but also to provide training to other providers that could benefit from using beacon. However, in 2 years this had not occurred. A pre-conceived notion that chemotherapy was not happening, or happening minimally drove this decision. As volumes were assessed through this project, it became clear that this education was needed.

The lack of use of the EMR potentially led to the underdevelopment of nursing staff in the inpatient setting. Part of training included the meaning behind releasing of orders by nursing. This documentation represented nurse’s acknowledgement of their assessment of not only orders, but the patient. In addition, the project led to a standardization of the current practice across all settings at PMMC.

**Documentation.** Locating patient consents for chemotherapy administration was challenging. The primary investigator noted that consents were listed with the use of multiple titles in the media section of the medical record. Titles included “consent – chemotherapy”, “HPH Chemotherapy Consent”, or had no title. Recommendations include evaluating the current informed consent process for chemotherapy. Providing a methodology for this practice will limit the inconsistencies since nurses are required to verify consent on multiple regimens.

In a multi-hospital system, the opportunities for standardizing the medical record are countless due to wide variations in documentation. Continued efforts to standardize documentation will provide patients consistent care across all care sites.
Essential V: Health Care Policy for Advocacy in Health Care

Cancer care is constantly at the forefront of healthcare policy. In particular, the cost of cancer care is extremely high and chemotherapy administrations occurring in the inpatient setting are impacted by policy standards related to insurance coverage. Ethically, chemotherapy that is given close to the time of death needs to be further evaluated. End-of-life issues were not discussed or presented in this project. However, the inpatient population could be further assessed for the impact of chemotherapy at the end-of-life.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

This project resulted in unprecedented communication between nursing, pharmacy, leadership, and physicians related to chemotherapy administration in the inpatient setting. Ongoing evaluation of how these disciplines communicate will continue after project completion. The Oncology Practice Council has expanded to include physician and pharmacy members. Chemotherapy treatment planning is a multidisciplinary process where each discipline brings specialized expertise. Physicians determine the best treatment plan to offer the patient related to the underlying disease. Pharmacy brings their level of expertise related to drug preparation and expectations. Finally, nursing brings their expertise in administration and assessment of the patient. All components are needed to provide quality care to cancer patients.

Essential VII. Clinical Prevention and Population Health for Improving the Nation’s Health

Inpatient nurses can be the gate-keepers to providing information related to prevention and population health. When patients are admitted to the hospital, the primary focus is placed on the current acute process. However, the patient is in the optimal place to receive education and potential follow up as related to prevention.

This project allowed for a standardized policy that will impact not only the patients of PMMC, but all patients across Hawaii Pacific Health (HPH). In addition, it provided the ability for consistent
documentation across the system. Beyond HPH, the second largest provider in the state is currently on-boarding the same functionality, in the same EMR. EPIC allows for a functional known as Care Everywhere. This functionality allows for all hospitals who share EPIC to communicate elements of the medical record. With like documentation across the 2 largest providers in Hawaii, ultimately the community can be positively impacted related to the increased opportunities for communication.

Essential VIII. Advanced Nursing Practice

Currently, Hawaii Pacific Health does not employ a Clinical Nurse Specialist or Advanced Practice Nurse in the inpatient adult cancer care setting. The recognition of the lack of knowledge, need of education and standardization of practice was initiated by the primary investigator. Project results indicate that mentorship by an advanced practice nurse or doctor of nursing practice impacts patient care in the inpatient setting by providing consistent recommendations, grounded in evidence-based practice. In the care of a complex cancer patients, advanced practice nurses or doctors of nursing practice support the ever-growing cancer population that is challenged by new discoveries including new treatment modalities such as chemotherapy, biotherapy and targeted therapy.

Plans for Dissemination

Multiple venues will be utilized to disseminate the results of this project. First, it will be defended on-site at Pali Momi Medical Center. Leadership from PMMC and across Hawaii Pacific Health will be invited to this defense. Plans for dissemination also include submission to the Oncology Nursing Society (ONS) conference. Submissions for ONS Congress 2017 will be pursued. In addition, at least one manuscript will be prepared for submission to a peer-reviewed cancer nursing journal.

Summary

The Chemotherapy Collaborate improved the quality and safety of the chemotherapy and biotherapy administration to patients with cancer in an inpatient setting. Results revealed that a comprehensive training program yielded competent nurses to safely care for patients. A new policy
guiding the practice of interdisciplinary health care providers was successfully adopted by Pali Momi Medical Center. The Chemotherapy Collaborate created the foundation for a system-wide approach to delivering the highest quality of cancer care to all patients at Hawaii Pacific Health.
Appendix A. Literature Matrix
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Journal</th>
<th>Title</th>
<th>Research Question</th>
<th>Study Design</th>
<th>Sample</th>
<th>Data Collection</th>
<th>Findings</th>
<th>Comments</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kampitsi, A. Papa, T. Papadouri, A. Papageorgiou, D. Papara, V. Katsaragakis, S.</td>
<td>2012</td>
<td>European Journal of Oncology Nursing</td>
<td>123 Oncology Nurses' Knowledge and Practices About Safety Handling and Administration of Chemotherapy Agents – a Hellenic Oncology Nursing Society Multicenter Study</td>
<td>What are the oncology nurses' practices and knowledge in Greece regarding chemotherapy handling and administration procedures?</td>
<td>Descriptive</td>
<td>199 Registered Nurses working in oncology wards from 4 oncology hospitals and 7 general hospitals in Greece. Not clarified convenience or random sampling</td>
<td>23 item Questionnaire</td>
<td>73.4% of nurses reported they knew the guidelines for safe handling chemotherapy agents, only 46.8% of them were taking special precautions measures during the preparation process and on only 26.1% during administration. Only 31.7% of nurses attended an educational program; those who did took special precautions during preparation process but not during administration. Oncology nurses in Greece self-reported that the absence of standards and protective equipment related to safe handling and administration has resulted in inconsistent safety measures.</td>
<td>VI</td>
<td></td>
</tr>
<tr>
<td>Neuss, M. N. Polovich, M. McNiff, K. Esper, P. Gilmore, T. R. LeFebvre, K. B. Schulmeister, L. Jacobson, J. O.</td>
<td>2013</td>
<td>Oncology Nursing Forum</td>
<td>2013 updated American Society of Clinical Oncology/Oncology Nursing Society chemotherapy administration safety standards including standards for the safe administration and management of oral chemotherapy</td>
<td>Providing safety standards and clinical practice guidelines for chemotherapy administration.</td>
<td>Meta-Analysis</td>
<td>N/A</td>
<td>N/A</td>
<td>38 participants including oncologists, pharmacists, social work, nurses, practice administrators, and patient advocates did a systematic review of current literature and compared to last guidelines published in 2012. In addition, 207 responders</td>
<td>Nurses were the most common responders</td>
<td>VII</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Year</td>
<td>Journal</td>
<td>Article Title</td>
<td>Study Type</td>
<td>Key Points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>---------</td>
<td>---------------</td>
<td>------------</td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drexler, D. Newman, N.</td>
<td>2011</td>
<td>Oncology Nursing Forum</td>
<td>Acuity adaptable nursing units in oncology</td>
<td>Case Study</td>
<td>What is the impact of an acuity adaptable nursing units on staff and oncology patients? Evaluate and describe Patient and Companion Satisfaction Scores n = approximately 200, Anonymous Nursing staff surveys, RN turnover, and Medication Errors for 2 years. 2 set of data were collected one during the first year of implementation and the second during year 2. Patient Satisfaction: Year 1-97%, Year 2-99%. Medication Errors: Year 1-1.4, Year 2 1.35 (national average 5). Staff Satisfaction - RN Turnover: Year 1 32.7, Year 2 2. This study is important because selecting the right unit at Pali Momi to give chemotherapy is part of the teams focus. Currently there are 2 potential units, one with an ability to offer a higher level of acuity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smith, N.</td>
<td>2011</td>
<td>Clinical Journal of Oncology</td>
<td>Administering Chemotherapy in Nononcology Settings: A Case Study</td>
<td>Case Study</td>
<td>In one case, how was chemotherapy administered in a nononcology setting. Evaluate and describe one patient case Administering chemotherapy in a nononcology setting requires much coordination and communication. Provision of time is important to allow an oncology nurse educate both the staff and patient. Providing a list of steps to nursing will ensure that staff ensure safe care to patients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ohio Nurses Review</td>
<td>2008</td>
<td>Ohio Nurses Review</td>
<td>Administration of IV chemotherapy &amp; biotherapy agents</td>
<td>N/A</td>
<td>Nursing Practice Statement</td>
<td>N/A</td>
<td>Practice Statement by governing body of Ohio</td>
<td>Guidelines are provided by the state of Ohio to all nurses who are administering chemotherapy and biotherapy. Only RNs may administer, a physician should be immediately accessible, prior to administration all resource information should be reviewed, the agency is responsible for providing measures of competence, and written policies and procedures should be established and reviewed annually by each institution. Patients were found to be only moderately worried about safety and perceived the risk of error lower than other treatments. Patients tended to underestimate risk of error or harm although there was widespread conception of chemotherapy being highly toxic. All patients agreed that patients can make contributions to safety. Follow ONS guidelines related to nursing administration. Follow ASHP guidelines related to preparation and verification. Concludes that clinicians in the ICU setting should have a basic understanding of chemotherapy. It is interesting that Ohio has made these specific statements to chemotherapy as part of their nursing practice act</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schwappach, D. L. B.</td>
<td>2010</td>
<td>Quality &amp; Safety in Health Care</td>
<td>Am I (un)safe here? Chemotherapy patients’ perspectives towards engaging in their safety</td>
<td>N/A</td>
<td>Descriptive, Semi structured Interviews</td>
<td>n=30 chemotherapy patients from a large Swiss community hospital</td>
<td>First a baseline interview followed by another interview 9 weeks later. Patients were asked to participate by their attending physician.</td>
<td>Study highlighted crucial role of oncology nurses engaging patients.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitello, N.</td>
<td>2010</td>
<td>Current Drug Safety</td>
<td>Approaches for administering chemotherapy in the intensive care unit</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>This is not a study, rather a collection of recommended guidelines and a review of recommendations current at the time. Addresses the additional complication of the acuity of the ICU patient and lack of knowledge by ICU staff related to chemotherapy.</td>
<td>Other: Review of Lit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Journal</td>
<td>Year</td>
<td>Title</td>
<td>Purpose of the article</td>
<td>Methodology</td>
<td>Setting</td>
<td>Findings</td>
<td>Comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>------</td>
<td>-------</td>
<td>-------------------------</td>
<td>-------------</td>
<td>---------</td>
<td>----------</td>
<td>----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moody, M. Jackowski, J.</td>
<td>Clinical Journal of Oncology</td>
<td>2010</td>
<td>Are patients on oral chemotherapy in your practice setting safe?</td>
<td>Purpose of the article is to describe the development of an oral chemotherapy nursing position as well as role implementation in an ambulatory medical oncology setting</td>
<td>Descriptive</td>
<td>in the ICU setting.</td>
<td>Collected patient volume data, triage phone call data, teaching provided etc. - no Metrix data</td>
<td>163 patients provided initial patient education 1,710 patient visits, 2,410 telephone triage in 6 months. Only 3 patients altered from the prescribed doses of oral chemotherapy - 2 while nurse was on vacation. Although not a study, this descriptive article describes the impact of knowledgeable RN administering and providing education for oral chemotherapy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papa, D. Kampitsi, A. Katsaragaki S, C. Leventelis, C. Papageorgiou, D. Papadouri, A.</td>
<td>European Journal of Oncology Nursing</td>
<td>2010</td>
<td>Assessing Hellenic oncology nurses' knowledge and practice about chemotherapy handling and administration</td>
<td>What is Hellenic oncology nurses' knowledge and practice about chemotherapy handling and administration</td>
<td>Descriptive</td>
<td>n = 70 RNs working in oncology hospitals and wards</td>
<td>74.3% only administered, some prepared and administered. 63% reported a lack of protective systems and equipment. Only 35.7% reported taking special precautions. 62.9% did report taking a special program on chemotherapy handling and administration. However, the nurses who did the class reported taking proper precautions. A lack of standards regarding safe handling and administration exists.</td>
<td>Small subset of previously discussed article.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author(s)</td>
<td>Journal</td>
<td>Year</td>
<td>Article Title</td>
<td>Abstract</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>------</td>
<td>---------------</td>
<td>----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bruce, S. D.</td>
<td>Clinical Journal of Oncology</td>
<td>2013</td>
<td>Before you press that button: a look at chemotherapy errors</td>
<td>Understanding the issues associated with chemotherapy infusion errors and preventative strategies will provide oncology nurses with a foundation for eliminating such errors. Administration is the safe process most vulnerable to error. Presented elements of independent checks. Pump setting verification is a new necessary step.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sullivan, T., Harrold, K., Bell, K., Griffin, C.</td>
<td>Cancer Nursing Practice</td>
<td>2013</td>
<td>Benefits of attending nurse-led pre-chemotherapy group sessions</td>
<td>Is a new approach to providing information on chemotherapy and support in group sessions improving patient experience and outcomes? Patient surveys revealed that patients felt the group setting met their needs 92-100% of the time. 90-95% of patients continued to learn in this setting. Patients reported that having other patients presented allowed information and questions they did not think of to be asked. Consistent information presented to patients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mota, A., Corcoran, S., Reid, J.</td>
<td>Oncology Nursing Forum</td>
<td>2007</td>
<td>&quot;Bridge to Oncology&quot;: an innovative program designed to bridge the gap for new graduates and oncology naive nurses practicing in an ambulatory chemotherapy treatment setting</td>
<td>Program developed to enable oncology naive nurses to practice safely and competently. Orientation pathway clearly stated learning objectives. Content progressed in difficulty. Many methods of learning were used—online reading, ebp lectures, off-unit observational experiences. Reviews were completed. Method of improving competency understanding.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authors</td>
<td>Title</td>
<td>Year</td>
<td>Journal</td>
<td>Study Design</td>
<td>Participants</td>
<td>Methods</td>
<td>Results</td>
<td>Discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td>---------</td>
<td>--------------</td>
<td>--------------</td>
<td>---------</td>
<td>---------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosenzweig, M., Giblin, J., Morse, A., Sheehy, P., Sommer, V.</td>
<td>Bridging the Gap: A Descriptive Study of Knowledge and Skill Needs in the First Year of Oncology Nurse Practitioner Practice</td>
<td>2012</td>
<td>Oncology Nursing Forum</td>
<td>Cross-Sectional, Descriptive</td>
<td>601 self-described ONPs from the Oncology Nursing Society’s database</td>
<td>National email 28 item electronic survey distributed randomly</td>
<td>After the first year 90% of ONPs rated themselves as prepared. 78% (n=81) rated themselves as not at all or somewhat prepared to manage clinical issues of chemotherapy and biotherapy. 70% (n=77) rated themselves as not at all or somewhat prepared to manage oncological emergencies. 81% received their primary source of education from supervising physicians. There is specific knowledge and skills needed for ONPs related to chemotherapy onc emergencies, toxicities and symptom management prior to entering into a cancer care practice.</td>
<td>Impact of knowledge by mid-level providers and potential knowledge gap if no formal education has been provided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strother, R. M., Fitch, M., Kamau, P., Beattie, K., Boudreau, A., Busakhal, N., Loehrer, P. J.</td>
<td>Building cancer nursing skills in a resource-constrained government hospital</td>
<td>2012</td>
<td>Support Care Cancer</td>
<td>Descriptive/Case Study</td>
<td>N=30 nurses and non-nurses (22/8) from one hospital in western Kenya</td>
<td>22 nurses and 8 physicians/pharmacists were provided with a 5 day education program and compare pre-test and post-test to assess and to evaluate retention</td>
<td>Clinical impact was not evaluated (limitation) Overall knowledge and retention improved for all attendees. New standards of care and policies were started in result of this education. An increase in knowledge related to biology and pharmacology was noted. (Percentages on Table 2 in article)</td>
<td>Education provided to all team members - despite discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haylock, P.</td>
<td>2011</td>
<td>Oncology Nursing Forum</td>
<td>Identify critical elements of the major shift in cancer nursing practice, education and the expectations of professional nursing immediately following world war II that were precursors of contemporary oncology nursing preparation and practice.</td>
<td>Data Synthesis</td>
<td>N/A</td>
<td>N/A</td>
<td>Professional nursing in general and cancer nursing in particular underwent significant changes and distinct paradigm shift in cancer nursing education and practice in the period of time surrounding world war II (development of chemotherapy for use as treatment) stimulating cancer nursing. Provided knowledge related to need to collaborate and educate nurses.</td>
<td>Other: Review of Lit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Courtney, D. M. Aldeen, A. Z. Gorman, S. M. Handler, J. A. Trifilio, S. M. Parada, J. P. Yarnold, P. R. Bennett, C. L.</td>
<td>2007</td>
<td>The Oncologist</td>
<td>What are the clinical outcomes and economic costs of emergency department care of cancer associated neutropenia fever</td>
<td>Descriptive</td>
<td>n = 57 patient visits (48 patients)</td>
<td>retrospectiv e medical record review</td>
<td>12% of patients died from febrile neutropenia, 8% received ICU care and survived. Blood cultures were positive for 37% of patients. Median time in ED was 3.3 hours. 91% of visits antibiotics were administered in ED at a mean of 1.7 hours. Median costs were $1455 for care. Cost of ED care was similar to cost of one day care</td>
<td>VI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muehllbauer, P. M.</td>
<td>2012</td>
<td>ONS Connect</td>
<td>What is the impact of chemotherapy administration for non-oncology purposes?</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A - Interviews with experts</td>
<td>Described ONS treatment basics course for non-oncology nurses. Discussed when and where chemotherapy may be administered - ICU med-surge. Explained oncology nurses role, training of nursing staff. Listed non-oncology diseased</td>
<td>VII</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crannell, C.</td>
<td>Oncology Nursing Forum</td>
<td>2012</td>
<td>Assess chemotherapy competency of inpatient oncology nurses in an environment as close to the actual patient administration setting as possible - simulation.</td>
<td>N/A</td>
<td>Pre and Post evaluation surveys. Competency Assessment using scenario based cases</td>
<td>n = 66 (66 pre evaluations and 64 post evaluations)</td>
<td>Confidence increase noted for all areas post simulation. (See Figure 1). Increases most in the verification and safe handling process. Competency assessment using simulation is valuable - provides closest possible environment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oestreicher, P.</td>
<td>ONS Connect</td>
<td>2007</td>
<td>Chemotherapy education for novice oncology nurses may create a culture of safety for nurses and patients</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Presents that 48,000 newly diagnosed patients with cancer experience adverse events related to medical care (source). 66% are preventable. Steps to prevention include education for nurses, creation of a multidisciplinary team to prevent errors, prevents strategies to enhance learning.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gonzalez, T.</td>
<td>2013</td>
<td>Clinical Journal of Oncology</td>
<td>Chemotherapy extravasations: prevention, identification, management, and documentation</td>
<td>Review of Literature related to Extravasations</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Incidence of extravasation 0.1%-6% from peripheral IV and 0.3 - 4.7% for central lines. Knowledge and skills of the nurse is key to prevention. Selection of appropriate IV access is important - requirement of chemotherapy certification. Presents assessment guidelines. Vesicant extravasation guidelines - reference ONS (2009) and antidotes. Documentation of chemotherapy of extravasations. Recommendations of care form - British Columbia Cancer Agency 2012) Creation of a chemotherapy taskforce, review of existing guidelines, practice of other NCI facilities. Revision of procedure including of 2 RN independent checking process, staff and patient education and inclusion of patient in checking process. Independent double checks was the key initiative to reducing errors. Comprehensive review of extravasation prevention, management, identification and documentation. Should be applied to system wide policy. Important to recognize CVAD just as high risk. Other: Review of Lit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friedel, P. Roberts, M.</td>
<td>2006</td>
<td>Oncology Nursing Forum</td>
<td>Chemotherapy safety initiative: experienced nurses lead the way</td>
<td>Improve patient safety measures and error detection related to chemotherapy administration</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Creation of a chemotherapy taskforce, review of existing guidelines, practice of other NCI facilities. Revision of procedure including of 2 RN independent checking process, staff and patient education and inclusion of patient in checking process. Independent double checks was the key initiative to reducing errors. Presents methods but not statistical impact of project. Other: Performance Improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Journal</td>
<td>Title</td>
<td>Team</td>
<td>Description</td>
<td>Methodology</td>
<td>Findings</td>
<td>Notes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td>-------------</td>
<td>-------------</td>
<td>----------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Clinical Journal of Oncology</td>
<td>Decreasing patient misidentification before chemotherapy administration</td>
<td>TeamSTEPPS, an evidenced-based teamwork system, was initiated by one hospital in the Bone Marrow Transplant unit. Project designed to answer 2 questions - Does the implementation of a bedside check of patient identification by 2 chemotherapy competent nurses prior to administering chemotherapy decrease the incidence of wrong-patient related medication errors and how consistently are these bedside checks performed?</td>
<td>N/A</td>
<td>Evaluation tool brief/debrief model was used to collect data from November 2008 - February 2009. BMT nursing survey was completed</td>
<td>Of the 90 incidences of chemotherapy administration in the data collection period no errors related to misidentification were found. 100% of the staff reported that it improved safety and practice. No errors were reported prior to data collection time.</td>
<td>III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Journal of Cancer Education</td>
<td>Developing a longitudinal cancer nursing education program in Honduras</td>
<td>To develop and deliver cancer nursing education conferences in Honduras using volunteer nurses educators</td>
<td>Longitudinal</td>
<td>Delivery of 2 conferences and 2 Site assessments, Surveys</td>
<td>Less than 4% of nurses had formal training in cancer care prior to these offerings. More than 65% had internet access allowing for remote access to conferences and educational offerings far away. Recommendation for internet-based formal education programs</td>
<td>Waiting for original article Presents other options for cancer education. This would impact Hawaii as we are remote and have less opportunity to attend conferences etc. due to cost and distance</td>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batty, N. White, S. Miller, C.</td>
<td>2011</td>
<td>Cancer Nursing Practice</td>
<td>Developing an e-learning package to provide chemotherapy updates</td>
<td>Describes the development of an e-learning package to deliver annual mandatory updates on the safe handling of chemotherapy and how this became a regional education package in the west of Scotland</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**E learning development:**
A team was created to create the modules on safe handling and administration. **Cost:** There was no cost to develop the on-line learning modules. They replaced 3 four hour classes, it is suspected it will have a cost savings, but this is not clearly defined. **Assessment:** Each module is presented with multiple quizzes to assess understanding, certificate is created at completion

No structured data presented, but article states initial feedback is positive. IT skills are required.

**Other:** Performance Improvement
<table>
<thead>
<tr>
<th>Chung, C. Collins, A. Cui, N.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>American journal of health-system pharmacy</strong></td>
</tr>
<tr>
<td><strong>Development and implementation of an interdisciplinary oncology program in a community hospital</strong></td>
</tr>
<tr>
<td><strong>Does the development and implementation of an interdisciplinary oncology program in a community hospital improve communication and outcomes?</strong></td>
</tr>
<tr>
<td><strong>Case Study</strong></td>
</tr>
<tr>
<td><strong>A three phase program that started in 2005, was introduced to the community hospital. Phase 1: Development of Guidelines and References. Pharmacy driven protocols and order sets, including chemotherapy induced nausea and vomiting, hypersensitivity reactions, etc. Phase 2: Full time position created for Oncology Pharmacist Specialist and a Clinical Nurse Specialist in Oncology. Restructuring of non-oncology services. Interdisciplinary team creation. Development</strong></td>
</tr>
<tr>
<td><strong>96 chemotherapy orders before program implementation and 75 orders post implementation.</strong></td>
</tr>
<tr>
<td><strong>96 chemotherapy orders before program implementation and 75 orders post implementation. Cost Savings related to decreased drug use secondary to drug dose rounding. (120,000). Reduction in chemotherapy dosing and scheduling errors, 45% reduction (p&lt;0.0625) – not statistically significant, but substantial. Most common cause of error was missing information typically an omitted schedule, dose, route, or premedication (63% of all errors documented). Improved awareness about staff competency and understanding. Assess</strong></td>
</tr>
<tr>
<td><strong>Communication and interdisciplinary communication with pharmacy.</strong></td>
</tr>
<tr>
<td>III</td>
</tr>
<tr>
<td>Nelson, W. K. Moore, J A. Grasso, J A. Barbarotta, L Fischer, D S.</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Gaguski, M. E. Karcheski, T.</td>
</tr>
<tr>
<td>Yu, H. Yu, S. Chen, I. J. Wang, K. K. Tang, F</td>
</tr>
<tr>
<td>Authors</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Bennett, C. L. Calhoun, E. A.</td>
</tr>
<tr>
<td>Vioral, A.N.</td>
</tr>
<tr>
<td>Year</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>2008</td>
</tr>
<tr>
<td>Year</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>2012</td>
</tr>
<tr>
<td>2007</td>
</tr>
<tr>
<td>Reference</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Kim, K. Lee, H. S. Kim, Y. Kim, B. J. Kim, M. H. Choi, S. C. Ryu, S. Y.</td>
</tr>
<tr>
<td>De Raad, J. Gool, G. Ward, R</td>
</tr>
<tr>
<td>Year</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>2012</td>
</tr>
</tbody>
</table>
| Keat, C. H.  
Sooaid, N. S.  
Yun, C. Y.  
Sriraman, M. | Improving safety-related knowledge, attitude and practices of nurses handling cytotoxic anticancer drug: pharmacists' experience in a general hospital, Malaysia | Assessed the change of nurses' safety-related knowledge as well as attitude levels and subsequently to assess the change of cytotoxic drug handling practices in wards after a series of pharmacists-based intervention. | 2013 | Asian Pacific journal of cancer prevention : APJCP | Prospective interventional longitudinal study | 96 nurses who administered chemotherapy from 15 wards | Self-administered questionnaire and performance checklist to assess compliance - 2 assessment and 9 months of intervention in between | Pharmacist based interventions included series of educational and administrative support measures- drugs were mixed and prepared, closed system. 2 sessions of continued nursing education, and a drug handling workshop. Most nurses were female and married. Significant increase in the mean knowledge score from 45.5+ 10.52 to 73.4+ 8.8 out of 100 (p<0.001) Mean practice scores on assessments increase from 7.6+5.51 to 15.3+2.55 out of 20. | IV |
| Ashley, L.  
Dexter, R.  
Marshall, F.  
McKenzie, B  
Ryan, M.  
Armitage, G. | Improving the Safety of Chemotherapy Administration: An Oncology Nurse-Led Failure Mode and Effects Analysis | To assess and improve the safety of hospital based adult chemotherapy administration. | 2011 | Oncology Nursing Forum | Prospective Clinical Risk Assessment | 8 person nurse-led multidisciplinary team | FMEA, prospective risk assessment methodology, bi weekly team meetings, mapping the chemotherapy process, identifying and numerically prioritizing potential errors (Failure Modes) generating strategies. | Several failure modes were identified which had not been previously recognized: drug regimen is administered twice, infusion bag removed before entire dose is administered, bolus drugs are given as infusions- vincristine, drug from regimen omitted etc. 16 areas identified. 20 remedial strategies developed to overcome errors. | Other: Performance Improvement |

Similar to Sheridan-Leos study in 2007. Methodology is useful in identifying gaps that may not be reported.
| Levy, M. A. Giuse, D. A. Eck, C. Holder, G. Lippard, G. Cartwright, J. Rudge, N. K. | 2011 | Journal of oncology practice / American Society of Clinical Oncology | Integrated information systems for electronic chemotherapy medication administration | N/A | N/A | N/A | System adaptation occurred however there remained some limitations related to day of treatment and dose number. Safety Alerts are possible with the BCMA: Missing order alert, wrong dose alert, wrong route alert, wrong schedule alert. In addition, the BCMA provided audit reports that can be generated. However, it was necessary to provide Oncology specific configuration. Support was needed for 3 weeks, 24 hours a day, 7 days a week. Unfortunately the flow sheet did not recognize a specific nursing pre assessment, no start and stop times, etc. Most disadvantages were related to documentation, but the safety and outweigh these limitations. | Current system at PMMC created work around EPIC/Beacon d/t initial limitations but no changes have been made since implementation. |
| Wilkes, G. | 2009 | Journal of Infusion Nursing | Intravenous administration of antineoplastic drugs | N/A | N/A | N/A | Review of chemotherapy and biotherapy mechanisms of action, treatment regimens, dose determination, calculations, safe handling, and administration guidelines. All guidelines followed the 2009, ASCO and ONS recommendations and referenced the guidelines. The article also presented other trends and issues, including extravasation | Following ASCO/ONS guidelines | Other: Review of Lit |
and hypersensitivity reactions. Current trend related to hospitals initiating policies reacted to these trends. Article states that nurses that administer antineoplastic agents should have a strong foundational knowledge.

<p>| Daouphars, M, Magali, A Bertrand, E Basuyau, F Violette, S Varin, R | 2012 | Clinical Journal of Oncology | Knowledge Assessment and Information Needs of Oncology Nurses Regarding Inpatient Medication | Identify some issues oncology nurses have related to drug and help establish improvement measures within a 130 bed French regional hospital. | Descriptive | All of the nurses considered their knowledge to be on an intermediate level. 156 drugs were assessed. 84% of the pharmaceutical classes were known. 95% of the indications, 94% were familiar with dosages, 48% reported related to side effects knowledge, etc. Over half of the nurses reported that they experienced lack of knowledge related to medications. There was a correlation with knowledge and experience in years of the nurse | Major lack of knowledge is reacted to side effects, contradictions, and drug-drug interactions | VI |</p>
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Journal</th>
<th>Title</th>
<th>Methodology</th>
<th>Participants</th>
<th>Results/Findings</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheridan-Leos, N.</td>
<td>2007</td>
<td>Clinical Journal of Oncology</td>
<td>A model of chemotherapy education for novice oncology nurses that supports a culture of safety</td>
<td>Describe how chemotherapy education was redesigned using a proactive approach to help novice oncology nurses who were perceived to be the most likely to make treatment based errors</td>
<td>450 bed community hospital over 24 months. Dedicated oncology medical and surgical units, ambulatory treatment center, and on-site radiation therapy</td>
<td>Near misses events was used to evaluate the program. Multidisciplinary team created to design error prevention team. Education Plan: observation for 6 months, ONS Chemotherapy course, additional education on error prevention. Clinical practicum, annual retesting, open book examination annually. Evaluation chemotherapy as a system vs. task. New nurses scored higher on examination than experienced nurses who had given chemotherapy. Near misses reported was also higher as they were educated to report.</td>
<td>Education program is consistent with the plan I proposed at PMMC</td>
</tr>
<tr>
<td>Geddie, P. I.</td>
<td>2008</td>
<td>Journal of Infusion Nursing</td>
<td>Nononcologic use of chemotherapy</td>
<td>This review of literature was completed to identify the use of chemotherapy for nononcology uses.</td>
<td>N/A</td>
<td>N/A N/A N/A Issues such as drug knowledge, safe handling, disposal, side effect management and patient education arise when patients who do not have cancer are cared for nurses who do not have knowledge related to chemotherapy. Diseases presented were primarily autoimmune disorders that are the most common to be treated with chemotherapy- See table 2 for disease and treatment recommendations</td>
<td>References for nononcology uses extensive and useful as a resource for dosing parameters and how to manage in the non oncology patient population. Table is very applicable and could be used as a resource.</td>
</tr>
<tr>
<td>Authors</td>
<td>Year</td>
<td>Journal</td>
<td>Study Title</td>
<td>Design</td>
<td>Sample Size</td>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------</td>
<td>--------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Schwappacher, D. L. B.</td>
<td>2010</td>
<td>Oncology Nursing Forum</td>
<td>Oncology nurses’ perceptions about involving patients in the prevention of chemotherapy administration errors</td>
<td>Qualitative Descriptive</td>
<td>11 actively participating oncology nurses working in an ambulatory unit.</td>
<td>Nurses participated in 2 focus groups on 2 occasions. Participants discussed their personal experiences with patient involvement in chemotherapy error prevention, and changes in relationships with patients. Nurses reported positive experiences with engaging patients in safety behaviors. Although they did describe engaging patients to be a challenge. Nurses intuitively chose strategies and pattern of language to engage patients. 2 primary models of engaging patients: participative and authoritative. Considerable differences related to organizational barriers encountered by nurses. Patient participation is a complex learning process that requires cultural change in the organization.</td>
<td></td>
</tr>
<tr>
<td>Day, D. D.</td>
<td>2014</td>
<td>Clinical Journal of Oncology</td>
<td>The Oncology Nursing Society Leadership Competency Project: Developing a Road Map to Professional Excellence</td>
<td>N/A</td>
<td>N/A</td>
<td>Review of new competencies to be published by ONS. The competencies cover the domains of vision, knowledge, interpersonal effectiveness, systems thinking, and personal mastery. Data to create the competencies was from literature review, data synthesis, and peer and expert review. Competencies could be applicable to experienced nurses in oncology. Available from ons. Article reviews process. Goal to provide a professional pathway for oncology nurses.</td>
<td></td>
</tr>
<tr>
<td>Maloney, K. W., Denno, M. Kider, T., McClintock, K. Moore, A., Rutyna, T., Wiley, K., Sullivan, M. D.</td>
<td>2013</td>
<td><em>Clinical Journal of Oncology</em></td>
<td>Development of a phone consultation and intervention service to address increasing needs for the specialty of oncology nursing and care for patients in the non oncology setting</td>
<td>N/A</td>
<td>N/A</td>
<td>1453 phone calls to the oncology phone since phones inception in 2009. Paper collection of consultation was first approach; online data collection was then applied to capture use of consultation service</td>
<td>Calls were for bed management, line care, education, chemotherapy, pleurex and laboratory. Chemotherapy and education were the most calls consecutively for 2 years. Chemotherapy calls in the first year were 189 and 374 in year 2. High quality care was ensured by providing the service. Valuable data related to needs in the non oncology setting were gained. Goal was to provide safe and effective care.</td>
</tr>
</tbody>
</table>

| Kvale, K., Bondevik, M. | 2010 | *Oncology Nursing Forum* | Patients' perceptions of the importance of nurses' knowledge about cancer and its treatment for quality nursing care | Qualitative Descriptive | 20 patients (10 men and 10 women) | In depth interviews were taped and recorded, transcribed and analyzed. The text was read as a whole condensed into units of meaning, and clustered into themes. Consistency between identified themes and the general structure of the interviews checked. | Patients perceived knowledge about cancer and its treatment as basic in nursing and took for granted that nursing had competency. Knowledge was important 3 themes: makes patients feel safe and secure, prevents and alleviates suffering by providing useful information, and alleviates suffering as related to suffering. Patients appreciated the clinical and biological knowledge nurses had. Nurses who alleviated pain and suffering made patients feel safe and secure | Patient satisfaction and comfort can be impacted by nursing knowledge. | VI |
| 2007 | Journal of Cancer Education | Pattern and outcome of admission to a medical oncology inpatient service | Describe the admissions to a medical oncology inpatient service with a 2 year period | Descriptive | Chart Review | Chemotherapy admission was the number one reason for admission (81.2%). The median number of hospitalizations was 1 (range 1-21). Length of stay was 1-189 days, median 4 days. Most patients were discharged, but 9.9% of patients died in the inpatient setting. | Awaiting extended article - further discussion related to disease process and correlation to admission reasons and length of stay. |
|---|---|---|---|---|---|---|
| Ranchon, F Moch, C You, B Salles, G Schwiertz, V Vantard, N Franchon, E Dussart, C Henin, E Colomban, O Girard, P Freyer, G Rioufol, C | 2012 | European Journal of Cancer | Predictors of prescription errors involving anticancer chemotherapy agents | To identify predictors of prescription errors involving anticancer chemotherapy agents | Correlation | 17,150 chemotherapy prescriptions | 540 of 17,150 chemotherapy orders contained at least one error. (3.15%). Risk factors identified: Patients with BSA >2m², protocols with more than 3 drugs, protocols involving carboplatin, protocols with at least one modification by physician, inpatient care, and prescriptions by resident physician | These identified risk factors should be applied. Specifically, the risk of inpatient alone and the risk of resident orders - hospitalist service is the most common to write chemotherapy |
| Rishel, C.J. | 2013 | Oncology Nursing Forum | Professional development for oncology nurses: a commitment to lifelong learning | Article presented different strategies for professional development in oncology nursing | N/A | N/A | N/A | Strategies include Journal Clubs - ONS methodology, Certification - promotion of certification with review courses, celebration, mentoring. Writing a publication, involvement in local chapters. | Journal Club is a creative way to inspire learning in nurses to provide continuing education. Becoming involved in local HI chapter should be encouraged by nurses. Certification review course first offered last year |
| Gabel Speroni, K Fisher, J Dennis, M Daniel, M | 2013 | Nursing | What causes near-misses and how are they mitigated? | To determine the reasons hospital RNs attribute to near-misses and the techniques they used to mitigate these near-misses to prevent serious reportable events | Descriptive | 123 RN Respondents | Survey completion about self-reported near misses or another RN near miss they witnessed | Total of 144 near misses were self-reported or witnessed. 43 (35%) self-reported a near miss event and 80 (65%) reported a witnessed event. Medication administration (19%) and transcription errors (10%) as the most common types of errors. 412 factors were identified to contribute to near misses. More personal factors than institutional factors. Top personal: not following policy, inappropriate decision making, and critical assumptions. Institutional factors: interruptions, distractions, and poor communication | Developing a system that incorporated multidisciplinary collaboration and decreases distractions.
<p>| Schulmeister, L. | 2005 | Clinical Journal of Oncology | Ten simple strategies to prevent chemotherapy errors | Presented strategies to prevent chemotherapy errors | N/A | N/A | N/A | 10 simple strategies: 1. Consistently use reliable method to verify patient identification prior to chemotherapy. 2. Measure height and weight in centimeter and kilograms. 3. Have good lighting, employ caution, and use high-visibility tools such as calculators with large numbers. 4. Organize the work and workspace for safety and efficiency. 5. If chemotherapy orders are transmitted via fax, use an original order sheet printed with a font larger than 12 points. 6. Eliminate the use of abbreviations and acronyms in all clinical documentation. 7. Provide and use up-to-date easily accessible information at the point of care. 8. Follow the 80/20 rule. 9. Reduce the potential for human error. 10. Include the stakeholder with the most to lose—the patient—in chemotherapy prevention. | Use this reference currently in teaching - not a research study but provides review of literature related to strategies. | Other: Review of Lit |</p>
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Journal</th>
<th>Title</th>
<th>Methodology</th>
<th>Study Details</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weingart, S. N., Li, J. W., Zhu, J., Morway, L., Stuver, S. O., Shulman, L. N., Hassett, M. J.</td>
<td>2012</td>
<td>Journal of oncology practice / American Society of Clinical Oncology</td>
<td>US Cancer Center Implementation of ASCO/Oncology Society Chemotherapy Administration Safety Standards</td>
<td>Descriptive</td>
<td>Assess the implementation status of ASCO/ONS chemotherapy administration guidelines (2009)</td>
<td>Only 4 centers reported full implementation of all 31 standards. Implementation varied by standard (see table.) poorest implementation of standards that addressed documentation of chemotherapy planning - only 6 sites. General chemotherapy practice standards - only 5 sites with full implementation. Patient consent also noted as 11 sites with full implementation. Significant opportunities for improvement noted. This article was presented in 2012 and in 2013 updates of guidelines published.</td>
</tr>
<tr>
<td><strong>American Society of Health-System Pharmacists</strong></td>
<td><strong>2014</strong></td>
<td><strong>Best Practices for Hospitals &amp; Health-System Pharmacy</strong></td>
<td><strong>ASHP Guidelines on Preventing Medication Errors with Chemotherapy and Biotherapy</strong></td>
<td><strong>Guidelines for Practice</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2013</strong></td>
<td><strong>Clinical Journal of Oncology</strong></td>
<td><strong>Calling a Chemo Nurse: Ensuring Safe Chemotherapy Administration Outside of Oncology</strong></td>
<td><strong>To minimize risk of adverse events and enhance care quality in a large academic medical center, the chemotherapy pager project was implemented</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
</tr>
</tbody>
</table>
Nurse experts administered 465 doses of chemotherapy and 52% were on critical care units. Visits required an average of 30 minutes.
Appendix B. Chemotherapy and Biotherapy Administration Policy
Policy Name: Chemotherapy and Biotherapy Administration & Handling
Department: Nursing, Pharmacy
Effective Date: 05/2015 Reviewed:
Previous Version(s):

Policy & Procedure
Replaces: Chemotherapy Administration Policy

**The reader is cautioned to refer to the Central Policy Database for the most current version of this document and not rely on any printed version.**

Scope:
This policy applies to Medical, Pharmacy, Nursing and Laboratory staff, as well as all others involved in the medication use process within Pali Momi Medical Center (PMMC), an affiliate of Hawai‘i Pacific Health (HPH).

Policy Statement:
Hawai‘i Pacific Health recognizes the inherent risks to the patient and caregiver associated with the administration of chemotherapy and biotherapy. The following procedure has been developed to outline the requirements for the administration of chemotherapy and biotherapy. All employees who work with chemotherapy/biotherapy and/or patients receiving chemotherapy/biotherapy will be educated in the proper safety procedures, and in the proper handling of these agents.
Employees with a medical limitation (*i.e.*, pregnancy, breastfeeding) may elect to (but are not required to) refrain from preparing, administering, or caring for patients during the time of the chemotherapy/biotherapy administration and up to 48 hours after administration. They may be assigned to other work areas as work assignments permit.

All healthcare workers who prepare or administer chemotherapy/biotherapy will be monitored in a systematic program of medical surveillance intended to prevent occupational injury and disease (See HPH policy "Cytotoxic Drug Handlers Medical Surveillance").

The chemotherapy and biotherapy agents covered by this policy are identified as Chemotherapy, Hazardous, or Reproductive Risk in Epic, Pyxis and by pharmacy labeling.

**Definitions:**

**Hazardous Drugs:** Drugs are considered hazardous when they possess any one of the following characteristics: genotoxicity, carcinogenicity, teratogenicity or other developmental toxicity, fertility impairment, organ toxicity at low doses, structure and toxicity profiles of new drugs that mimic existing drugs determined hazardous by the aforementioned criteria.

**Chemotherapy:** All antineoplastic agents given through any route. These agents are classified according to pharmacologic action or their effect on cell reproduction. Types include but are not limited to alkylating agents, antimetabolites, plant alkaloids, nitrosoureas, and antitumor antibiotics.

**Biotherapy:** Are systemic treatments that may modify the patient’s own immune defenses. They may be so specific as to target a single receptor on the surface of tumor cell or an enzyme within a cell. They can cause side effects and toxicities different from those of other antineoplastic agents. Types include but are not limited to colony-stimulating factors, interferons, interleukins, immunotoxins, monoclonal antibodies, and small molecule inhibitors.

**Hormone Therapy:** Are systemic treatments that may have a tumoricidal effect in hormone-sensitive tumors because of reduction or blockage of the source of the hormone or receptor site where the hormone is active.
**Extravasation:** Accidental administration of intravenous medication into surrounding tissue by leakage or direct exposure. Tissue sloughing and necrosis may occur depending on the amount of medication extravasated and the strength of the agent.

**Vesicant:** Any medication that has known potential to cause blistering, severe tissue injury or tissue necrosis when extravasated.

**Policy / Procedure:**

I. **Patient Education**
   A. Patient education will take place *prior to and throughout treatment*.
   
   B. Teaching content will be delivered in terms the patient and support person can understand and may include the following topics:
      1. What is cancer
      2. What is chemotherapy
      3. What is biotherapy (if applicable)
      4. What is radiation (if applicable)
      5. Information on their specific cancer and treatment regimens
      6. Goals of treatment
      7. Symptom management
      8. IV management
      9. Who to contact for concerns, questions, or further information
   
   C. The RN will assess the patient for understanding of the education provided.

II. **Verification and Initiation of Administration**
   
   A. Verification: Prior to the initiation of a treatment regimen the RN will verify the following elements of the treatment plan and schedule:
      1. Review the regimen and anticipated side effects
      2. Verify the ordered regimen is appropriate for the indication
3. Verify orders against an approved reference:
   a. Treatment Plan, Protocol, or Road Map
   b. Journal Article
   c. If a non-standard regimen or research protocol is used, ensure a copy of the non-standard regimen or research protocol is available to verify the ordered regimen (See Cancer Chemotherapy (Antineoplastic Agents) Physician Prescribing Policy)
   d. The ordering physician will be responsible for ensuring treatment plans or protocols (road maps) and informed consent are available to the nursing staff and pharmacy staff on the in-patient and out-patient units.

4. Evaluate any necessary diagnostic testing (i.e. Echo/MUGA, laboratory values, dose-limiting toxicities, etc.).

5. Obtain clarification orders if there are any aspects of the orders that can be misinterpreted. (Example - Total dose in mg and no mg/m2).

6. Verify dose(s) are within normal range for indication.

7. Discrepancies > 10 % are discussed with prescribing physician and medication administration is held until validated and documented by the prescriber.


9. Verify order and scheduling of supportive medication and/or fluids. (i.e., Emergency medications, hydration, antiemetic medications, etc.).

10. For premenopausal women, an order for a pregnancy test will be requested, but ordered at the discretion of the ordering physician.

B. **Initiation of Administration:** Two chemotherapy competent team members (nurse, pharmacist, and/or physician) will check the drug label against the prescribed order and patient identifiers at bedside/chairside. This applies to chemotherapy, biotherapy, and supportive care agents such as Mesna or Leucovorin.

1. Accuracy of the medication label and prescribed order are verified and compared: patient name, medical record number, (birthdate if outpatient), drug name, route, dose, volume, diluent, infusion time, date, treatment duration, drug expiration, number of doses/dates of administration, and/or comparison to treatment plan/roadmap.
2. After prescribed order has been verified, two chemotherapy competent team members will verify and compare the drug label to patient identifiers, in the patient’s presence.

3. After the correct patient has been verified, two chemotherapy competent team members will verify the following: Infusion rate, infusion line(s) are unclamped, connection site is intact.

4. For intravenous administration, 2 chemotherapy competent nurses are preferred.

III. During Administration

A. Personal Protective Equipment (PPE) and Safety Procedures for Administering Hazardous Drugs

1. PPE should be utilized in all activities related to chemotherapy administration. For specific instructions related to PPE and Safety Procedures please refer to Table 1 as a reference.

2. Place a disposable, absorbent plastic-backed pad under the connection to catch possible droplets and avoid exposing the patient’s skin to the drug.

3. Gloves should be changed every 30 minutes or when torn, punctured, or contaminated. Outer gloves should be removed first, then the chemotherapy gown, and then the inner gloves.

4. All gowns worn for chemotherapy (hazardous materials) should be used only once, then, removed and disposed of as contaminated waste.

5. Observe precautions when working with chemotherapy and bioterrorism hazardous agents.

   a. Wash hands before and after handling the drug, avoid touching the drug and always wear gloves when handling any container of a hazardous agent.

   b. Wash surfaces that come in contact with the drug with soap and water, and dispose of toweling in the appropriate waste receptacle. A plastic lined protective pad will be placed under all containers of chemotherapy at all times.

6. Tubing will never be disconnected from the bag of a hazardous agent.

7. Pharmacy will prime all IV tubing with a non-hazardous containing solution, unless indicated. If there is air or any other complication with IV tubing, the administering nurse will return the drug to pharmacy for correction.

8. Excess medication or air contained within a syringe should never be expressed into the air.

9. Oral chemotherapy
a. Oral Chemotherapy will be verified by pharmacy and reviewed by nursing prior to administration.

b. Hazardous agents should never be crushed or broken by the nurse or family member. If the patient is unable to swallow pills, the drug should be returned to Pharmacy to prepare a suspension or solution in the biological safety hood. The patient and family will be instructed to never crush pills at home.

10. A spill kit will be carried at all times during the transportation of hazardous drugs. Hazardous drugs should be transported in the elevator, not in the stairwells.

**B. General Guidelines for IV Chemotherapy / Biotherapy Administration**

1. Peripheral IV:
   a. Prior to administration, assessment of access should be completed ensuring peripheral access is appropriate.
   b. A new IV access should be obtained prior to administration: avoid areas of hematoma, edema, impaired lymphatic drainage, phlebitis, inflammation, induration, sites of previous irradiation, sites distal to previous IV catheters or venipuncture sites less than 24 hours old, and avoid use of lower extremities.
   c. Assess patency of IV, absence of swelling, discomfort, or erythema prior to administration.
   d. Ensure brisk blood return prior to administration. If there is no blood return, the nurse should place a new PIV in a safe location (i.e., Above the previous site or in the opposite arm).
   e. If PIV access is difficult to obtain, consult physician to discuss potential CVAD placement to ensure safe administration and document plan.

2. Central lines:
   a. Assess adequacy of brisk blood return, absence of swelling, discomfort or erythema.
   b. Assess for signs of venous obstruction, jugular venous distension, superficial collateral circulation on chest wall, arm swelling on side of central line. If present, hold chemotherapy administration and contact prescribing physician.
   c. If flow is absent, sluggish or resistant, contact prescribing physician. Obtain order for a central line occlusion procedure to restore catheter patency and/or obtain an order for an imaging study of the line to assess placement.
   d. Chemotherapy / biotherapy will not be administered unless catheter placement and patency can be confirmed.

3. Assess pump flow and ensure no leakage from IV tubing.

4. Observe IV or catheter exit site for changes and IV infusion flow for changes in quality or rate of infusion.

5. At completion of drug infusion, flush line sufficiently to ensure entire dose was delivered.

6. Vinka alkaloids will only be administered by a mini-bag through free-flowing IV.
C. **Administration of Intrathecal Chemotherapy**

1. Intrathecal doses will be labeled by the Pharmacy "INTRATHECAL USE ONLY".

2. Intrathecal chemotherapy will be stored in an isolated container or location.

3. The intrathecal chemotherapeutic agent will be verified by two chemotherapy competent team members prior to administration.

4. At the time of administration, the intrathecal chemotherapeutic agent and the dose will be double checked with the written physician order during the time out by an RN and the provider who is performing the procedure.

5. Intrathecal chemotherapy may only be administered by oncologists or oncology nurse practitioners who are privileged to do so.

D. **Administration of Vesicant Chemotherapy**

1. The use of a central line or new peripheral IV is strongly recommended. For pediatric patients at KMCWC, a physician order must be obtained to use an existing peripheral IV line for vesicant administration. In all other settings, a new IV should be obtained.

2. Avoid the antecubital fossa and any blood vessels that have had venipunctures in the preceding 24 hours.

3. Avoid areas around joints, nerves, and tendons, such as hands and inner aspect of the wrist. The large veins of the forearm are preferred.

4. Avoid areas of impaired lymphatic drainage.

5. Avoid the use of veins in the scalp or feet.

6. Remove tight clothing and jewelry prior to starting of IV.

7. Alternate arms if possible when administering multiple doses over several days or weeks.

8. Continuous infusion (more than 30 minutes) of vesicant medication requires a central venous catheter. Vesicants cannot be infused continuously through a peripheral IV. An implanted port will not be used for the continuous administration of a vesicant in pediatric patients.

9. When a vesicant is administered through a peripheral vein the nurse must observe the infusion site at all times.

10. The following are risk factors for extravasation in the administration of vesicants:

    a. Decreased venous integrity

    b. Poor venous circulation

    c. Venous stasis
d. Poor nutrition

e. Diabetes

f. Inability to communicate

11. All IV push vesicant chemotherapy will be administered through the side arm of a free flowing IV. Do not use an IV pump, as pump use may increases pressure on the veins.

12. Prior to administering a vesicant, flush the line with the appropriate sterile IV solution and observe for any signs and symptoms of infiltration. A brisk blood return must be obtained before infusing vesicants.

13. Check blood return pre-infusion, during, and at the end of the drug administration. Blood return should be assessed at least every four hours during a continuous infusion of a vesicant and every 3-5cc for IV push vesicant administration.

14. The site of the central venous catheter should also be evaluated for signs of inflammation and extravasation every hour. Check for ease of flow, lack of subcutaneous swelling, absence of pain, and burning.

15. It is recommended that patients be alert enough, and instructed to respond to potential adverse reactions (i.e., burning, pain).

16. Stop the infusion if a change in sensation, pain, burning, stinging, or swelling occurs at the IV site or if unable to obtain a blood return. Follow the procedure for extravasation (see below) if infiltration is suspected.

E. Continuous Infusions (non-vesicant and vesicant)

1. An infusion pump is required.

2. Observe IV/line site and tubing every hour for appropriate flow rate/leakage and assess blood return every 4 hours.

3. Continuous infusions should not be interrupted unless absolutely necessary to ensure that the agent is delivered as ordered over the prescribed amount of time. If the patient has to leave the care area, they should travel with a spill kit at all times.

F. Management of suspected or actual extravasation (The use of a central line does not preclude extravasation injuries).

1. Immediately STOP administering the vesicant and IV fluids.

2. Disconnect the IV tubing from the IV device. Do not remove the IV device or noncoring port needle.

3. Attempt to aspirate residual vesicant from the IV device or port needle using a small (3mL) syringe.

4. Remove the peripheral IV device or port needle.
5. Assess the site of the suspected extravasation.

6. Assess symptoms experienced by the patient (e.g., pain, impairment in range of motion of extremity).

7. Notify physician or advanced practice nurse.

8. Initiate appropriate management measures listed in Table 2 (Adult) and Table 3 (Pediatrics).

9. Document the following in the medical record:
   a. Date and time that extravasation occurred or was suspected
   b. Type and size of peripheral venous access device or type of central venous access device and gauge / length of noncoring needle (implanted ports)
   c. Location and patency of peripheral or central venous access device
   d. Number and location(s) of venipuncture attempts (for peripheral vesicant administration)
   e. Description and quality of a blood return before and during vesicant administration
   f. Vesicant administration technique (e.g., bolus, infusion)
   g. Concentration and estimated amount of extravasated vesicant
   h. Symptoms reported by patient (e.g., burning, pain)
   i. Description of administration site appearance and including measurement of edema and/or redness if present
   j. Photographs of administration site that include date and time in the photograph field if appropriate
   k. Assessment of extremity (if applicable) for range of motion and discomfort with movement
   l. Immediate nursing interventions (e.g., topical cooling or heating, physician notification)
   m. Follow-up recommendations based on physician orders. (e.g., referral to plastic surgery, return appointments)
   n. Patient teaching (e.g., skin assessment, temperature monitoring, reporting pain)

10. Patient follow-up
   a. Assess the patient’s response to extravasation management based on physician’s orders, the treatment plan and extent of injury.
   b. Assessment should include inspection and measurement of extravasation area, skin integrity, presence of pain or other symptoms, arm / hand mobility (for peripheral extravasations), and sensation.
c. Obtain follow-up photographs that include the date and time.

d. In collaboration with the physician or advanced practice nurse, refer the patient for specialized care when indicated (e.g., plastic or hand surgery consultation, physical therapy, pain management, rehab services).

e. Instruct the patient to protect the extravasation area from sunlight, monitor the site, and report fever, chills, blistering, skin sloughing, and worsening pain.

G. Administration of chemotherapy agents classified as “high potential” for hypersensitivity reactions in Table 4 and biotherapy agents listed in Table 5.

1. Pre-administration Guidelines

   a. Obtain and record baseline vital signs.

   b. Review the patient’s allergy history.

   c. Administer premedications as ordered.

   d. Ensure emergency equipment and medications are readily available.

      i. For pediatrics: Calculate amount of drug to be used for the most common emergency medications (e.g., diphenhydramine, methylprednisolone, and epinephrine). Record doses on Chemotherapy Anaphylaxis Medication Calculation Form (see Attachment 1) and have readily available.

   e. Verify physician orders and medication access for emergency treatment before drug administration.

   f. Instruct the patient to report symptoms of hypersensitivity and infusion reaction as soon as possible.

   g. Monitor for reactions with each treatment. Hypersensitivity reactions can occur with a patient’s repeated exposure to a drug and at any time during the infusion or treatment cycle. The patient should be closely observed immediately after initiation of the agent and for one hour after completion of administration.

      i. Clinical manifestations of anaphylaxis and hypersensitivity include: airway compromise such as tongue or throat swelling, stridor, or hoarseness; breathing difficulties such as shortness of breath, wheezing, cyanosis or respiratory arrest; circulatory compromise such as tachycardia, hypotension, myocardial ischemia or cardiac arrest; neurological changes such as confusion, agitation or loss of consciousness; skin and mucosal changes such as erythema, urticaria, or periorbital or facial edema.

      ii. Clinical manifestations of cytokine-release syndrome: fever or chills, nausea, hypotension, tachycardia, asthenia, headache, rash, tongue and throat swelling, dyspnea.

2. Emergency Management of Anaphylaxis (Symptoms usually arise within 30 minutes of initial administration or increase in infusion rate. Immediate action is imperative.)

   a. STOP drug infusion immediately.
b. Maintain IV line with normal saline or another compatible solution.

c. Stay with the patient. Another staff member shall notify the physician and emergency team if indicated.

d. Place the patient in a comfortable position: sitting if short of breath or vomiting, lying flat if hypotensive with elevated legs for shock (SBP < 60 mmHg).

e. Monitor vital signs (HR, RR, BP, O2 sat) every 2 minutes until patient is stable, then every 5 minutes for 30 minutes, then every 15 minutes for 1 hour. Monitor ECG for serious reactions.

f. Maintain airway. Administer oxygen if needed. Anticipate need for CPR.

g. Administer emergency medications per physician orders.

h. Provide emotional support to patient and family.

i. Document all treatments and the patient’s response in the medical record.

3. **Clinical Management of Cytokine-Release Syndrome** (Risk factors include first infusion of mAbs, chemotherapy-naïve patients receiving mAbs, patients with leukemia or lymphoma, especially those with high circulating lymphocyte counts > 25,000/mm3).

a. Stop infusion and observe the patient until symptoms resolve (usually within 30 minutes).

b. Administer additional treatment medications as ordered (e.g., H2 blockers).

c. Resume infusion at a slower rate (50%) after resolution of symptoms, and titrate the rate slowly.

d. For severe reactions, administer emergency medications per physician orders.

e. Notify Physician.

4. **Clinical Management of Localized Hypersensitivity**.

a. Observe for and evaluate symptoms (e.g., urticaria).

b. Administer treatment medications per physician orders (e.g., diphenhydramine, H2 blockers, corticosteroids).

c. Monitor vital signs at least every 15 minutes for 1 hour.

d. Document the episode, including all treatments and the patient’s response to treatment.

e. Notify Physician.

III. **After Administration**

**Disposal**

A. Body fluids
1. Use universal precautions when handling blood, emesis, or excretions of patients who have received chemotherapy / biotherapy until 48 hours after the last dose. Wear a gown and goggles when appropriate and if splashing could occur.

2. Provide a urinal with a tight fitting lid for male patients.

3. For children in diapers or incontinent adults, a protective barrier ointment to the diaper area to avoid painful chemical burns when voiding is recommended. Clean the skin well with each diaper change, and change diapers frequently.

4. Instruct family members to wear gloves when changing diapers or assisting the patient with toileting. Recommend that female family members who may be pregnant or breastfeeding refrain from handling excretions as much as possible.

B. Linen

1. Institute universal precautions when handling linen soiled with blood or body fluids.

2. Discard disposable diapers and/or heavily soiled pads with other hazardous wastes in plastic bags intended for hazardous waste disposal for at least 48 hours following the last dose of chemotherapy / biotherapy.

3. After use, discard gloves and gown in the appropriate waste container.

C. Equipment and supplies

1. Identify antineoplastic waste products by using leak proof, sealable, plastic bags or other appropriate containers with brightly colored labels designating the hazardous nature of the contents.

2. Use puncture-proof appropriately labeled containers for sharps or breakable items.

3. Syringes or IV bags with residual hazardous drug must be returned to pharmacy for proper disposal.

4. Only those housekeeping personnel who have successfully completed an appropriate competency in safe handling procedures shall handle chemotherapy and other hazardous drug waste containers.

IV. Management of Hazardous Spills

A. Any spillage should be managed according to the spill procedure outlined in this policy and in accordance with Environment of Care policies. Consult the Safety Data Sheet (SDS) for recommendations specific to the spilled drug or chemical.

B. Spill kits, clearly labeled, should always be kept in or near preparation and administration areas, as well as during transport. Spill kits will be OSHA and ASHP compliant.

C. Spills shall be immediately identified with a warning sign so others in the vicinity will not be exposed.
D. If the spill cannot be contained with one spill kit, dial “500” and page Code Orange to the appropriate area. Spills that can be managed with one spill kit will be contained and cleaned up by the nursing personnel administering the chemotherapy.

E. Spills and breakage shall be cleaned up immediately by trained personnel using chemotherapy spill kits. Follow the instructions included with the spill kit.
   1. All contaminated materials, protective garments and disposable cleaning equipment shall be disposed of in chemotherapy drug disposal containers.
   2. If an oral chemotherapeutic drug bottle is broken, double bag all of its contents, label as chemotherapy and return to pharmacy.
   3. If the patient had already received part of the dose prior to the spill, estimate volume of spill and contact the physician to determine plans for a replacement dose.

V. Management of Accidental Exposure

A. For skin exposure, remove any contaminated garments and immediately wash affected area with soap and water. Dispose of contaminated garments in the appropriate hazardous waste container.

B. For eye exposure, immediately flood the affected eye with saline solution or water for at least fifteen minutes. An acceptable alternative to an eyewash station is sterile saline connected to IV tubing.

C. Medical attention shall be obtained as soon as possible for all exposures to hazardous agents. Employees shall report to the Employee Health Nurse, or the Emergency Room if the Employee Health Nurse is not available. The employee will call the HPH Work Injury Line at 535-7200 as soon as possible after the exposure.

D. Exposed family members/visitors shall report to the emergency room.

E. Employees will report all spills, exposures, injuries and unsafe conditions to their supervisors immediately.

VI. Medical Record Documentation

A. The RN will document the following in the medical record:
   1. All double check procedures done to ensure accuracy of administration.
   2. Site and device used for chemotherapy infusion.
   3. Start and stop times of continuous infusions.
   4. Status of IV and site prior to, during and following infusion.
   5. Complications and/or adverse drug reactions during chemotherapy administration.
   7. Record date and dose of chemotherapy on the paper protocol or “roadmap” in the patient’s chart, if available.
VII. **Education Requirements:** To verify and administer chemotherapy or biotherapy
Registered Nursing staff must complete the following requirements:

A. A minimum of 6 months experience of caring for patients with cancer and/or a foundational oncology educational class

B. Manager Recommendation

C. Successful completion of either:
   1. Oncology Nursing Society (ONS) Chemotherapy and Biotherapy Provider Course
   2. The Association of Pediatric Hematology/ Oncology Nurses (APHON) Pediatric Chemotherapy and Biotherapy Provider Course

D. Successful completion of unit-based practicum

E. Complete annual HPH Chemotherapy and Biotherapy Competency Assessment

F. Special Considerations: Non-chemotherapy competent registered nurses who have attended an educational session related to the administration of specific medications and completed a clinical competency may administer this agent as needed. For example, low dose Methotrexate, (50mg/m² or less) in non-cancer conditions.

---

**Standard / Reference & Year:**


**Rationale for Revision:**

☐ New  ☒ Update  ☒ Consolidation

**Author(s) & Department(s):** Oncology Practice Council

**Reviewer(s) & Department(s):** Chief Nurse Executives, Pharmacy & Therapeutics Committees

---

**Table 1. PPE and Engineering Controls for Working with Hazardous Drugs.**
<table>
<thead>
<tr>
<th>Formulation</th>
<th>Activity</th>
<th>Gloves</th>
<th>Gown</th>
<th>Eye Protection</th>
<th>Respiratory Protection</th>
<th>Ventilated Engineering Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact tablet or capsule</td>
<td>Administration from unit dose package</td>
<td>Single glove</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Tablets or capsules</td>
<td>Administration</td>
<td>Double glove</td>
<td>Yes</td>
<td>No</td>
<td>Yes, if powder generated</td>
<td>N/A</td>
</tr>
<tr>
<td>Oral liquid drugs</td>
<td>Administration</td>
<td>Double glove</td>
<td>Yes</td>
<td>No, unless patient may resist or administered by feeding tube</td>
<td>No, unless patient may resist or administered by feeding tube</td>
<td>N/A</td>
</tr>
<tr>
<td>Topical drug</td>
<td>Administration</td>
<td>Double glove</td>
<td>Yes</td>
<td>Yes, if liquid could splash</td>
<td>Yes, if inhalation potential</td>
<td>N/A</td>
</tr>
<tr>
<td>Subcutaneous Injection</td>
<td>Administration from prepared syringe</td>
<td>Double glove</td>
<td>Yes</td>
<td>Yes, if liquid could splash</td>
<td>Yes, if inhalation potential</td>
<td>N/A</td>
</tr>
<tr>
<td>Intravenous Solution</td>
<td>Administration of prepared solution, IV tubing already attached &amp; primed</td>
<td>Double glove</td>
<td>Yes</td>
<td>Yes, if liquid that could splash</td>
<td>Yes, if inhalation potential</td>
<td>N/A; CSTD recommended</td>
</tr>
<tr>
<td>Solution for Irrigation</td>
<td>Administration (bladder, HIPEC, limb perfusion, etc.) – this could cover intravesicular intrapleural intraperitoneal Intralesional correct</td>
<td>Double glove</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Powder / Solution for Inhalation</td>
<td>Inhalation</td>
<td>Double glove</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, when applicable</td>
</tr>
</tbody>
</table>
Intra-arterial Administration (embolization) | Double glove | Yes | Yes | Yes | N/A

More detailed information on safe handling practices may be found through NIOSH 2004, ASHP 2006, USP 2008 and ONS 2011.

BSC: Class II Biological Safety Cabinet
CACI: Compounding Aseptic Containment Isolator
CSTD: Closed System Drug Transfer Device
HIPEC: HyperthermicIntraperitoneal Chemotherapy

Table 2. Adult Vesicant Extravasation Management Guidelines

<table>
<thead>
<tr>
<th>Classification / Drug</th>
<th>Immediate Topical Therapy</th>
<th>Antidote or Treatment</th>
<th>Antidote or Treatment Administration, Patient Monitoring, and Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalating Agent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechlorethamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hydrochloride (nitrogen mustard, Mustargen)</td>
<td>Apply ice for 6-12 hours following sodium thiosulfate antidote injection</td>
<td>Antidote: Sodium thiosulfate Prepation: Prepare 1/6 molar solution. 10% sodium thiosulfate solution: Mix 4ml with 6ml SWFI. 25% sodium thiosulfate solution: Mix 1.6ml with 8.4ml SWFI. Storage: Store at room temp between 15C-30C (59F-86F).</td>
<td>Inject 2ml of the sodium thiosulfate solution for each mg of mechlorethamine suspected to have extravasated. Inject the solution subcutaneously into the extravasated site using a 25-gauge or smaller needle. Change needle with injection. Assess the extravasation area for pain, blister formation, and skin sloughing periodically in accordance with guidelines laid out by this policy. Instruct the patient to monitor the extravasation site and report fever, chills, blistering, skin sloughing, and worsening pain. Instruct the patient with peripheral extravasation to report arm and hand swelling and stiffness.</td>
</tr>
<tr>
<td>Anthracenedione</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitoxantrone (Novantrone)</td>
<td>Apply ice pack for 15-20 minutes at least 4 times a day for the first 24 hours</td>
<td>No known antidotes or treatments</td>
<td>Extravasation typically causes blue discoloration of the infusion site area and may require debridement and skin grafting. Assess the extravasation area for pain, blister</td>
</tr>
<tr>
<td>Anthracyclines</td>
<td>Apply ice pack (but remove at least 15 minutes prior to dexrazoxane treatment)</td>
<td>Treatment: Dexrazoxane for injection</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Daunorubicin (Cerubidine), Doxorubicin (Adriamycin), Epirubicin (Ellence), Idarubicin (Idamycin)</td>
<td></td>
<td>Dose: Day 1 – 1,000 mg/m2 (max dose 2,000mg) Day 2 – 1,000 mg/m2 (max dose 2,000mg) Day 3 – 500 mg/m2 (max dose 1,000mg) Reduce dose by 50% for CLcr &lt; 40 ml/min.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preparation: Each 500mg vial of dexrazoxane must be mixed with 50ml diluent. The patient's dose is then added to 1,000ml NS for administration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage: Store at room temp between 15C-30C (59F-86F)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The first dexrazoxane infusion should be initiated as soon as possible and within 6 hours of the anthracycline extravasation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dexrazoxane should be infused over 1-2 hours in a large vein in an area other than the extravasation area (e.g., opposite arm). The same arm should be used only when the patient’s clinical status (e.g., lymphedema, loss of limb) precludes the use of the unaffected arm, and a large vein distal to the extravasation site should be used for dexrazoxane administration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DMSO should not be applied to the extravasation site.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assess the extravasation area for pain, blister formation, and skin sloughing periodically in accordance with guidelines laid out by this policy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instruct the patient to monitor the extravasation site and report fever, chills, blistering, skin sloughing, and worsening pain.</td>
<td></td>
</tr>
</tbody>
</table>
Instruct the patient with peripheral extravasation to report arm and hand swelling and stiffness.

Instruct the patient about treatment side effects (e.g., nausea / vomiting, diarrhea, stomatitis, bone marrow suppression, elevated liver enzyme levels, infusion site burning).

Monitoring the patient's CBC and liver enzymes.

<table>
<thead>
<tr>
<th>Antitumor Antibiotics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitomycin (Mutamycin), Dactinomycin (Actinomycin D, Cosmogen)</td>
<td>Apply ice pack for 15-20 minutes at least 4 times a day for the first 24 hours</td>
<td>No known antidotes or treatments</td>
</tr>
</tbody>
</table>

No known antidotes or treatments

Assess the extravasation area for pain, blister formation, and skin sloughing periodically in accordance with guidelines laid out by this policy.

In collaboration with the physician or advanced practice nurse, refer the patient for specialized care when indicated or needed (e.g., plastic or hand surgery consult, physical therapy, pain management, rehab services).

<table>
<thead>
<tr>
<th>Plant Alkaloids and Microtubule Inhibitors</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinblastine (Velban), Vincristine (Oncovin), Vinorelbine (Navelbine)</td>
<td>Apply warm pack for 15-20 minutes at least 4 times per day for the first 24-48 hours. Elevate extremity (peripheral extravasations).</td>
<td>Antidote: Hyaluronidase Preparation: Amphadase and Hylenex – Do not dilute. Use solution as provided. Store in refrigerator at 2C-8C (36F-46F).</td>
</tr>
</tbody>
</table>

Administer 150 units (1ml) as 5 separate injections, each containing 0.2ml of hyaluronidase, subcutaneously into the extravasation site using a 25-gauge of smaller needle. Change needle with injection.

Assess the extravasation area for pain, blister formation, and skin sloughing periodically in accordance with guidelines laid out by this policy.

Instruct the patient to monitor the extravasation.
site and report fever, chills, blistering, skin sloughing, and worsening pain.

Instruct the patient with peripheral extravasation to report arm and hand swelling and stiffness.

**Taxanes**
- Docetaxel (Taxotere), Paclitaxel (Taxol), Paclitaxel protein-bound particles for injectable suspension (Abraxane)

Apply ice pack for 15-20 minutes at least 4 times a day for the first 24 hours

No known antidote or treatment

Docetaxel extravasation may cause hyperpigmentation, redness, and tenderness.

Paclitaxel is a mild vesicant; extravasation may cause induration, blistering and rarely tissue necrosis.

Protein-bound paclitaxel extravasation has been identified during post-approval use. Monitor the infusion site closely for possible infiltration during administration.

Assess the extravasation area for pain, blister formation, and skin sloughing periodically in accordance with guidelines laid out by this policy.

Instruct the patient to monitor the extravasation site and report fever, chills, blistering, skin sloughing, and worsening pain.

Instruct the patient with peripheral extravasation to report arm and hand swelling and stiffness.

**Table 2. Pediatric Vesicant Extravasation Management Guidelines**

<table>
<thead>
<tr>
<th>Chemotherapy Agent</th>
<th>Extravasation Potential</th>
<th>Local Care</th>
<th>Antidote</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleomycin (Blenoxane)</td>
<td>None / Irritant</td>
<td>Cold compress</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Drug Name</td>
<td>Type of Toxicity</td>
<td>Management</td>
<td>Treatment Notes</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------</td>
<td>------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Carboplatin (Parplatin)</td>
<td>None / Irritant ≥ 10mg/ml</td>
<td>Cold compress</td>
<td>None vs. DMSO (IIB+)</td>
<td></td>
</tr>
<tr>
<td>Carmustine (BiCNU)</td>
<td>Vesicant / Irritant</td>
<td>Cold compress</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Cisplatin (Platinol)</td>
<td>Vesicant at concentration &gt; 0.4mg/ml</td>
<td>Cold compress</td>
<td>-Elevate site of extravasation&lt;br&gt;-Cisplatin extravasation treatment is only indicated for large volume extravasations (&gt;20ml) of a concentrated solution (&gt;0.4mg/ml)&lt;br&gt;-Doses of sodium thiosulfate for newborns and infants have not been established</td>
<td></td>
</tr>
<tr>
<td>Cyclophosphamide (Cytoxan)</td>
<td>None / Irritant</td>
<td>Cold compress</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Dacarbazine (DTIC-Dome)</td>
<td>Irritant / Vesicant</td>
<td>Cold compress</td>
<td>None vs. DMSO (IIC)&lt;br&gt;-Elevate site of extravasation&lt;br&gt;-Protect area from sunlight</td>
<td></td>
</tr>
<tr>
<td>Dactinomycin (Cosmogen)</td>
<td>Vesicant</td>
<td>Cold compress</td>
<td>None vs. DMSO (IIC)&lt;br&gt;-Do NOT use dextrazoxane and DMSO together. The combination may increase tissue damage.&lt;br&gt;-Elevate site of extravasation&lt;br&gt;-Do not apply heat, it may worsen injury&lt;br&gt;-Protect site from heat and sunlight&lt;br&gt;-Corticosteroids worsen toxicity</td>
<td></td>
</tr>
<tr>
<td>Daunorubicin (Cerubidine)</td>
<td>Vesicant</td>
<td>Cold compress</td>
<td>Dexrazoxane (IA) vs. DMSO (IIC)&lt;br&gt;-Do NOT use dextrazoxane and DMSO together. The combination may increase tissue damage.&lt;br&gt;-Elevate site of extravasation&lt;br&gt;-Do not apply heat, it may worsen injury&lt;br&gt;-Protect site from heat and sunlight&lt;br&gt;-Corticosteroids worsen toxicity</td>
<td></td>
</tr>
<tr>
<td>Docetaxel (Taxotere)</td>
<td>Vesicant / Irritant</td>
<td>Cold compress</td>
<td>None&lt;br&gt;-Elevate site of extravasation</td>
<td></td>
</tr>
<tr>
<td>Doxorubicin (Adriamycin)</td>
<td>Vesicant</td>
<td>Cold compress</td>
<td>Dezrazoxane (IA) vs. DMSO (IIB+)&lt;br&gt;-Do NOT use dextrazoxane and DMSO together. The combination may increase tissue damage.&lt;br&gt;-Elevate site of extravasation&lt;br&gt;-Do not apply heat, it may worsen injury&lt;br&gt;-Protect site from heat and sunlight&lt;br&gt;-Corticosteroids worsen toxicity</td>
<td></td>
</tr>
<tr>
<td>Drug</td>
<td>Type / Phosphate</td>
<td>Treatment</td>
<td>Enzyme</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Etoposide (VePesid)                       | Vesicant / Irritant | Warm compress    | Hyaluronidase (IIC)             | - Elevate site of extravasation  
- Do not apply heat, it may worsen injury  
- Protect site from heat and sunlight  
- Corticosteroids worsen toxicity       |
| Etoposide phosphate (Etopophos)           | Irritant          | Warm compress    | Hyaluronidase (IIC)             | - Elevate site of extravasation  
- Hyaluronidase only recommended for large volume extravasations of concentrated solutions |
| Flurouracil (Adrucil)                      | Irritant vs. None | None             | None vs. DMSO (IIB+)            |                                               |
| Gemtuzumab ozogamicin (Mylotarg)           | Irritant          | Cold compress    |                                 |                                               |
| Idarubicin (Idamycin)                      | Vescitant         | Cold compress    | Dexrazoxane (IA) vs. DMSO (IIC) | - Do NOT use dexrazoxane and DMSO together. The combination may increase tissue damage.  
- Elevate site of extravasation  
- Do not apply heat, it may worsen injury  
- Protect site from heat and sunlight  
- Corticosteroids worsen toxicity |
| Ifosfamide (Ifex)                          | Irritant          | Cold compress    | None vs. DMSO (IIB+)            |                                               |
| Irinotecan (Camptosar)                     | Irritant          | Ice              |                                 |                                               |
| Melphalan                                  | Irritant vs. Vesicant | Cold compress    | None                            | - Elevate site of extravasation           |
| Mitomycin (Mutamycin)                      | Vesciant          | None or Cold     | DMSO (IIB+) vs. Sodium Thiosulfate (IIB+) | - Elevate site of extravasation  
- Do not apply heat, it may worsen injury  
- Protect site from heat and sunlight |
Delayed injuries from mitomycin have been documented at sites distant from the site of extravasation.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Type</th>
<th>Treatment</th>
<th>Antidote</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitoxantrone (Novantrone)</td>
<td>Irritant vs. Vesicant</td>
<td>Cold compress</td>
<td>Dexrazoxane (IA) vs. DMSO (IIB+)</td>
<td>Do NOT use dexrazoxane and DMSO together. The combination may increase tissue damage. Elevate site of extravasation.</td>
</tr>
<tr>
<td>Oxaliplatin (Eloxatin)</td>
<td>Vesicant vs. Irritant</td>
<td>None (do NOT apply cold)</td>
<td>None</td>
<td>Elevate site of extravasation. DO NOT APPLY COLD. Cold can precipitate acute neurotoxicity. Early administration of corticosteroids may be beneficial to decrease inflammation.</td>
</tr>
<tr>
<td>Paclitaxel (Taxol)</td>
<td>Vesicant / Irritant</td>
<td>Cold compress</td>
<td>Hyaluronidase (IIB)</td>
<td>Elevate site of extravasation.</td>
</tr>
<tr>
<td>Topotecan (Hycamtin)</td>
<td>Irritant</td>
<td>Cold compress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinblastine (Velban)</td>
<td>Vesicant</td>
<td>Warm compress</td>
<td>Hyaluronidase (IA)</td>
<td>Elevate site of extravasation. Corticosteroids and topical cooling worsen toxicity.</td>
</tr>
<tr>
<td>Vincristine (Oncovin)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinorelbine (Navelbine)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Antidote Grading:**
Grade I – Benefits outweigh costs, risks, burdens
Grade II – Less certain of magnitude of benefits, risks, costs
Grade A – Consistent, positive results from human and animal studies (multiple reports)
Grade B+ – Positive results from human studies (single reports)
Grade B – Inconsistent results in human or animal studies
Grade C – Expiric use: No studies but based on favorable results when used in other members of the drug class

**Warm Compress:**
Apply warm pack for 15-20 minutes at least 4x per day for the first 24-48 hours.

**Cold Compress:**
Apply cold compress for 6-12 hours, or alternatively apply cold compress for at least 15-30 minutes 4x per day.

**Hyaluronidase preparation and administration:**
1. Reconstitute hyaluronidase solution to 150 units/ml. Note: Amphadase comes as 150 units/ml, Vitrase comes as 200 units/ml and needs dilution to achieve 150 units/ml.
2. Prepare 5 injections of 0.2 ml = 30 units each.
3. Infiltrate the area with a total dose of 150 units by making 5 injections of 0.2ml each over and around the circumference of the affected area. Use a new 25-gauge needle for each injection.
4. Hyaluronidase is NOT for IV injection.
5. Hyaluronidase has an immediate onset of action with a 24-48 hour duration of effect.
6. Hyaluronidase should NOT be injected into tumors, acute inflamed or infected areas.

**Sodium Thiosulfate preparation:**
1. To prepare 1/6 M solution from 25% solution: Mix 1.6ml of 25% sodium thiosulfate solution with 8.4ml of sterile water for injection or 0.9% sodium chloride.
2. To prepare 1/6 M solution from 10% solution: Mix 4ml of 10% sodium thiosulfate solution with 6ml of sterile water for injection or 0.9% sodium chloride.

**Dimethyl sulfoxide (DMSO):**
1. Availability varies: Obtain 50-99% (w/v) topical solution.
2. Apply DMSO: 4 drops/10cm² of skin surface area topically to twice the area of the site 3-4 times per day for 7-14 days.
3. Allow to air dry. Do not cover.
4. When applying DMSO, person applying should avoid direct contact with DMSO. Use double gloves; use metal forceps to apply sterile gauze pads.
5. DMSO application as been associated with mild local burning as well as severe pain.

**Dexrazoxane:**
1. Give daily 24 hours apart for 3 consecutive days. Days 1 & 2: dexrazoxane dose : anthracycline dose is 20:1. Days 3: dexrazoxane dose : anthracycline dose is 10:1. Max single dose 2000mg. For example, 250 mg/m² dexrazoxane : 25 mg/m² doxorubicin.
2. Start as soon as possible and within 6 hours of extravasation.
3. Remove cooling packs (if used) at least 15 minutes prior to start of dexrazoxane infusion.
4. Dilute reconstituted dexrazoxane with D5W or NS to a final concentration of 1.3-5 mg/ml.
5. Infuse dose over 1-2 hours.
6. Do not use DMSO in conjunction with dexrazoxane. This combination may increase tissue damage.
7. Monitor for neutropenia, thrombocytopenia.


**Table 4. Immediate Hypersensitivity Reactions: Predicted Risk by Chemotherapy Agent.**

<table>
<thead>
<tr>
<th>High Potential</th>
<th>Occasional Potential</th>
<th>Rare Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-Asparaginase</td>
<td>Anthracyclines: Doxorubicin, Daunorubicin, Idarubicin, Epirubicin</td>
<td>Bleomycin</td>
</tr>
<tr>
<td>Taxanes: Paclitaxel, Docetaxel</td>
<td>Mercaptopurine</td>
<td>Chlorambucil, Melphalan</td>
</tr>
<tr>
<td>Platinum Compounds: Cisplatin, Carboplatin, Oxaliplatin</td>
<td>Azathioprine</td>
<td>Cyclophosphamide, Ifosfamide</td>
</tr>
<tr>
<td>Epipodophyllotoxins: Etoposide, Teniposide</td>
<td></td>
<td>Cytarabine, Fludarabine</td>
</tr>
<tr>
<td>Generic Name</td>
<td>Brand Name</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Dacarbazine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dactinomycin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Fluorouracil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydroxyurea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methotrexate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEG-Modified E. coli Asparaginase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vincristine, Vinblastine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Biotherapy Drugs Associated with Hypersensitivity Reactions and Cytokine-Release Syndrome.

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Brand Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldesleukin</td>
<td>Proleukin</td>
</tr>
<tr>
<td>Alemtuzumab</td>
<td>Campath</td>
</tr>
<tr>
<td>Bevacizumab</td>
<td>Avastin</td>
</tr>
<tr>
<td>Brentuximab</td>
<td>Adcetris</td>
</tr>
<tr>
<td>Cetuximab</td>
<td>Erbitux</td>
</tr>
<tr>
<td>Denileukin diftitox</td>
<td>Ontak</td>
</tr>
<tr>
<td>Gemtuzumab ozogamicin</td>
<td>Mylotarg</td>
</tr>
<tr>
<td>Ibritumomab tiuxetan</td>
<td>Zevalin Y-90</td>
</tr>
<tr>
<td>Interferon alfa</td>
<td>Intron-A, Roferon-A</td>
</tr>
<tr>
<td>Interferon beta (1A and 1B)</td>
<td>Betaseron, Extavia, Avonex, Rebif,</td>
</tr>
<tr>
<td>Interferon gamma</td>
<td>Actimmune</td>
</tr>
<tr>
<td>Ipilimumab</td>
<td>Yervoy</td>
</tr>
<tr>
<td>Ofatumumab</td>
<td>Arzerra</td>
</tr>
<tr>
<td>Panitumumab</td>
<td>Vectibix</td>
</tr>
<tr>
<td>Rituximab</td>
<td>Rituxan,</td>
</tr>
<tr>
<td>Temsirolimus</td>
<td>Torisel</td>
</tr>
<tr>
<td>Tositumomab</td>
<td>Bexxar</td>
</tr>
<tr>
<td>Trastuzumab</td>
<td>Herceptin</td>
</tr>
</tbody>
</table>
Table 6. Recommended Doses for Chemotherapy Anaphylaxis Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Recommended Adult Dose</th>
<th>Recommended Pediatric Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine</td>
<td>0.3mg</td>
<td>0.01 mg/kg; max dose 0.5mg</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>125mg</td>
<td>2 mg/kg</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>50mg</td>
<td>1 mg/kg; max dose 50mg</td>
</tr>
<tr>
<td>Famotidine</td>
<td>20mg</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Chemotherapy Anaphylaxis Medication Calculation Form

Patient’s Name: _____________________________
Weight: __________

The following precautions have been taken because

[ ] Etoposide [ ] PEG Asparaginase [ ] Erwinia Asparaginase [ ] Other: ________
(Check drug to be administered)

Call MD for hives, itching, coughing, SOB, hypotension, anxiety or restlessness.

Epinephrine (1:1000) 1mg/1ml vial
Dose: 0.01 mg/kg IM PRN for anaphylaxis (MAX dose 0.5 mg)

Patients Dose: _____mg = _____ml

Methylprednisolone (Solu-Medrol)
[ ] 40mg/1cc vial or [ ] 125 mg/2ccvial
Dose: 2mg/kg IV PRN for anaphylaxis
Patients Dose: _____mg = _____ml

**Diphenhydramine (Benadryl) 50mg/ml vial**

Dose: 1mg/kg PRN for anaphylaxis (MAX dose 50 mg)

Patients Dose: _____mg = _____ml

Please calculate doses and verify calculated dose match ordered doses.

Confirm medications are available in the pyxis.
Appendix C. Algorithm
Appendix. D. Chemotherapy Checklist
Patient Name: ______________

Chemotherapy Order Verification Checklist

| On arrival to clinical area, obtain weight & confirm height | Ht_________ Wt_________ |
| Obtain ordered labs; initiate hydration as ordered within 1 hour of arrival to clinical area |
| Confirm signed consent is in chart for regimen patient is receiving. If no consent is available, notify the prescribing physician. |
| Verify the prescriber is authorized in the springboard report |
| Does the patient have adequate venous access based on regimen? If no, notify MD/LIP. |
| Obtain pregnancy test for female patient of childbearing age (Age between initial reported menses and one year after last reported menses) |
| Calculate creatinine clearance* (For patients receiving Methotrexate or Carboplatin) Creatinine Clearance |
| Assess pertinent lab results **Call MD if ANC <1500, WBC <3.0, platelets <100** |
| Calculate BSA & compare with BSA used in treatment protocol. BSA______ |

Confirm that drug regimen is complete by comparing against one of the following:
1. An approved treatment protocol
2. A research article provided by the prescriber
3. A chemotherapy reference book
4. A clinical trial protocol
**if there is any deviation from the standard, the rationale must be documented by the prescriber; if no rationale is documented, notify the prescriber

Independently calculate & confirm drug doses (any discrepancy in dose >10% must be communicate to MD/LIP)

Select start time for released treatment plan/review timing of chemotherapy and supportive medications (steroids, antiemetic, hydration, etc.)

Calculating BSA: \[ \frac{\text{height in cm} \times \text{weight in kg}}{3600} \]

Conversions
1 inch = 2.54 cm
2.2 pounds = 1 kilogram

Creatinine clearance formulas:

Cockroft-Gault:
Men: \[ 140 - \text{age(ABW in kg)} \]
Women: \[ 140 - \text{age(ABW in kg)} \times 0.85 \]
Serum creatinine x 72
Serum creatinine x 72

Calvert formula: (target AUC) x (GFR + 25) = Dose of Carboplatin (mg)

Measured urine collection: \[ \frac{\text{urine creatinine \times \text{urine volume}}}{\text{Serum creatinine \times \text{time (min.)}}} \]

Determining Ideal Body Weight

Women: 45.5kg + 2.3 (# of inches over 5 feet)
Men: 50kg + 2.3 (# of inches over 5 feet)

References to Verify Chemotherapy

EPIC Protocols
Up To Date – link from EPIC
Micromedex – link from EPIC

EB 1/15
Appendix E. Pharmacy Checklist
Patient Name: __________  MR# __________

(Modified for pharmacy use: INPATIENT CHEMO 7/14/15ga/mo)

Inpatient Chemotherapy Checklist for PHARMACY

<table>
<thead>
<tr>
<th>Obtain &amp; verify height, weight, BSA</th>
<th>Ht</th>
<th>Wt</th>
<th>BSA</th>
</tr>
</thead>
</table>

All oncology regimens must be in Beacon. Non-oncology regimens (i.e. rheumatology or neurology use of chemotherapeutic, biotherapy or hazardous agents that require chemo trained nurse to administer) should ideally be entered in to Beacon. Telephone orders are not allowed. If MD is not Beacon-trained, a signed paper order must be obtained and entered in Beacon by a pharmacist. Contact Beacon-trained pharmacist for assistance or questions. (note: Oncologists and neurologists are Beacon trained, oncology nurses on the floor are trained in beacon)

Confirm status of pt and necessity to treat in the inpatient setting (vs outpt setting)

Note: in many situations, starting chemo is not emergent and can be started once everything is assessed and in place (i.e. staffing, orders, drug availability etc). Collaborate with appropriate physician, nursing, CRC and case management) to agree upon a reasonable start date/time. Some patients may even be able to start after discharge. Notify Case management to help determine if this option is appropriate.
The 5th floor is the designated chemo floor (unless pt is in ICU). If Patient is currently on the 5th floor, notify 5th floor charge nurse regarding staffing needs. (Requirement: two chemo trained RNs to start each chemo and enough chemo trained staff to monitor patient during post-chemo period) Have charge nurse or manager notify pharmacy once staffing is arranged. IF patient is NOT on the 5th floor, notify CRC. They should work with 5th floor charge nurse to try and arrange for patient to be moved to the 5th floor.

Important phone numbers: Mindy x4356

1. CRC (bed control): x1730 or 485-3730 (*call if pt is not currently admitted or is admitted but not on the 5th floor. If pt is currently admitted on 5th floor, you do not need to call CRC.

2. 5th floor charge nurse: x4450 (notify charge nurse of pt and regimen so they can arrange for staffing. If charge nurse not available, please call Danette Butterfield (Manager) x1715

3. Case Management (if applicable) Linda Matsuura x4523 (secretary) - ask her for the name of the person overseeing pt and their phone number.

4. Notify Pharmacy Biller to research insurance issues/cost of treatment (if applicable) (Keri-Ann Yasuhara X4163)

5. Notify Rx Buyer to confirm drug availability, if necessary. (Joseph Yee x4184)

Confirm that drug regimen is complete and appropriate by comparing against one of the following: (RNs have also been instructed to follow this same procedure)

1. An approved standard treatment protocol
2. A research article provided by the prescriber
3. A chemotherapy reference book
4. A clinical trial protocol

Print regimen/articles for pharmacy profile and if requested, send to the floor.
**if there is any deviation from the standard, the rationale must be documented by the prescriber; if no rationale is documented, notify the prescriber.

Double check with RN to confirm that a signed consent is in chart for regimen patient is receiving. If no consent is available, RN must notify the prescribing physician. It is the physician’s responsibility to have a discussion with the patient and consent must be signed by both parties at the same time.

Have RN verify adequate venous access based on regimen/medication. If not, have RN discuss with MD and notify pharmacy when pt is cleared.

Created 7/14/15
Verify regimen (usually done by onc pharmacist): check chemo(s), dose, route, frequency, indication. Check for appropriate labs and parameters, adequate pre/post hydrations or appropriate running IV (i.e. for cyclophosphamide or cisplatin), and premeds as required by regimen. (RN, MD, and Pharmacist should be communicating and double checking each other)

Review pregnancy test results for women 10-80 years old: confirm negative results per cycle

Review any drug specific labs/test results (if appropriate) prior to treatment (i.e. TB testing, TFTs, MUGA/echo for cardio toxic medications). Call MD for results out of parameters. (i.e. if ANC <1500, WBC <3.0, platelets <100, renal/hepatic function)

Calculate creatinine clearance as appropriate* (i.e. For patients receiving Methotrexate or Carboplatin) Creatinine Clearance ________

Independently calculate & confirm drug doses using CURRENT h/wt/BSA (any discrepancy in dose >10% from original order must be discussed with MD)

ONCE IT IS DETERMINED BY ALL PARTIES THAT TREATMENT IS OK TO BEGIN:
1. RN will "release" orders from Beacon
2. Pharmacy to "verify" orders and prepare medications
3. Chemotherapy should be double checked by TWO chemo trained personnel at bedside prior to starting infusion
4. Maintain constant communication between chemo nurse and pharmacy

Side Note: Chemo/oncology patients admitted for medical admissions (i.e. PNA, neutropenic fever, SOB, etc.) should also be assigned to the 5th floor for continuum of care

USEFUL FORMULAS:

Measured urine collection: \( \frac{\text{urine creatinine}}{\text{Serum creatinine}} \times \frac{\text{urine volume}}{\text{time (min.)}} \)

Determining Ideal Body Weight
- Women: 45.5 kg + 2.3 (# of inches over 5 feet)
- Men: 50 kg + 2.3 (# of inches over 5 feet)

Creatinine Clearance:
\[ \frac{(140 - \text{age}) \times \text{wt kg}}{72 \times \text{SCr}} \times 0.85 \text{ for females} \]

Carboplatin dose calculation:
\[ \text{Cr Cl (max 125ml/min) } \times 25 \times \text{AUC} \]

Useful References to Verify Chemotherapy:
- www.chemorestonmen.com
- Up To Date - link from EPIC
- Micromedex - link from EPIC
- Nccn.org

167
Appendix F. Exempt from IRB Review
April 7, 2015

Elizabeth Blasiak, MSN, RN, OCN
Pali Momi Medical Center
98-1079 Moanalua Road
Aiea, HI 96701

Dear Ms. Blasiak:

SUBJECT: EXEMPT FROM IRB REVIEW
Project Leader: Elizabeth Blasiak, MSN, RN, OCN
Project Title: THE CHEMO COLLABORATE: IMPROVING THE PROCESS OF CHEMOTHERAPY ADMINISTRATION IN THE INPATIENT SETTING
HPHRI Study Number: 2015-057

On April 7, 2015 a designee of the Institutional Official of Hawai‘i Pacific Health determined the above referenced study is not research (as defined in 45 CFR 46.102(d)) subject to review by an Institutional Review Board. The project was reviewed and determined to be a Quality improvement activity and part of hospital operations as it seeks to improve patient care.

Any report on the results of this study is to include only de-identified data in an aggregated format.

Hawai‘i Pacific Health Research Institute will maintain files on all studies determined to be exempt from regulations.

Sincerely,

[Signature]

David T. Honc, MD
Hawai‘i Pacific Health Institutional Official Designee

DH/ea
Appendix G. Chemotherapy Competency
15_HPH_Chemotherapy Competency

Employee Information

Employee: [Redacted]
Job Title: 10799-Registered Nurse
Manager: [Redacted]
Department: 6070-5th Floor General Routine

Institution Name: PMMC-Pali Mom Medical Center

Assessment Summary

Assessment Status: Closed
Assessor: Elizabeth Blasiak
Start Date: 06/08/2015
Due Date: 09/01/2015

Overall Rating: Proficient
Extensive experience in this area/skill; able to teach and mentor others.
Overall Score:
Completion Date: 06/19/2015

Assessment Detail

Chemotherapy Administration

Proficient

Chemotherapy Verification

Competency evaluation for the pre-assessment of administration of chemotherapy

Behavioral Criteria:

1. Assesses patient: vital signs, allergies, systems.
2. Assesses tolerance to last cycle if appropriate.
3. Performs Medication Reconciliation noting any potential interactions with chemotherapy.
4. Verifies MD chemo order in EMR: right patient, drug, dosage, solution, route, duration/frequency of administration, premeds and/or IV hydration.
5. Verifies chemotherapy using an appropriate reference.
6. Verbalizes the most common side effects of each drug prior to administration.
7. Correctly calculates BSA and/or creatinine clearance as appropriate.
8. Ensure a pregnancy test is performed as required.
9. Ensure that a consent is obtained by MD.
10. Review all test results, assessment findings and documentation reporting to MD as appropriate.
12. Involves the patient and family in care planning and attempts to establish interventions specific to the individual needs of the patient.
13. Participates in interdisciplinary care planning with physicians, nurses, and other health care professionals (e.g. social worker, dietician, home care).

Rater: Blasiak, Elizabeth
Rated Date: 06/19/2015

Proficient
Chemotherapy Administration

Competency evaluation for the administration of chemotherapy

Behavioral Criteria:

1. Performs double check with chemo competent RN comparing original order from MAR to drug bag.
2. Verifies correct patient identification using 2 identifiers.
3. Applies gloves and gown and uses safe-handling precautions.
4. Verifies adequacy of venous access and appropriate IV site selection and ensures blood return.
5. Demonstrates safe administration of IV push if indicated:
   i. Pushes through side arm of a freely flowing IV, or at hub closest to patient. Checks patency every 2-5 ml.
   ii. Ensures appropriate rate of administration.
   iii. Assesses site for redness, swelling, leaking or tenderness.
   iv. Flushes between drugs.
6. Anticipates complications of chemotherapy and takes action to prevent or minimize the complications.
7. Demonstrates knowledge and skill in the assessment, management, and follow-up care of extravasation.
8. Verbalizes appropriate action in the event of hypersensitivity reaction.

Rater: Blasiak, Elizabeth
Rated Date: 06/19/2015
Risk/Outcome: High Risk, Safety
MOV: Evidence of Daily Work, Direct Observation
Comment: HDArac Idarubicin Rituxan

Post Chemotherapy Care

Competency evaluation on events after the administration of chemotherapy

Behavioral Criteria:

1. Flushes line with at least 5-10 ml NS.
2. Appropriately removes device or flushes/maintains VAD.
3. Disposes of chemotherapy waste according to Hazardous Drug policy.
4. Documents medication, education, and patient response.
5. Communicates post-treatment considerations to patient, family members, and appropriate personnel.
6. Instructs the patient about the prevention and management of gastrointestinal complications (e.g., nausea, constipation, diarrhea).
7. Involves the patient and family in care planning and attempts to establish interventions specific to the individual needs of the patient.
8. Instructs the patient about hair and scalp care, and takes measures to minimize hair loss and preserve body image.
10. Identifies patients at risk for stomatitis and instructs them about oral hygiene and preventive measures.
11. Demonstrates knowledge of the use of drug therapy, relaxation, and diversional therapies in the prevention and management of nausea and vomiting.

Rater: Blasiak, Elizabeth
Rated Date: 06/19/2015
Risk/Outcome: High Risk, Safety
MOV: Evidence of Daily Work, Direct Observation
Appendix H. Staff Survey
This survey is being sent to you due to your involvement in the inpatient chemotherapy and biotherapy process.

* 1. When did you learn about BEACON (the chemotherapy order entry application in EPIC)?
   - [ ] When BEACON was first implemented at Straub Clinic and Hospital in 2012
   - [ ] When BEACON was implemented at Pali Momi Medical Center (PMMC) in 2013
   - [ ] During your orientation at PMMC
   - [ ] After February of 2015

* 2. How did you learn about BEACON? Check all that apply
   - [ ] During BEACON training that was provided to you
   - [ ] On-Unit Training for chemotherapy administration (Nursing Only)
   - [ ] During Chemotherapy Skills Class (Nursing Only)
   - [ ] I have not learned about BEACON
   - Other (please specify)
     [ ]

* 3. Prior to this improvement project, were you aware that nursing could release chemotherapy orders?
   - [ ] Yes
   - [ ] No
* 4. What are the methods you use to communicate with others related to patients who will require chemotherapy? (check all that apply)

- BEACON order entry
- Email
- In-Basket Communication via EPIC
- Personal Communication (i.e. phone calls or direct conversations)
- Safety Huddles
- Other (please specify)

* 5. In your role, what is the most reliable method?

- BEACON Order Entry
- Email
- In-Basket Communication via EPIC
- Personal Communication (i.e. phone calls or direct conversations)
- Safety Huddles

* 6. What inpatient units are the most appropriate for patients to receive intravenous chemotherapy or biotherapy at PMMC?

- ICU with Chemotherapy Competent Nurse
- 4th Floor
- 5th Floor
- 6th Floor

* 7. Please rank the following:

<table>
<thead>
<tr>
<th>How satisfied are you with the current inpatient chemotherapy or biotherapy administration process at PMMC?</th>
<th>Unsatisfied</th>
<th>Somewhat Satisfied</th>
<th>Satisfied</th>
<th>Very Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
8. Please rate the following:

<table>
<thead>
<tr>
<th>Not Improved</th>
<th>Somewhat Improved</th>
<th>Improved</th>
<th>Very Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the last year, how would you rate the improvement of the inpatient chemotherapy administration process at PMMC?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 9. Please complete the statement: In my opinion, safety measures for patients receiving chemotherapy have ________.

- [ ] Increased
- [ ] Decreased
- [ ] Stayed the same

Comments:

* 10. Please rate the following:

<table>
<thead>
<tr>
<th>Not Efficient</th>
<th>Somewhat Efficient</th>
<th>Efficient</th>
<th>Very Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>How efficient is the current inpatient chemotherapy administration process at PMMC?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 11. In the last year, efficiency related to the inpatient chemotherapy administration process has ________.

- [ ] Increased
- [ ] Decreased
- [ ] Stayed the same
12. Please indicate your role:

- Nursing Staff (Administers Chemotherapy)
- Nursing Leadership
- Oncology Pharmacist
- Pharmacist
- Pharmacy Leadership
- Prescribing Physician

Pali Momi Medical Center
An Affiliate of Hawaii Pacific Health

PMMC Inpatient Chemotherapy Collaborate

Nursing Staff

13. What shift do you primarily work?

- Day
- Night
- Combination

14. Prior to February 2015, what education had you received related to chemotherapy or biotherapy administration at PMMC?

- I previously held an ONS Provider Card that I received while at another organization
- I previously held an ONS Provider Card that I received while employed at PMMC
- No education
- In-services or other education offered at PMMC

15. Have you ever administered intravenous chemotherapy without any formal education, including taking down chemotherapy at PMMC?

- Yes
- No
16. Have you recently taken the online ONS Chemotherapy and Biotherapy Administration Certificate Course?

- Yes
- No
- In this course presently

### PMMC Inpatient Chemotherapy Collaborate

#### Nursing Staff

17. Please complete the statement:

| I am satisfied with the ONS Chemotherapy and Biotherapy Certificate Course. |
|-----------------|---------------|----------------|----------------|
| Unsatisfied     | Somewhat Satisfied | Satisfied | Very Satisfied |
| ○               | ○             | ○           | ○             |

18. How prepared to administer chemotherapy did you feel after taking this course?

- Unprepared
- Somewhat prepared
- Prepared
- Very Prepared

19. Have you attended the four hour chemotherapy skills course offered at HPH?

- Yes
- No
20. How prepared to administer chemotherapy did you feel after taking the chemo skills course?

- Unprepared
- Somewhat Prepared
- Prepared
- Very Prepared

21. What additional education would you like to see in the future? Comment Optional
* 22. What is your comfort level with the following:

<table>
<thead>
<tr>
<th></th>
<th>Uncomfortable</th>
<th>Somewhat Comfortable</th>
<th>Comfortable</th>
<th>Very Comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of BEACON in EPIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i.e. Protocol review,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>order releasing, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chemotherapy or</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>biotherapy (i.e. hanging,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>taking down, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Checking at the</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bedsides</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall comfort level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>regarding chemotherapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and biotherapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 23. Please complete this statement: In the last year, my comfort level with chemotherapy has _____.

○ Increased
○ Decreased
○ Stayed the same

* 24. What resources do you utilize while verifying or administering chemotherapy? (check all that apply)

☐ Not aware of resources
☐ The chemotherapy verification checklist
☐ ONS Chemotherapy and Biotherapy Book available On-line
☐ PMMC Chemotherapy and Biotherapy Administration Policy
☐ Oncology Pharmacists
☐ Nursing Mentors (i.e. infusion nurses, experienced inpatient chemo nurses, oncology service line coordinator)
* 25. What resource do you most utilize while verifying or administering chemotherapy?

- Not aware of resources
- The chemotherapy verification checklist
- ONS Chemotherapy and Biotherapy Book available On-Line
- PMMC Chemotherapy and Biotherapy Administration Policy
- Oncology Pharmacists
- Nursing Mentors (i.e. infusion nurses, experienced inpatient chemo nurses, oncology service line coordinator)

26. What additional resources do feel are needed to continue to improve inpatient chemotherapy administration at PMMC?

27. Do you have any additional comments regarding the inpatient chemotherapy and biotherapy administration process at PMMC?
REFERENCES


183


Retrieved at Hawaii Pacific Health Intranet.

Maloney, K. W., Denno, M., Kider, T., McClintock, K., Moore, A., Rutyna, T., Sullivan, M. D. (2013). The oncology phone: An innovative program for the management of the oncology population in an


Mota, A., Corcoran, S., & Reid, J. (2007). "Bridge to Oncology": An innovative program designed to bridge the gap for new graduates and oncology naive nurses practicing in an ambulatory chemotherapy treatment setting... Oncology Nursing Society 32nd Annual Congress, April 24-27, 2007, Las Vegas, NV. *Oncology Nursing Forum, 34*(2), 554-555.


administration... 7th EONS Spring Convention, 15-16 April 2010, The Hague, The Netherlands.


Indiana University of Pennsylvania.


