A CONTINUING EDUCATION RESOURCE FOR REGISTERED NURSES ADMINISTERING SYSTEMIC THERAPY IN THE OUTPATIENT SETTING

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Abstract

Background: Systemic therapy administration is a specialized nursing skill that requires advanced education. While initial education for registered nurses (RNs) administering systemic therapy in Newfoundland and Labrador (NL) is well-developed, no formal continuing education resources are available. Comprehensive continuing education assists systemic therapy RNs to maintain their competency, ultimately promoting the health and safety of nurses and patients.

Purpose: To develop a continuing education resource for RNs administering systemic therapy in the outpatient setting at the Dr. H. Bliss Murphy Cancer Center.

Methods: I conducted a literature review, environmental scan, and consultations with key local stakeholders to explore a lack of continuing education for systemic therapy RNs globally, identify national educational approaches, identify local learning needs, and determine whether a continuing education resource was needed in the local setting.

Results: Findings from the literature review, environmental scan, and consultations indicated that a continuing education resource for systemic therapy RNs in the local setting would be beneficial. I developed a comprehensive educational resource that aligns with national systemic therapy nursing practice standards.

Conclusion: A continuing education resource for RNs administering systemic therapy in NL should promote maintaining their competency, thus promoting the health and safety of patients and nurses.

Keywords: *continuing education, educational resource, systemic therapy, registered nurses*

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Finally, this project is dedicated to my son, Sullivan. I hope one day you see that it is possible to do hard things when you set your mind to it.

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Introduction

Registered nurses (RNs) who work in outpatient oncology centers across Canada provide care to patients receiving systemic therapy. Systemic therapy is an umbrella term encompassing the various types of cancer treatments that damage or kill cancer cells, including chemotherapy, immunotherapy, hormone therapy, and targeted therapy (BC Cancer, n.d.). With rapid developments in cancer care and the introduction of new systemic therapies, RNs working in systemic therapy units must be adequately prepared to administer systemic therapy and care for the patients receiving them (Frith & Chao, 2022). Throughout this report, the administration of systemic therapy will refer to the direct physical handling and administration of systemic therapy agents, as well as the nursing care of patients receiving systemic therapies. Nursing care of patients receiving systemic therapy includes assessment of the patient's clinical status, managing treatment-related side effects and toxicities, providing psychosocial support, and patient education (Frith & Chao, 2022).

The administration of systemic therapy agents is a specialized nursing skill requiring advanced education (Frith & Chao, 2022). As an RN working in the outpatient systemic therapy unit at the Dr. H. Bliss Murphy Cancer Center in St. John's, Newfoundland (NL), I can attest to the expansive knowledge and clinical skills required for effective nursing practice in this specialized setting. RNs in NL are required to complete an initial systemic therapy certification course before administering systemic therapy. This provincially developed certification course provides a foundational basis for cancer care knowledge coupled with a supervised clinical practicum, satisfying the requirements of the Canadian Association of Nurses in Oncology (CANO) standards for practice in systemic therapy. Once the RN has obtained initial certification in systemic therapy administration in NL, they maintain this designation provided

they regularly engage in systemic therapy administration and satisfy provincial continuing education requirements.

A provincial continuing competency program exists for RNs who practice in NL regardless of their practice setting which is governed by the College of Registered Nurses of Newfoundland and Labrador (CRNNL). The CRNNL requires that RNs who practice in NL participate in continuing education activities and complete 24 education hours annually to maintain their licensure (CRNNL, 2024). While this continuing competency program is mandatory for RNs in NL, it is self-directed meaning RNs are free to choose continuing education activities of interest to them, provided they are relevant to their nursing practice (CRNNL, 2024). Unfortunately, there are no specific continuing education requirements for RNs administering systemic therapy in the local setting or formal evaluation of their competence. While the NL Health Services Provincial Cancer Care Program provides access to a variety of education opportunities and recommends that RNs administering systemic therapy engage in continuing education, participation in these activities remains optional.

Through my practice, I have identified a lack of formal continuing education resources for RNs administering systemic therapy in the local setting. Following CANO's recommendation that RNs administering systemic therapy demonstrate their continued competency yearly, many provinces have developed comprehensive continuing competency programs that incorporate formal continuing education resources. Despite CANO's recommendations, continuing competency programs in NL remain underdeveloped. Thus, it can be challenging for systemic therapy RNs in NL to effectively maintain their competency without access to comprehensive continuing education. The focus of this practicum project was to develop a comprehensive continuing education resource for RNs administering systemic therapy in NL, allowing them to

maintain and enhance their competency and provide high-quality nursing care to patients receiving systemic therapy, ultimately continuing to promote positive patient outcomes.

Objectives

To achieve the overall goal of the practicum, the key practicum objectives included:

1. Identify factors contributing to a lack of continuing education for RNs administering systemic therapy globally and the impacts that a lack of continuing education has on RNs and patients.
2. Identify the most effective approaches for delivering continuing education to RNs administering systemic therapy.
3. Explore current approaches to systemic therapy continuing education across Canada.
4. Identify local learning needs and the preferred learning methods of RNs administering systemic therapy in NL.
5. Develop a comprehensive continuing education resource to meet the learning needs of RNs administering systemic therapy in NL.
6. Demonstrate advanced nursing practice competencies in education, research, and leadership.
7. Develop a preliminary plan for implementing and evaluating the developed educational resource.

Overview of Methods

I utilized several methods to meet the objectives of this practicum project. I conducted an extensive literature review and identified the significance of a lack of continuing education for RNs administering systemic therapy, as well as contributing factors to, and impacts of this lack

of continuing education. I identified key interventions for oncology education delivery and explored various teaching methodologies. I conducted an environmental scan and identified national practice standards for RNs administering systemic therapy and provincial approaches to continuing education across Canada. I engaged in local consultations with key stakeholders and identified systemic therapy RNs' learning needs and preferred learning methods.

I utilized the findings from the literature review, environmental scan, and consultations to develop a comprehensive continuing education resource for systemic therapy RNs in NL. Ethical approval was not required for any portion of this practicum project as this was a quality improvement project for education purposes, making it exempt from needing approval based on the Health Research Ethics Approval screening. I ensured participants were informed that their unidentified responses may be used in practicum reports. Thus, their voluntary participation during data collection indicated their implied consent. I ensured data collection was anonymized or de-identified whenever possible and prioritized safe data storage and destruction.

Summary of the Literature Review

I conducted an extensive literature review to identify whether a lack of continuing education for RNs administering systemic therapy was an issue globally and explore strategies that have been utilized to address the issue. Please see the complete literature review in Appendix A and the literature summary tables in Appendix B.

Literature Search

I conducted this literature review from May to July 2024 using healthcare literature databases available through Memorial University of Newfoundland (MUN), primarily the CINAHL Plus and PubMed databases. Keywords included "systemic therapy or chemotherapy",

"cancer treatment", "administration", "oncology nursing or oncology nurse or oncology nurses", "cancer patients or oncology patients or patients with cancer", "continuing education or professional development or lifelong learning", "education intervention", "education module", "virtual education", "continuing competency", "competency" and "proficiency". I reviewed abstracts from articles published between 2014 and 2024 that were primary research studies or literature reviews, published in English and included oncology nurses.

I identified nineteen studies of various research designs for inclusion in the review including literature reviews, mixed methods research, and quantitative, qualitative, and descriptive studies. I critically appraised the quality of individual studies using tools recommended for use in the Master of Science in Nursing (MScN) program at Memorial University of Newfoundland (MUN). I used the Public Health Agency of Canada (PHAC) Critical Appraisal Toolkit to assess quantitative studies, the JBI Checklist for Qualitative Research critical appraisal tool to assess qualitative studies, and the Mixed Methods Appraisal Tool to determine the quality of mixed methods research (Hong et al., 2018; JBI, 2020; PHAC, 2014).

Theoretical Framework

I used Patricia Benner's Novice to Expert Model as a framework to guide the literature review and educational resource development. Benner's model describes how nurses move through the novice, advanced beginner, competent, and expert stages of mastery in their clinical practice (Ozdemir, 2019). Based on Benner's model, I identified that RNs administering systemic therapy must be competent or expert to practice safely and provide high-quality nursing care in this specialized setting. Benner's model helped guide resource development, as I aimed to develop a comprehensive continuing education resource to assist RNs to remain competent, and

expert in their practice. I determined that a lack of continuing education for RNs administering systemic therapy was an issue outside of the local setting and explored the potential impacts that a lack of continuing education could have on RNs and patients receiving systemic therapy. I identified educational interventions used globally to address a lack of continuing education for systemic therapy RNs and explored their effectiveness.

Learning Needs

A lack of continuing education was an issue globally based on the extensive learning needs of systemic therapy RNs identified in multiple studies (Cannon et al., 2014; Liptrott et al., 2019; Mun & Hwang, 2020; Underhill et al., 2015). RNs identified patient education, management of cancer symptoms, and treatment-related side effects as priority learning needs (Cannon et al., 2014; Liptrott et al., 2019; Mun & Hwang, 2020). Additionally, RNs identified the need for more education on safely handling and administering systemic therapy agents and implementing evidence-based practice (Liptrott et al., 2019; Mun & Hwang, 2020; Underhill et al., 2015).

Impacts

A lack of continuing education for systemic therapy RNs may negatively impact the patient and the nurse. Patient impacts included subtherapeutic dosing resulting in decreased treatment efficacy, central line infections, decreased quality of life, and dissatisfaction with nursing care (Coolbrandt et al., 2018; Manias et al., 2014; Mun & Hwang, 2020; Sharour, 2018). Nurse impacts included accidental cytotoxic exposures and associated negative health effects including headaches, dizziness, skin rashes, and eye irritations (Banihani et al., 2022; Coyne et

al., 2019). Systemic therapy agents are also known to be carcinogenic and teratogenic (Banihani et al., 2022).

Key Contributing Factors

Three key contributing factors to a lack of continuing education for systemic therapy RNs included ineffective approaches to self-directed learning, inconsistencies in education, and a lack of accessibility to continuing education opportunities (Banihani et al., 2022; Challinor et al., 2020; Coyne et al., 2019; Hsu et al., 2023; Leung et al., 2019; Mun & Hwang, 2020; Nolan et al., 2022; Sharour, 2018; Underhill et al., 2015). Ineffective approaches to self-directed learning were characterized by a lack of motivation and incentives for RNs to participate in continuing education activities (Hsu et al., 2023; Leung et al., 2019). Significant differences in organizational requirements for the initial and continuing education of RNs administering systemic therapy demonstrated global educational inconsistencies (Challinor et al., 2020; Coyne et al., 2019; Nolan et al., 2022). A lack of accessibility to continuing education was highlighted by the many barriers to education systemic therapy RNs faced in their practice including a lack of available education opportunities, travel, costs, and time constraints (Banihani et al., 2022; Hsu et al., 2023; Leung et al., 209; Nolan et al., 2022; Underhill et al., 2015).

Key Educational Interventions

I explored oncology educational interventions, methodologies for education delivery, and their effectiveness and identified virtual education, traditional classroom education, and hybrid models as the most used approaches. Teaching methodologies used for education delivery included online courses, modules, group discussions, PowerPoint presentations, seminars, workshops, return demonstrations, audiovisual materials, simulation, supervised clinical practice,

case studies, and peer teaching (Banihani et al., 2022; Galassi et al., 2023; Hsu et al., 2023; Vioral, 2014). In some studies, systemic therapy RNs were highly satisfied with and preferred virtual education which offered benefits such as improved accessibility and engagement (Liptrott et al., 2019; Matsubara & Domenico, 2016; Nolan et al., 2022). Virtual education was shown in several studies to be effective in improving RNs' knowledge retention, clinical skills, and confidence in gynecology oncology, pain management, and pharmacogenomics (Dodson, 2018; Hsu et al., 2023; Leung et al., 2019). However, several challenges to virtual education were highlighted, including time constraints, lack of interaction with course instructors, and technology difficulties (Matsubara & Domenico, 2016).

I identified inconsistencies in the evidence supporting the effectiveness of hybrid education models in the literature. Hybrid education models were demonstrated to be effective in improving RNs' safety, competency, and confidence in systemic therapy administration (Banihani et al., 2022; Nolan et al., 2022), however ineffective at improving RNs' attitudes and usage of evidence-based practice (Underhill et al., 2015). Two studies compared the effectiveness of traditional classroom education to virtual education for systemic therapy RNs and concluded that they are both equivalent (Matsubara & Domenico, 2016; Mun & Hwang, 2020).

Implications

Based on the findings of this literature review, including the learning needs of systemic therapy RNs, the contributing factors, and the impact of a lack of continuing education, I determined that developing a continuing education resource for use in the local setting was warranted. Given that the effectiveness of traditional classroom education is comparable to

virtual education, I decided that the education resource would be adaptable for delivery using either approach depending on local needs.

Summary of Environmental Scan and Consultations

While the literature review provided information on the global context of a lack of continuing education for systemic therapy RNs, exploring this issue at the national and local levels was necessary. This was because I planned to develop a continuing education resource for RNs in the local setting. I needed to ensure that the resource addressed local learning needs and aligned with national standards for systemic therapy practice. I conducted an environmental scan to identify national recommendations for systemic therapy education and provincial continuing education approaches for RNs administering systemic therapy in select provinces across the country. I consulted with key stakeholders in the local setting to gain insight into the educational needs of RNs administering systemic therapy in St. John's, NL. Please see the full environmental scan and consultation report in Appendix C. Next, I will discuss the methods used for both the environmental scan and consultations and the combined findings of these approaches.

Environmental Scan

I conducted the environmental scan in July 2024 to identify national recommendations and approaches to continuing education for RNs administering systemic therapy in Canada. Specifically, I identified CANO recommendations for systemic therapy nursing practice and explored continuing education approaches for RNs administering systemic therapy in Atlantic Canada, Ontario (ON), and British Columbia (BC). I retrieved this information from publicly available websites and documents, and personal communications with representatives from provincial cancer care organizations. I reviewed the websites of cancer care organizations to find

information on their continuing education approaches. I also identified key representatives' (e.g., clinical educators) contact information from these websites and sent an email seeking more information on their continuing education approaches. The final sources for the environmental scan included CANO, the de Souza Institute, BC Cancer, Cancer Care Ontario (CCO), and provincial cancer care organizations in Nova Scotia (NS) and Prince Edward Island (PEI).

CANO Recommendations

The CANO (2022) document *Standards and Competencies for Oncology Nursing Practice in Systemic Therapy* outlines initial and continuing practice requirements for RNs administering systemic therapy in Canada. CANO states that a continuing education plan can be flexible to meet the individualized needs of RNs administering systemic therapy and may include regular systemic therapy administration combined with engagement in continuing education activities (CANO, 2022). It is recommended that individual cancer care organizations develop continuing competency programs (CCPs) that allow RNs to demonstrate their competency in systemic therapy administration yearly (CANO, 2022). Recommended continuing education activities include mentorship, attending education sessions, reviewing literature, and completing certification or competency maintenance programs (CANO, 2022).

CANO (2022) suggests several approaches for evaluating continued competency, including peer or colleague feedback, developing a professional portfolio, logging continuing education hours, successfully completing certification or continuing education programs, reporting practice hours, written exams, and structured clinical exams. CANO (2022) also outlines the specific content that should be covered to ensure that CCPs are comprehensive including systemic therapy cancer agents and regimens, principles of systemic therapy administration, equipment for administration of systemic therapy agents, best practice standards,

policies and procedures, symptom management, monitoring parameters throughout treatment, adverse event monitoring and management, and safe handling, spill management, and waste disposal of hazardous drugs.

The de Souza Institute

The de Souza Institute, located in Toronto, Ontario develops and provides healthcare professionals online educational opportunities in cancer and palliative care (de Souza Institute, 2024a). While the de Souza Institute offers an initial systemic therapy certification course, they also have a continuing education course for RNs administering systemic therapy (de Souza Institute, 2024a). The *Chemotherapy Competency Maintenance Course* (CCMC) is a self-directed eight-week course that combines learning modules, supplemental readings, and collaborative discussion forums, followed by a final course examination (de Souza Institute, 2024b). Topics covered in the CCMC include assessment and order verification, administration and documentation, safe handling, chemotherapy, biotherapy, immediate complications, and sexuality and fertility (de Souza Institute, 2024b). The CCMC is regularly updated to ensure that course content reflects current practice evidence and includes new systemic therapies (de Souza Institute, 2024b). The CCMC aligns with CANO standards and competencies for oncology nursing practice in systemic therapy (de Souza Institute, 2024b).

Provincial Approaches

I reviewed provincial continuing education requirements for RNs administering systemic therapy in BC, ON, NS, and PEI. BC Cancer recommends that RNs administer at least 50 systemic therapy agents yearly and engage in professional development activities to maintain competence (BC Cancer, 2024). RNs administering systemic therapy at BC Cancer must record

their drug administration and continuing education activities and submit records to their clinical nurse coordinator annually (BC Cancer, 2024). CCO encourages RNs administering systemic therapy to engage in self-reflection and professional development and maintain their knowledge and skills to ensure continued competence (CCO, 2021). CCO (2021) recommends that RNs complete an approved systemic therapy maintenance course such as the CCMC from the de Souza Institute to maintain their knowledge and skills.

In NS, the Learning Institute for Health Care Providers coordinates initial and continuing education for RNs administering systemic therapy (Learning Institute, 2024). RNs in NS are expected to complete the de Souza Institute CCMC every 24 months and participate in other continuing education activities to maintain their competency in systemic therapy administration (Learning Institute, 2024). I confirmed through email with the clinical educator at the PEI Cancer Treatment Center that RNs in their province are required to complete the CCMC from the de Souza Institute every 18 months and regularly administer systemic therapy to maintain their competency. These provincial approaches to continuing competency are aligned with CANO standards and competencies for oncology nursing practice in systemic therapy.

Consultations

I consulted with local key stakeholders throughout July 2024 to determine the learning needs of RNs administering systemic therapy in St. John's NL and their preferred education delivery methods. I consulted with frontline RNs administering systemic therapy directly and oncology RNs in leadership positions who are involved in the day-to-day operations of the outpatient systemic therapy unit. Consulting with these groups separately gave me subjective and objective observations of local learning needs. I utilized questionnaires and semi-structured interviews; I developed questionnaires and disseminated them in person and via email to

frontline RNs to make data collection more convenient and accessible. The questionnaire could be completed and returned anonymously by participants. I received 17 responses to my questionnaire, exceeding my initial goal of 10 responses. I used semi-structured interviews to consult with oncology RNs in leadership positions, as there were fewer individuals to consult with, making this method feasible. I used descriptive statistics and thematic analysis following Braun and Clark's (2006) six-step process outlined in Kiger and Varpio (2020).

Frontline RNs

I identified a wide array of learning needs of frontline RNs administering systemic therapy in the local setting. Participants included a mix of junior and senior RNs (53% with 0-6 years experience, 47% with 6-10 + years experience). Most participants (82%) thought that RNs administering systemic therapy should engage in continuing education at least yearly. All participants indicated that it was essential to include assessment and management of systemic therapy side effects and toxicities in continuing education content while most participants (94%) thought that the pharmacology of systemic therapy drugs, identification and management of oncologic emergencies, and identification and management of extravasation and hypersensitivity reactions should be included. Many participants (88%) identified that administering chemotherapy (i.e. safe handling, administration techniques, peripheral and central line care) and patient education were important. Fewer participants felt that principles of systemic therapy and management of systemic therapy spills and accidental exposures must be included in a continuing education resource. I also asked participants which additional content should be included in the continuing education resource. Suggestions included health assessment skills, supportive medications while receiving systemic therapy (e.g., steroids, anti-emetics, and prophylactic antibiotics), monitoring parameters for specific systemic therapy agents, and the

intravenous line setups for specific drugs. Finally, I asked about preferred methods for education delivery with most (76%) participants indicating a preference for in-person education led by an instructor followed by online self-directed learning and clinical simulation (41%).

Barriers to Continuing Education

Frontline RNs reported many barriers to continuing education. Using thematic analysis, I identified an overarching theme of the *unsuitability of continuing education* with three subthemes including *a lack of continuing education opportunities, timing of continuing education,* and *relevance of continuing education to nursing*. Participants' responses highlighted a lack of continuing education opportunities that indicated dissatisfaction with locally available continuing education, citing a lack of lunch-and-learn and peer-to-peer education and limited capacities for attendance at after-hours education sessions. Some participants felt that more consistency and closer monitoring of continuing education activities by organizational leadership may be warranted. Issues with the timing of continuing education were also evident, with participants identifying specific concerns such as lack of dedicated education time, or sufficient staffing to allow for time away from clinical practice to engage in continuing education. Many participants felt that attending education outside business hours, with busy homes and family lives, was challenging. They stated that virtual offerings could make educational opportunities more accessible. The relevance of continuing education to nursing was highlighted by participants' responses indicating that the initial systemic therapy certification course and many continuing education opportunities are not solely nursing-focused. Participants suggested that educational opportunities be directly relevant to their nursing practice to assist them in maintaining competency in systemic therapy administration.

RNs in Leadership Positions

Interviews with oncology RNs in leadership roles offered a unique subjective perspective on the learning needs of RNs administering systemic therapy. Using thematic analysis, I identified four themes *nursing skills, safety during administration, systemic therapy agents,* and *disease/treatment*. Interview participants stated that their responses were based on their observations of frontline RN's nursing practice, and the questions they get asked most frequently. *Nursing skills-related* learning needs included the types of intravenous lines required to administer specific systemic therapy agents, intraperitoneal chemotherapy administration, and care of central venous access devices. *Safety-related needs* were identified as the appropriate use of personal protective equipment and routine use of closed-system transfer devices to decrease the risk of hazardous drug exposures. Learning needs surrounding *systemic therapy agents* included infusion times, side-effects of specific agents, acceptable lab values, monitoring parameters, and locating systemic therapy protocols. *Disease and treatment-related* learning needs were primarily hematology-related including cell therapy treatments (e.g., bone marrow transplant and stem cell transplant), blood product transfusion requirements, electrolyte imbalances, and infection management.

I then asked participants what they thought were the most effective approaches to maintaining competency in systemic therapy administration. Using thematic analysis, I identified three themes *regular clinical practice*, *frequent engagement in continuing education activities*, and *organizational support.* Examples of regular clinical practice included frequently administering systemic therapy and informal peer-to-peer knowledge transfer. Participants suggested that frontline RNs could engage in continuing education activities by attending education sessions or conferences and completing case studies. They also felt that organizational

support, such as the regular presence of clinical educators in the systemic therapy unit, performance assessments, and implementation of annual competency checklists could help frontline RNs maintain their competency in systemic therapy administration. Finally, I asked participants whether they thought a continuing education resource for systemic therapy RNs could be valuable. I identified an underlying theme of *comprehensive, accessible education* based on responses. Participants felt that frontline RNs should have access to the most up-to-date knowledge on cancer therapies. They stressed the importance of ensuring a continuing education resource is reviewed and updated regularly to reflect current best practice evidence.

Summary of the Resource

I developed a continuing education resource for RNs administering systemic therapy locally using combined findings from the literature review, environmental scan, and consultations. These findings were essential in identifying the learning needs of systemic therapy RNs in the local setting, determining which content was necessary to include in the continuing education resource, and how best to deliver the education. I developed a comprehensive educational resource comprised of a participant instruction manual and an accompanying PowerPoint presentation. This resource includes embedded section case studies and a post-test exam. I chose these methods based on the demonstrated effectiveness of such teaching strategies identified in the literature by Banihani et al. (2022), Matsubara and Domenico (2016), and Mun and Hwang (2016) as well as the local preferences of RNs administering systemic therapy.

The educational resource is intended to be delivered as an in-person, instructor-led course, but was designed so that it can easily be adapted into a virtual format if required. I made this decision based on findings from the literature review that demonstrated similar classroom and online learning effectiveness in increasing the knowledge retention and skills of RNs

administering systemic therapy (Matsubara & Domenico, 2016; Mun & Hwang, 2020). Additionally, locally, RNs administering systemic therapy identified an overwhelming preference for in-person, instructor-led learning. However, CANO (2024) recommends that continuing education programs provide flexibility; thus, I felt it was necessary to consider how this continuing education resource could be adapted to a virtual format during the design phase.

I used CANO (2022) recommendations for systemic therapy continuing competence as a guide for content development. I identified core content to be included as systemic therapy cancer agents and regimens, principles of systemic therapy administration, equipment for the administration of systemic therapy agents, best practice standards, policies, and procedures, symptom management, monitoring parameters throughout treatment, adverse event monitoring and management, and safe handling, spill management, and waste disposal of hazardous drugs. I followed CANO (2022) recommendations to ensure that the resources I developed aligned with national standards for oncology nursing practice in systemic therapy. In doing so, I followed suit with other provinces such as BC, ON, NS, and PEI, which have aligned their continuing competency programs with CANO recommendations. Ensuring that national recommendations guide continuing education programs helps create consistency among provincially developed programs.

While CANO's (2022) recommendations provided the foundation for resource development, it was important that the resource also met local learning needs. These learning needs were identified during the consultation phase with frontline RNs administering systemic therapy and oncology RNs in leadership roles who are involved in the daily function of the local outpatient systemic therapy unit. It was necessary to tailor the educational resource to meet local learning needs to promote future uptake of this quality improvement project. Based on Roger's

diffusion model of change, ensuring innovation compatibility is essential to fostering change (Dearing & Cox, 2018). Compatibility is an individual's perception that an innovation is consistent with their values, ideas, and perceived needs (Kaminski, 2011). The involvement of local RNs during consultations allowed me to develop an educational resource that hopefully sufficiently meets their needs, thereby promoting the successful implementation of this project.

I have recommended incorporating the educational resource into the current continuing education approaches at the Dr. H. Bliss. Murphy Cancer Center in St. John's, NL. This continuing education course should be completed annually to align with CANO (2022) recommendations. Since systemic therapy administration is a specialized nursing skill, regularly completing continuing education is necessary to maintain the competent or expert level proposed in Benner's model (Ozdemir, 2019). I anticipate this continuing education course will take approximately four hours to deliver based on the amount of content to be covered and the time required to discuss case studies and complete the post-test examination. I further recommend that the educational resource be regularly reviewed and updated by the most appropriate individuals in the organization responsible for education delivery (i.e., clinical educators) to ensure that content remains current.

The ***Continuing Education Resource for Registered Nurses Administering Systemic Therapy in the Outpatient Setting*** (please see Appendix D) has eight sections based on the recommendations of CANO (2022). I developed course content using peer-reviewed cancer care organization websites, journal articles, drug and product monographs, and local health authority policies. A complete reference list is in Appendix D. The sections are organized as follows:

Section 1: Principles of Systemic Therapy Administration covers content on the goals of systemic therapy, treatment modalities, cancer staging, cancer grading, and the cell cycle.

Section 2: Systemic Therapy Cancer Agents covers common systemic therapy side-effects, and classes of systemic therapy agents including alkylating agents, antimetabolites, anti-tumor antibiotics, topoisomerase inhibitors, mitotic inhibitors, immunotherapy, monoclonal antibodies, targeted therapy, biosimilars, hormonal therapy, miscellaneous agents, supportive medications and bisphosphonates.

Section 3: Equipment for Administration of Systemic Therapy Agents reviews intravenous (IV) infusion pumps, IV lines, closed system transfer devices, and elastomeric infusors.

Section 4: Best Practice Standards, Policies, and Procedures reviews local policies on systemic therapy administration, peripheral venous access, central venous access devices, vesicant administration, and intraperitoneal chemotherapy.

Section 5: Symptom Management covers fatigue, myelosuppression, nausea and vomiting, decreased appetite and anorexia, constipation, diarrhea, stomatitis, alopecia, skin changes, peripheral neuropathy, cognitive changes, sexuality and intimacy, and fertility.

Section 6: Monitoring Parameters During Treatment reviews lab values, urine protein, vital sign monitoring, and special considerations for bevacizumab and rituximab.

Section 7: Adverse Event Monitoring & Management reviews local policies for managing extravasation and hypersensitivity reactions.

Section 8: Safe Handling, Spill Management, and Waste Disposal of Hazardous Drugs covers personal protective equipment, safe handling, hazardous drug exposures, and managing hazardous drug spills.

I developed case studies corresponding to the material covered in each section. Eight case studies are available for instructor use as an appendix in the participant manual and embedded following each section in the PowerPoint presentation. The intention is for the instructor to pause after teaching each section and allow for a short discussion with participants on each case study to reinforce teaching material. I developed a multiple-choice post-test examination for instructor use, also available as an appendix in the participant manual. The post-test consists of 15 questions, with at least one corresponding to each continuing education resource section. I added additional questions for heavier content sections such as systemic therapy agents and symptom management. To "pass" the examination, I recommend participants answer 12/15 questions correctly, resulting in a grade of 80%. This aligns with most approaches to post-test examinations, specifically the NL Health Services initial systemic therapy certification exam and the de Souza Institute CCMC (de Souza Institute, 2024b).

Discussion of Advanced Nursing Practice (ANP) Competencies

The *Advanced Practice Nursing: A Pan-Canadian Framework* published by the Canadian Nurses Association (CNA) in 2019 outlines the core competencies in which the nurse can demonstrate advanced nursing practice (ANP), including direct comprehensive care, health system optimization, education, research, leadership, and consultation and collaboration. Throughout this practicum project, I have demonstrated several ANP competencies, specifically *education*, *research*, and *leadership competencies*.

Educational competencies are demonstrated when advanced practice nurses (APNs) are committed to professional growth and learning for healthcare providers (CNA, 2019). I demonstrated education competencies by identifying the learning needs of RNs administering systemic therapy through a literature review and consultations with RNs in the local setting. I

also developed a continuing education resource to address their needs. APNs demonstrate research competencies when they generate, synthesize, critique, and apply research evidence (CNA, 2019). I displayed ***research competencies*** when I synthesized, appraised, and applied evidence from the literature review and collected and analyzed data from the environmental scan and consultations. Additionally, I compared and evaluated current approaches to continuing education in the local setting to findings from the literature review and environmental scan. ***Leadership competencies*** are demonstrated when APNs act as change agents and seek new ways to improve nursing practice and nursing care (CNA, 2019). I demonstrated leadership when identifying gaps in continuing education approaches for RNs administering systemic therapy locally. I also provided a solution to this issue by developing a continuing education resource.

Next Steps

I have developed a continuing education resource for RNs administering systemic therapy in the outpatient setting at the Dr. H. Bliss Murphy Cancer Center in St. John's, NL. Using my experience as a frontline RN administering systemic therapy in my current nursing practice combined with advanced education from graduate studies, I have developed a high-quality, comprehensive educational resource. While this initial resource is an excellent starting point for improving continuing education in the local setting, expert reviews of this resource are still warranted. I recommend that healthcare professionals from nursing and other disciplines (e.g., medical oncologists, oncology clinical nurse educators, and oncology clinical pharmacists) who are subject matter experts should conduct independent reviews of course content for comprehensiveness and accuracy. I would also recommend piloting this continuing education resource with a focus group of frontline RNs who currently administer systemic therapy to elicit feedback on the clarity of the resource and any suggestions for improvement.

While the time constraints of this course did not allow for the implementation or evaluation of this project, I considered the next steps for the quality improvement project. First, I would need the support of frontline systemic therapy RNs in the local setting. Based on Roger's diffusion model (Dearing & Cox, 2018), having a focus group of frontline systemic therapy RNs pilot this continuing education resource as change agents may encourage the adoption of practice changes. I would also need organizational support from management and leadership teams in my practice area. I plan to meet with the nurses in leadership roles (e.g., clinical educators, patient care facilitators, and oncology nursing managers) to review this resource and determine the feasibility of implementing this continuing education resource in the local setting. Considering this project's logistical aspects, such as implementing practice changes, updating local policies, and budgetary decisions that would need approvals from cancer care management and executive teams, is essential. Unfortunately, this is beyond the scope of this practicum project, but I hope to explore this further in the future with clinical and organizational support.

This quality improvement project could be evaluated in several ways. Feedback from a frontline RN focus group would provide an initial evaluation of the educational resource and its suitability as part of a continuing competency approach in the local setting. Self-reported outcomes assessment, such as RN's satisfaction with this new continuing education approach, and patient's satisfaction with the nursing care received could be completed. Measurement of outcomes such as adverse events for patients and nurses could also be completed. These outcomes could be measured at baseline and after implementation of the educational resource using an analytic research study design such as an uncontrolled before-after study (Public Health Agency of Canada, 2014).

Conclusion

Cancer treatments are evolving at a rapid pace with the introduction of new systemic therapy agents and complex systemic therapy protocols. Systemic therapy administration is a specialized nursing skill that requires individuals administering these therapies to undergo extensive training and maintain continued competence in their practice. While initial systemic therapy training is provided in the local setting, there is a lack of formal continuing education for RNs administering systemic therapy. Based on my nursing practice in outpatient systemic therapy, I identified this significant gap in continuing education for RNs administering systemic therapy locally. Findings from an extensive literature review echo similar concerns globally. A lack of continuing education for RNs administering systemic therapy has the potential to impact the health and safety of both patients and nurses.

Consultations with local key stakeholders reinforced the need for a comprehensive continuing education resource for RNs administering systemic therapy at the Dr. H. Bliss Murphy Cancer Center. To meet this need, I developed a comprehensive educational resource to address the gap in continuing education in NL and meet the needs of RNs administering systemic therapy locally. CANO recommends that RNs administering systemic therapy demonstrate their continued competency annually. During an environmental scan, I identified that many provinces have already implemented continuing competence programs that align with CANO standards and competencies. To ensure that NL is aligned with national standards and provincial approaches, I recommend that the NL Health Services Cancer Care Program implement the educational resource I have developed as a continuing competency requirement.

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Appendix A

Continuing Education for Registered Nurses Administering Systemic Therapy: A Literature Review

Administration of systemic therapy to patients with cancer in the outpatient setting is a complex skill that requires registered nurses (RNs) to be appropriately educated to ensure the safety of themselves and their patients. Systemic therapy units are considered specialized practice areas and require RNs working in these areas to undergo additional training beyond their undergraduate nursing education. In Newfoundland and Labrador (NL), RNs who work in systemic therapy administration in the NL Health Services Provincial Cancer Care Program must complete the Adult Chemotherapy Course including self-directed online modules and a supervised clinical practicum before they are deemed competent to administer systemic therapy independently. Once the initial training course is completed, the RN maintains their systemic therapy certification unless they leave the clinical setting for an extended period. If the RN is away from systemic therapy administration for the short term, they will be required to complete additional supervised systemic therapy administration to ensure competency. If the RN is away from the clinical setting for an extended period (two or more years), they must retake the Adult Chemotherapy Course. These decisions are made at the discretion of the clinical educator of the Provincial Cancer Care Program.

The College of Registered Nurses of Newfoundland and Labrador (CRNNL) requires that RNs in the province complete a minimum of 24 hours of self-directed continuing education per year to maintain licensure (CRNNL, 2024). While RNs administering systemic therapy in NL Health Services are encouraged to participate in continuing education activities to maintain their competence in systemic therapy administration, these activities are completed at the discretion of

the individual RN. There are no minimum requirements for continuing education set forth by the Provincial Cancer Care Program nor is there any routine formal evaluation of an individual's competence. Administration of systemic therapy agents is a specialized nursing skill that requires advanced initial and continuing education to ensure RNs remain competent (Frith & Chao, 2022). Frequent significant developments in cancer treatments, including new drugs and changing protocols, warrant that RNs stay up to date with their knowledge of systemic therapy (Frith & Chao, 2022). Systemic therapy agents can cause significant side effects and toxicities, which may affect any of the patient's major body systems (Canadian Cancer Society, 2024). Inappropriate handling and administration of systemic therapy agents may result in accidental harmful exposures that can have detrimental effects on the physical health of the RN administering the therapy (Banihani et al., 2022). A lack of continuing education for RNs administering systemic therapy is concerning as it may jeopardize the safety of the nurse and the patient and impact the quality of cancer care and patient outcomes.

I have proposed the development of an educational resource for RNs administering systemic therapy in the outpatient setting in NL to assist in maintaining their competency in systemic therapy administration. This educational resource is needed to address the lack of formal continuing education resources available to RNs in NL administering systemic therapy and to ensure that continuing education is consistent across the province. I conducted a literature review as a first step to explore continuing education initiatives for RNs administering systemic therapy, and to identify if a similar lack of continuing education resources has been identified elsewhere.

Literature Review

I conducted a literature review to determine whether a lack of continuing education for RNs administering systemic therapy has been identified globally. Specifically, I aimed to explore the outcomes associated with a lack of continuing education for RNs administering systemic therapy and identify the factors contributing to a lack of continuing education. Further, I aimed to identify key educational interventions implemented to address a lack of continuing education for RNs administering systemic therapy. Finally, I planned to identify different approaches to delivering continuing education for systemic therapy RNs and to determine whether these approaches were effective. Following the literature review, I intend to complete an environmental scan and conduct consultations with key stakeholders to further explore the issue at a national, provincial, and local level. The end goal of this exploration is to assist me in developing a comprehensive continuing education resource for RNs administering systemic therapy at the Dr. H. Bliss Murphy Cancer Centre in St. John's, NL, and satellite cancer care sites across the province.

I conducted the literature review between May and June 2024 utilizing healthcare literature databases available through Memorial University of NL, specifically the CINAHL Plus and PubMed databases. Keywords included "systemic therapy or chemotherapy", "cancer treatment", "administration", "oncology nursing or oncology nurse or oncology nurses", "cancer patients or oncology patients or patients with cancer", "continuing education or professional development or lifelong learning", "education intervention", "education module", "virtual education", "continuing competency", "competency" and "proficiency". I began with a review of abstracts from articles published between 2014 and 2024 that were primary research studies or literature reviews, published in English, and included RNs. I identified key questions for the

literature review as “Is a lack of continuing education for RNs administering systemic therapy an issue?” and “What interventions have been done to address a lack of continuing education for RNs administering systemic therapy?” I excluded articles from the literature review if the inclusion criteria were not met, or if they were not relevant to the key questions. I then critically reviewed articles meeting inclusion criteria that were relevant to key questions. Nineteen studies were included in this literature review, including twelve quantitative studies, two qualitative studies, two mixed methods studies, and three descriptive studies. Please see the literature summary tables included in the appendix of this paper. I critically appraised the literature using tools recommended for use in the Master of Science in Nursing (MScN) program at Memorial University of NL. I used the Public Health Agency of Canada (PHAC) Critical Appraisal Toolkit to assess quantitative studies and the JBI Checklist for Qualitative Research critical appraisal tool to assess qualitative studies (PHAC, 2014; JBI, 2020). Finally, I used the Mixed Methods Appraisal Tool (MMAT) to determine the quality of mixed methods research (Hong et al., 2018).

Theoretical Framework

The theoretical framework guiding this literature review and overall proposed resource development is Patricia Benner’s Novice to Expert Model. Originally published in 1982, Benner’s model describes how nurses move through various stages of mastery in their clinical practice (Ozdemir, 2019). Nurses begin in the novice stage where they possess knowledge but lack clinical experience, then transition into the advanced beginner stage with limited clinical experience (Ozdemir, 2019). In the competent stage, nurses with more clinical experience provide individualized nursing care and manage complex clinical situations while experts demonstrate mastery in the clinical setting and make critical clinical decisions (Ozdemir, 2019). As a specialty practice area, outpatient oncology settings require RNs who possess the advanced

knowledge and skills necessary for the administration of systemic therapy agents. Based on Benner's model, RNs must be at the competent or expert level to safely administer systemic therapy, which is evidenced throughout the literature reported in this review. Tomaszczuk et al. (2022) applied Benner's model to a quality improvement (QI) project focused on the redesign of a clinical advancement program (CAP) for RNs working in pediatric oncology. The purpose of the CAP was to assist RNs to transition from the novice and advanced beginner stages, into the competent and expert stages based on Benner's model (Tomaszczuk et al., 2022). Supporting nursing practice through CAPs has the potential to improve nursing care provision and improve patient outcomes in the cancer care setting (Tomaszczuk et al., 2022). The goal of my practicum project is to develop a continuing education resource for RNs administering systemic therapy to help improve their nursing practice and ultimately enhance optimal patient outcomes. Tomaszczuk et al. (2022) identified similar goals in their QI project. Based on the similarities between these two projects, I determined that Benner's model would be suitable to guide my practicum project.

Importance of the Problem

The occurrence of a lack of continuing education for RNs administering systemic therapy is reflected by the extensive learning needs of RNs that were identified in several studies in this literature review (Cannon et al., 2014; Liptrott et al., 2019; Mun & Hwang, 2020, Underhill et al., 2015). As a result of the lack of continuing education for systemic therapy RNs, there are impacts on both the patient and the nurse. The impacts on patients and providers are well-documented in the literature (Banihani et al., 2022; Collet et al., 2022; Coolbrandt et al., 2018; Coyne et al., 2019; Manias et al., 2014; Mun and Hwang., 2020; Sharour, 2018). For example, impacts on the patient include subtherapeutic treatments, central line infections, and decreased

quality of life (Coolbrandt et al., 2018; Mun & Hwang, 2020; Sharour, 2018). Impacts on the nurse include accidental cytotoxic exposures and related health effects (Banihani et al., 2022; Coyne et al., 2019). In the following sections, I will discuss the lack of continuing education for systemic therapy RNs and explore these impacts on both the patient and the nurse.

Occurrence

In the reviewed literature, the learning needs of systemic therapy RNs were discussed in four studies. Mun and Hwang (2020) identified the learning needs of RNs administering systemic therapy in South Korea through preliminary research for their high-quality randomized controlled trial (RCT). Similarly, Liptrott et al. (2019) examined the self-reported learning needs and learning preferences of RNs in Europe in a medium-quality cross-sectional study while Cannon et al. (2014) assessed the learning needs of RNs in the US in a low-quality cross-sectional study. In a low-quality uncontrolled before-after study (UCBA), Underhill et al. (2015) described RNs' attitudes toward and use of evidence-based practice (EBP) in an ambulatory oncology setting in the US. In three of the studies, systemic therapy RNs identified patient education, management of cancer symptoms, and treatment-related side effects as important learning needs (Cannon et al., 2014; Liptrott et al., 2019; Mun & Hwang, 2020). Safe handling and administration of systemic therapy agents were highlighted as learning needs in the studies by Liptrott et al. (2019) and Mun and Hwang (2020). Cannon et al. (2019) identified additional learning needs including complementary/alternative/integrative medicine, screening recommendations, and hematological cancers. RNs in the study by Underhill et al. (2015) identified a lack of awareness and knowledge surrounding EBP and reported being ill-equipped to implement EBP into their nursing practice.

Impact

The complexity of systemic therapy administration poses potential risks for both the patient and the nurse administering the treatment (Coyne et al., 2019). Systemic therapy agents are considered high-risk medications requiring RNs to be appropriately educated to administer them safely and effectively (Mun & Hwang, 2020). Rapid development of new systemic therapy agents and protocols, and increased use of combination systemic therapies warrants that RNs stay current in their knowledge and training (Mun & Hwang, 2020). Patient and provider impacts have been identified that may be attributed to a lack of continuing education for RNs administering systemic therapy. Ensuring systemic therapy RNs have adequate education is paramount in promoting the safety of both nurses and patients (Challinor et al., 2020).

Patient Impacts

In a medium-quality retrospective cohort study, Manias et al. (2014) conducted chart audits to identify medication errors associated with the prescription and administration of high-alert medications in specialty nursing settings including oncology care. Manias et al. (2014) reported that 758 medication errors occurred during the administration of high-alert medications in one year across all settings. Most medication errors were related to improper documentation, and incorrect intravenous infusion rates with 264 administration errors reported in the oncology care setting, accounting for approximately 35% of the total medication administration errors (Manias et al., 2014). High-alert medication administration errors, including those involving systemic therapy agents, have the potential to cause adverse patient outcomes (Manias et al., 2014). Systemic therapy agents have narrow therapeutic indexes and require complex dosage calculations, which if done incorrectly could lead to subtherapeutic dosing resulting in decreased efficacy of treatments (Mun & Hwang, 2020).

An example of an adverse outcome for patients with cancer includes venous catheter-related bloodstream infections (Sharour, 2018). Central lines are frequently used in outpatient oncology settings and complications of central line usage such as bloodstream infections can result in significant healthcare costs and suboptimal patient outcomes (Sharour, 2018). Many of these bloodstream infections are preventable and are associated with improper technique when performing central line care (Sharour, 2018). Ensuring RNs are appropriately educated to provide central line care is an important consideration (Sharour, 2018). The competency of systemic therapy RNs is essential to the provision of high-quality cancer care and to promoting positive patient outcomes (Challinor et al., 2020).

Patients' quality of life and satisfaction with the nursing care they receive may also be impacted by a lack of continuing education for RNs administering systemic therapy. In a mixed-methods study, Coolbrandt et al. (2018) explored the experiences of patients receiving systemic therapy who received a nurse-led intervention aimed at improving self-efficacy, self-management of side effects, and reducing systemic therapy symptom burden. Similarly, in a systematic review and meta-synthesis of 50 qualitative studies, Collet et al. (2022) examined the experiences of patients in their interactions with healthcare providers (HCPs) during cancer treatment. Collet et al. (2022) determined that patients reported positive healthcare experiences when their providers demonstrated *support, respect, and agency*, provided the appropriate *quantity, timing, and clarity of information,* and displayed *confidence, honesty, and expertise in* their practice.

Participants in the study by Coolbrandt et al. (2018) highlighted that the support, competent care, and reassurance they received improved their confidence and self-efficacy while undergoing systemic therapy. Improved self-efficacy may alleviate symptom burden, and improve quality of life, and patient outcomes (Coolbrandt et al., 2018). Patients in the study by

Collet et al. (2022) identified that a personalized approach to cancer care and feeling valued by their HCP contributed to positive healthcare experiences. In contrast, patients reported negative cancer care experiences when their HCPs lacked communication skills and failed to provide care using a person-centered approach (Collet et al., 2022). Patients highlighted that effective communication skills and expertise of their HCPs evoked feelings of trust and safety and improved their overall healthcare experience (Collet et al., 2022). Understanding the patient's perspective and prioritizing their care needs is essential to providing high-quality cancer care and increasing patient satisfaction with the care they receive (Collet et al., 2022; Coolbrandt et al., 2018). It is my understanding, based on the findings of the studies by Collet et al. (2022) and Coolbrandt et al. (2018), that a lack of supportive, competent nursing care may negatively impact the patient's healthcare experience.

Provider Impacts

Inadvertent cytotoxic exposure is a potential occupational hazard in the handling and administration of systemic therapy agents, posing a potentially serious risk to RNs (Banihani et al., 2022; Coyne et al., 2019). Systemic therapy agents are known to be carcinogenic, and teratogenic, and can have significant detrimental impacts on the physical health of HCPs handling and administering them (Banihani et al., 2022). Headaches, dizziness, skin rashes, and eye irritations are among the physical side effects that may be experienced by RNs who have continued exposure to systemic therapy agents (Coyne et al., 2019). Specialized education regarding the safe handling and administration of systemic therapy agents as well as the use of personal protective equipment can help ensure the health and safety of RNs handling hazardous systemic therapy drugs (Banihani et al., 2022; Challinor et al., 2020). From these studies, I can extrapolate that a lack of continuing education to maintain competency in the safe handling and

administration of systemic therapy agents could negatively impact the health of RNs. I will discuss the factors contributing to the lack of continuing education for RNs administering systemic therapy in the following section.

Key Contributing Factors

The lack of continuing education for RNs administering systemic therapy is influenced by several key contributing factors. Contributing factors include ineffective approaches to self-directed learning, inconsistencies in education, and a lack of accessibility to continuing education opportunities (Banihani et al., 2022; Challinor et al., 2020; Coyne et al., 2019; Hsu et al., 2023; Leung et al., 2019; Mun & Hwang, 2020; Nolan et al., 2022; Sharour, 2018; Underhill et al., 2015). Organizational priorities should focus on alleviating barriers to continuing education to ensure an appropriately educated oncology nursing workforce (Underhill et al., 2015).

Ineffective Approaches to Self-Directed Learning

Motivation is a key factor to consider if continuing education for systemic therapy RNs is to follow a self-directed approach (Hsu et al., 2023). Applying Keller's motivational model to RN education, Hsu et al. (2023) discussed four motivational factors: attention, relevance, confidence, and satisfaction. Attention is identified as the learner's interest and curiosity for learning, while relevance refers to the learner meeting their personal needs and goals (Hsu et al., 2023). Confidence is described as the learner recognizing their success while satisfaction involves the positive affirmations that encourage continued learning (Hsu et al., 2023). Deficiencies in any of these areas may result in a lack of motivation to participate in self-directed learning (Hsu et al., 2023). Leung et al. (2019) reported that some RNs participated in a virtual education initiative to obtain education hours that could be used toward specialty certification

and concluded that offering personal incentives could increase RNs' participation in continuing education activities.

Inconsistencies in Education

In a narrative review, Challinor et al. (2020) reported that while most specialized systemic therapy RN training programs combine theory and practice-based components to provide comprehensive education, there were significant differences between RN training globally. While North America has many well-established systemic therapy RN training programs, there is a lack of similar programs in low- and middle-income countries (Challinor et al., 2020). An integrative review conducted by Coyne et al. (2019) identified that there is low-level evidence in the literature regarding the practice requirements and continuing education of RNs administering systemic therapy. Sharour (2018) identified inconsistencies in the knowledge levels of RNs in cancer care units in a Jordanian hospital. RNs in the study completed a questionnaire measuring their knowledge of central line care, and only 50% of participants achieved a satisfactory knowledge score (Sharour, 2018). Of significance, RNs with higher education and more years of nursing experience had statistically higher central line knowledge scores ($p = 0.03$, and $p = 0.000$ respectively) (Sharour, 2018).

Mun and Hwang (2020) suggested yearly continuing education to maintain RNs' competency in systemic therapy administration. However, there are significant inconsistencies in approaches to continuing education for RNs internationally (Nolan et al., 2022). Nolan et al. (2022) advocated for consistency in the education provided to RNs new to oncology to ensure they are adequately prepared to practice in this setting. Likewise, Coyne et al. (2019) reported that governance by healthcare organizations such as minimum initial and continuing education requirements for practice are essential to ensure RNs' competence in systemic therapy

administration. Coyne et al. (2019) further suggested simulated practice and annual audits of RNs' systemic therapy administration practices to ensure their continued competence. RNs administering chemotherapy in Korea are mandated to complete annual training to supplement their practice (Mun & Hwang, 2020). In the literature reviewed, evidence of mandatory annual training or practice audits for RNs in other countries was lacking.

Lack of Accessibility of Continuing Education Opportunities

Several studies have identified barriers to accessing continuing education. RNs have cited the unavailability of educational opportunities as negatively impacting the safety of their practice in handling and administering systemic therapy agents (Banihani et al., 2022). A lack of access to educational opportunities was identified as a barrier to the implementation of EBP in the oncology setting (Underhill et al., 2015). RNs practicing in rural settings may experience additional challenges in accessing in-person education due to the requirement to travel to larger cancer centers (Leung et al., 2019). In an action research study, Nolan et al. (2022) reported that RNs identified costs such as those associated with travel as a barrier to traditional classroom learning. If continuing education opportunities such as lectures or conferences are available, these may not be accessible for frontline RNs as they require significant time commitments and it may not be feasible to obtain time off to attend such events (Hsu et al., 2023). Similarly, RNs in the study by Underhill et al. (2015) also reported a lack of time as a barrier to their use of EBP in the outpatient oncology setting. RNs reported that access to virtual education removed time constraints for participation in continuing education activities (Nolan et al., 2022).

Proposed Educational Resource

Continuing education activities for systemic therapy RNs are necessary to ensure the provision of high-quality cancer care (Collet et al., 2022). Providing access to continuing education opportunities and ensuring that RNs administering systemic therapy are competent in their practice, should be organizational priorities in cancer care settings (Liptrott et al., 2019). Safe administration of systemic therapy agents should follow EBP (Coyne et al., 2019). Based on these findings, I have determined that a continuing education resource for RNs administering systemic therapy could be beneficial for RNs in the local practicum setting. My next steps will be to conduct an environmental scan and consultations with local stakeholders to confirm whether RNs administering systemic therapy in NL feel that a continuing education resource could assist them in maintaining their competency in systemic therapy administration.

I will determine the most effective way to deliver continuing education in the local practicum setting by identifying effective continuing education approaches in the literature review and considering findings from the environmental scan and local consultations. During the environmental scan, I will review national standards for systemic therapy administration and identify whether continuing education resources for RNs administering systemic therapy have already been developed in Canada. In the consultation phase, I will consult with frontline RNs administering systemic therapy and oncology RNs in leadership positions to determine learning needs and identify preferred approaches to continuing education. Based on these findings, I plan to develop a comprehensive continuing education resource for RNs administering systemic therapy that meets local learning needs and preferred learning styles. The geographical distance between the urban cancer centers in the province, and smaller satellite systemic therapy units

poses a unique challenge for continuing education of RNs in NL. I must consider these factors while developing a continuing education resource for RNs administering systemic therapy in NL.

Key Interventions

During the literature review, I identified key educational interventions for systemic therapy RNs. Educational interventions consisted of traditional classroom education, virtual education, or hybrid models. Within each model, multiple teaching methodologies and strategies were utilized to deliver the education to RNs. I will discuss the various teaching methodologies and educational interventions in the following sections.

Teaching Methodologies

In a narrative review, Galassi et al. (2023) reported that there was a wide variation of teaching methodologies utilized for delivering systemic therapy RN education in the literature. Galassi et al. (2023) argued that teaching methodologies must be aligned with learner's expectations to ensure that educational interventions are effective. Those designing educational interventions for RNs should consider incorporating newer technologies and teaching methods such as virtual reality and simulation when possible (Galassi et al., 2023). Galassi et al. (2023) further discussed the benefits of delivering educational interventions using passive or teacher-centered methodologies versus active or learner-centered methodologies. Passive methodologies such as traditional classroom learning may promote active listening but often involve lengthy lectures and a reliance on prepared teaching materials instead of open discussion (Galassi et al., 2023). Active methodologies such as using case discussions and role-playing can increase learners' engagement and thus increase knowledge retention (Galassi et al., 2023). In a systemic review, Banihani et al. (2022) identified multiple teaching modalities that were used to deliver

educational interventions to RNs including online courses, modules, group discussions, PowerPoint presentations, seminars, workshops, return demonstrations, and audiovisual materials (Banihani et al., 2022). Galassi et al. (2023) identified specific teaching strategies for delivery of RN education including demonstrations, lab simulation, supervised clinical practice, case studies, peer teaching, and round table discussions. Other teaching modalities were used in the intervention studies included in this literature review such as simulated clinical scenarios by Hsu et al. (2023), a poster presentation by Underhill et al. (2015), and simulated electronic learning vignettes by Vioral (2014).

Virtual Education Interventions

In a cross-sectional study, Liptrott et al. (2019) identified that 41.9% of hematology RNs felt favorably toward education provided virtually while Leung et al. (2019) reported that 77-97% of participants in a UCBA study were satisfied with the virtual education they received. RNs new to the oncology setting who completed an oncology education program also indicated that they preferred online learning (or a hybrid model) versus traditional classroom learning (Nolan et al., 2022). Improving accessibility through virtual education opportunities may promote systemic therapy RNs' engagement in self-directed learning (Matsubara & Domenico, 2016). Providing virtual educational opportunities can also remove barriers to continuing education for RNs practicing in rural settings (Leung et al., 2019). Despite the benefits, there can be challenges to virtual education. Participants in the intervention group of the medium-quality RCT who received virtual oncology education identified several difficulties with virtual training including time constraints, lack of interaction with course instructors, and technology difficulties (Matsubara & Domenico, 2016). Consideration of the benefits and challenges of virtual

education should be addressed during the planning and implementation phase of educational resource development (Matsubara & Domenico, 2016).

In a medium-quality UCBA study, Leung et al. (2019) evaluated the effectiveness of a facilitator-led online education module on improving RNs' knowledge of cancer pain management. Similarly, in a medium-quality UCBA study, Dodson (2018) assessed the effectiveness of a virtual, interactive continuing education module in improving the RNs' knowledge of pharmacogenomics in the US. Leung et al. (2019) reported that participants overall confidence in their pain management abilities significantly improved from 57.5% at baseline to 75.7% after completing the online education model. Dodson (2018) also reported statistically significant improvements ($p < 0.01$) in participants' pharmacogenomics knowledge scores from pre-test (72.7/100) to post-test (85.9/100) after they completed the virtual education module. The study by Dodson (2018) had a low participation rate and the study by Leung et al. (2019) lacked a control group and had some loss of participants to follow-up which weakened the quality of the respective studies. Leung et al. (2019) concluded that an online education module was effective in improving the knowledge, skills, and confidence of RNs who provide pain management to patients with cancer.

Like Dodson (2018) and Leung et al. (2019), in a medium-quality UCBA study, Vioral (2014) investigated the effectiveness of a virtual oncology education intervention that consisted of simulated electronic learning vignettes. Vioral (2014) reported improvements in mean knowledge scores from the pre-test (4.6, SD 1.51) to the post-test (5.3, SD 2.06) that were statistically significant ($p < 0.01$), however, one-month knowledge retention scores returned to near baseline (4.7, SD 1.46). Satisfaction with electronic learning varied, with overall satisfaction scores reported as 36.4 (SD 13.79, min 15, max 75) with participants citing

technology challenges as negatively impacting their experience (Vioral, 2014). Issues that weakened the quality rating of the study by Vioral (2014) included a risk of recall bias and the lack of a control group.

In a low-quality cross-sectional study, Hsu et al. (2023) evaluated the effectiveness of a virtual education program using simulated clinical scenarios in improving gynecology oncology RNs' engagement in continuing education and knowledge retention. Hsu et al. (2023) also explored the effects of learning involvement and motivation on self-directed learning. According to Hsu et al. (2023), learning involvement is the perceived relevance of an educational opportunity which is influenced by cognitive involvement (understanding of educational content) and affective involvement (feelings invoked by participating in educational activities). Using structural equation modeling, Hsu et al. (2023) determined that cognitive involvement significantly influenced motivation and concluded that increasing cognitive involvement could increase gynecology oncology RNs' motivation to engage in self-directed continuing education and thus improve learning outcomes. While Hsu et al. (2023) used sophisticated statistical analysis, self-report bias may have been introduced with the use of self-report questionnaires which contributed to a low-quality rating. Delivering continuing education in a virtual format offers greater flexibility for RNs and may remove barriers associated with traditional classroom instruction (Hsu et al., 2023).

Hybrid Models

In a moderate-quality systematic review, Banihani et al. (2022) assessed the effectiveness of various educational interventions aimed at increasing RNs' safe handling and administration of systemic therapy agents. The systematic review included nine studies in total: four quasi-experimental studies, three pre/post-test designs, and two RCTs. Banihani et al. (2022) described

multiple studies in which educational interventions were implemented using a combination of traditional classroom education and virtual education and utilized various teaching methodologies. Researchers reported strong correlations between educational interventions and increased safety in handling and administering systemic therapy agents in 88.9% (n = 8) of the studies reviewed (Banihani et al., 2022). While researchers concluded that educational interventions aimed at increasing the safety of systemic therapy handling and administration by RNs were effective, several issues threatened the quality of the systematic review. Banihani et al. (2022) only reviewed studies published in English and did not report statistics from the individual studies, so further investigation may be warranted.

In a low-quality UCBA study, Underhill et al. (2015) implemented an educational initiative with an in-person poster presentation and online modules to improve RNs' attitudes toward and implementation of EBP in an outpatient oncology setting. No significant differences were found in RNs' attitudes toward and use of EBP after participating in the educational initiative. Self-report bias was a potential issue in Underhill et al. (2015) along with a low participation rate, considerable loss to follow-up, and potential inconsistencies between baseline and post-intervention participants. In a qualitative action research study, Nolan et al. (2022) developed and evaluated an educational program focused on patient safety, oncologic emergencies, resilience, and self-care for RNs new to oncology. Two cohorts of RNs completed the program, the first cohort (n = 6) completed an in-person offering of the program, while the second cohort (n = 11) completed a virtual adaptation of the program due to the COVID pandemic (Nolan et al., 2022). Both cohorts of RNs reported increased confidence and increased clinical competency resulting from participation in the education intervention (Nolan et al., 2022).

Virtual Education Compared to Traditional Classroom Education

In a medium-quality RCT, Matsubara and Domenico (2016) investigated the effectiveness of a virtual oncology nursing training program compared to face-to-face training at a Cancer Center in Brazil. Similarly, Mun and Hwang (2020) conducted a high-quality RCT that examined the effectiveness of an interactive virtual systemic therapy education program compared to traditional in-person education for RNs in South Korea. Matsubara and Domenico (2016) reported that the virtual and face-to-face education programs had identical content but did not discuss which topics were included. Virtual education program content differed from in-person education session content in the study by Mun and Hwang (2020) which limited the comparability of the interventions. Virtual education topics included cancer diagnosis/treatment, principles of systemic therapy, safe handling and administration of systemic therapy agents, and management of systemic side effects while the in-person education included only cancer treatment and systemic therapy drugs (Mun & Hwang, 2020). In the RCT by Matsubara and Domenico (2016), participants in both the control (face-to-face training) and intervention (virtual training) groups showed improvements in post-intervention knowledge scores, but there were no significant differences noted between the groups ($p = 0.76$). Mun and Hwang (2020) detected statistically significant differences in pre- and post-test knowledge scores between the control (in-person education) and intervention (virtual education) groups ($p = 0.001$). Researchers in both studies concluded that the effectiveness of virtual learning is at least equivalent to or better than traditional in-person learning (Matsubara & Domenico, 2016; Mun & Hwang, 2020). While both RCTs were medium to high-quality studies, participants were recruited from a single setting in each study limiting the generalizability of findings for other cancer care settings.

Summary of Evidence

This literature review consisted of sixteen studies that examined existing continuing education resources for systemic therapy RNs. The evidence base included findings from twelve quantitative studies, including one medium-quality systematic review, two RCTs (one high and one medium quality), four UCBA studies (three medium and one low quality), one medium-quality cohort study, and four cross-sectional studies (two medium and two low-quality studies). Based on the criteria for rating evidence in the PHAC (2014) critical appraisal tool kit, the body of evidence from quantitative studies is assigned a rating of Moderate BII as it features "one strong design study with support from multiple weak design studies of high/medium quality of results" (p. 26). In addition to quantitative evidence, descriptive studies, qualitative studies, and MMR reported similar findings and showed support for continuing education initiatives for systemic therapy RNs.

Conclusion

Based on my experience as an RN in the outpatient cancer care setting, I identified a lack of continuing education for RNs administering systemic therapy which is supported in the literature. A lack of continuing education for RNs can impact both the patient receiving systemic therapy and the nurse administering it. Key contributing factors that potentiate a lack of continuing education include ineffective approaches to self-directed learning, inconsistencies in education, and the lack of accessibility to continuing education opportunities. Several key educational interventions exist for systemic therapy RNs to maintain and enhance competency; virtual, in-person, and hybrid education models. Within these delivery models, poster presentations, online modules, group discussions, PowerPoint presentations, seminars, workshops, simulations, case studies, and return demonstrations have been used to enhance

competency. Based on the findings in this review, a comprehensive continuing education resource for RNs administering systemic therapy in NL is warranted. Further exploration with an environmental scan and local consultations is necessary to determine which educational approach will be the most appropriate to use in the local practicum setting.

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Appendix B

Literature Summary Tables

Quantitative Studies

Study/Design	Methods	Key Results	Comments
Authors: Banihani et al. (2022) Design: Systematic review Purpose: To assess the effectiveness of education interventions aimed at increasing the safe handling and administration of systemic therapy agents by oncology nurses.	Number of studies included: 9 studies. n = 4 quasi-experimental, n = 3 pre/post-test, n = 2 randomized controlled trials Country/setting: Review conducted in Jordan. Majority of studies from US/Egypt Search Criteria/Study Selection: • Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines • 4 databases searched, reviewed by 2-3 researchers. • Inclusion criteria: published from 2010-2021, primary research, quantitative studies, related to key question, published in English. Critical Appraisal of Studies: • Critical Appraisals Skills Program (CASP) Checklist for systematic reviews • Quality Assessment Tool (QAT) checklist for quantitative studies • Effective Public Health Practice Project (EPHPP) for risk of bias	**Types of Interventions** • Multidimensional interventions: demonstration, group discussion, seminar, audiovisual materials (n = 4) • Web-based interventions (n = 2) • Safety protocols (n = 2) • Standard education module (n = 1) **Findings** • Strong associations between educational interventions and safe handling/administration of systemic therapy agents (88.9%, n = 8 studies) • No improvement in safe handling/administration of systemic therapy agents (11.1%, n = 1 study)	Strength: **N/A** Quality: **Medium** Issues: • Only reviewed studies published in English. • No discussion of statistics from individual studies, unable to determine significance of findings

Study/Design	Methods	Key Results	Comments
Authors: Cannon et al. (2014) Design: Cross-sectional study Purpose: To identify the educational needs of oncology nurses	N: 1028 oncology nurses (60% of respondents from Texas, remaining majority from other US states) Country/setting: Texas, US. Data collection: • Researcher developed questionnaire, 29 items. Outcomes: • Learning needs Analysis: Statistical analysis lacking	**Highest Ranked Learning Needs** • Management of cancer symptoms and treatment side-effects (47%) • Complementary and alternative or integrative medicine (44%) • Cancer screening recommendations (43%) • Hematologic cancers (38%)	Strength: **Weak** Quality: **Low** Issues: • Low participation rate (5%) • Potential for self-report bias • Reported only percentages, no statistical analysis.

Study/Design	Methods	Key Results	Comments
Authors: Dodson (2018) Design: UCBA Purpose: To assess the efficacy of an interactive, virtual continuing education module in improving oncology nurses' knowledge of pharmacogenomics.	N: 434 oncology nurses (n = 32 from Florida, n = 402 from North Carolina) working in inpatient and outpatient settings who completed a virtual education module on pharmacogenomics Country/setting: Florida and North Carolina, US. Data collection: • Pre/post-test • Questionnaire • Adapted version of the Knowledge and Attitude Questionnaire about Pharmacogenomic Testing (KAQ-PGx); 10 knowledge questions Outcomes: • Knowledge Scores (KAQ-PGx) Analysis: • Simple statistics	**Mean Knowledge Scores** • Max score 100 • Pre-test 72.7 • Post-test 85.9 • Statistically significant difference between pre/post-test scores ($p < 0.01$) • No significant differences between knowledge scores of nurses working in inpatient vs outpatient settings ($p = 0.257$)	Strength: **Weak** Quality: **Medium** Issues: • Low participation rate (18%) • Data collection tools not tested for reliability and validity.

Study/Design	Methods	Key Results	Comments
Authors: Hsu et al. (2023) Design: Cross-sectional study Purpose: To evaluate a virtual education program using simulated clinical scenarios for nurses who care for patients with gynecologic cancer and to explore the effects of personal involvement and motivation on self-learning.	N: 84 nurses working in an obstetrics/gynecology department. Country/setting: Medical center in Taiwan. Data collection • Structured questionnaire, Likert scale • Revised Personal Involvement Inventory (RPII), Likert scale. • Attention, Relevance, Confidence, Satisfaction (ARCS) Model, Likert scale. Outcomes: • Learning effects • Learning involvement includes *cognitive* and *affective* involvement (RPII) • Learning motivation (ARCS Model) Analysis: • Structural equation modeling	**Learning Effects** • Maximum score 5 • Average score 4.33 **Learning Involvement** • Higher scores indicate higher involvement (max score 7) • Average scores: ○ *Cognitive Involvement* 6.32 ○ *Affective Involvement* 5.90 **Learning Motivation** • Higher scores indicate a higher level of motivation (max score 5) • Average scores: ○ *Attention* 4.21 ○ *Relevance* 4.26 ○ *Confidence* 4.20 ○ *Satisfaction* 4.23 **Structural Modelling Findings** • Cognitive involvement significantly influenced ARCS ($p = 0.015$, $p = 0.001$, $p = 0.010$, $p < 0.001$) • Attention and relevance significantly influence learning effects ($p = 0.008$, $p = 0.037$)	Strength: **Weak** Quality: **Low** Issues: • Potential for self-report bias • Unclear if the study was approved by an ethical review board.

Study/Design	Methods	Key Results	Comments
Authors: Leung et al. (2019) Design: UCBA Purpose: To examine the effectiveness of an online educational intervention on pain management for oncology nurses.	N: 327 oncology nurses Country/setting: 89 hospitals across Ontario, Canada Data collection: • At baseline and post-intervention • Knowledge/Attitude/Confidence survey (KACS), researcher developed, 21 items, Likert scale. • Satisfaction survey (SS), 27 items, Likert scale + open-ended questions Outcomes: • Nurse's knowledge, attitude, and confidence with pain management (KACS) • Learner satisfaction with the education intervention (SS) Analysis: • Regression analysis	**Knowledge/Attitude/Confidence** • Baseline: Overall confidence in knowledge and skills (57.5%) • Post-intervention: Overall confidence in knowledge and skill (75.7%) **Satisfaction** • 77-97% of participants rated the education intervention positively • 51% of participants were satisfied with the interactivity of the education.	Strength: **Weak** Quality: **Medium** Issues: • Lack of a control group • Loss to follow-up (~ 28%)

Study/Design	Methods	Key Results	Comments

Authors: Liptrott et al. (2019)
 	
Design: Cross-sectional study
 	
Purpose: To identify the educational needs and learning preferences of hematology nurses.
	N: 265 nurses who care for hematology patients.
	
	Country/setting: 21 Western European countries
	
	Data collection:
	• Questionnaire, 75 items, Likert scale
	
	Outcomes:
	• Self-reported educational needs
	• Learning preferences
	
	Analysis: Simple statistics
		Educational Needs
		
		• Safe handling and administration of treatments
		  ○ Knowledge of new systemic therapy agents (73.2%)
		  ○ Safe handling of systemic therapy agents (67.5%)
		  ○ Management of extravasation (61.9%)
		
		• Side-effect/symptom management
		  ○ Long-term side effects (74.0%)
		  ○ Pain control (71.7%)
		  ○ Infection (71.3%)
		
		• Patient education (71.7%)
		
		Learning Preferences
		
		• Educational conferences (70.6%)
		• Small group education (49.8%)
		• Written materials (44.5%)
		• Online modules (41.9%)
			Strength: **Weak**
			
			Quality: **Medium**
			
			Issues:
			• Data collection tool (questionnaire) developed by nurse experts, not tested for validity and reliability (V&R) but content validity assumed.
			• Potential for self-report bias

Study/Design	Methods	Key Results	Comments
Authors: Manias et al. (2014) Design: Retrospective cohort study (chart audit) Purpose: To measure the rate of medication errors associated with high-alert medications and to identify factors associated with medication errors.	N: 540 medical records of patients who received at least one high-alert medication while receiving care in the practice setting equating to 6984 opportunities for high-alert medication error Country/setting: 5 practice settings at a teaching hospital in Melbourne, Australia (cardiac care, emergency care, intensive care, oncology care, and perioperative care) Data collection: • Chart review from January 1st to December 31st, 2010. • The National Coordinating Council for Medication Error Reporting and Prevention (NCC-MERP) tool used. Outcomes: • High-alert medication errors Analysis: • Regression modeling	**Medication Incidents** • Overall error rate 27.69% • 758 errors related to administration of high-alert medication identified across all settings. • 264 errors related to administration of high-alert medication identified in cancer care. • Most common administration errors included documentation errors (71%), incorrect IV infusion rates (23%)	Strength: **Moderate** Quality: **Medium** Issues: • Retrospective nature of chart audit

Study/Design	Methods	Key Results	Comments
Authors: Matsubara & Domenico (2016) Design: Randomized controlled study (RCT) Purpose: To evaluate learning outcomes of a virtual adaptation of a *Nursing Oncology* training program compared to traditional classroom delivery of the same program.	N: 97 oncology nurses Control group (CG): n = 44, received face-to-face training Intervention group (IG): n = 53, received training by distance learning Country/setting: Oncology center at a hospital in Brazil. Data collection: • Pre/post-intervention • Knowledge Assessment Questionnaire (KAQ), 20 items, validated tool • Constructivist On-Line Learning Environment Survey (COLLES) Outcomes: • Knowledge scores (KAQ) • Participants' perception of online learning (COLLES) Analysis: • Mean knowledge scores. • Mann-Whitney test	**Knowledge Scores** CG • pre-intervention 4.72 (SD 1.28) • post-intervention 6.28 (SD 1.27) IG • pre-intervention 5.34 (SD 1.11) • post-intervention 6.24 (SD 1.18) **Perception of Online Learning** CG: Not applicable IG • 37.7% response rate (n=20) • Barriers identified by respondents: limited time (n=7), difficulty with program (n=9), difficulty with technology (n=2)	Strength: **Strong** Quality: **Medium** Issues: • Participant recruitment from a single setting • No description of the randomization process • Differences between groups at baseline (notably in age group)

Study/Design	Methods	Key Results	Comments

Authors: Mun & Hwang (2020)
 	
Design: RCT
 	
Purpose: To develop an online chemotherapy learning course for oncology nurses and evaluate its effectiveness on nursing knowledge, self-efficacy, and performance.
	N: 56 nurses who administer chemotherapy
	
	CG: n=28, received an in-person chemotherapy education session
	
	IG: n=28, received a self-directed virtual chemotherapy education session consisting of modules that took ~80 minutes to complete
	
	Country/setting: University Hospital in South Korea
	
	Data collection:
	• At baseline and two weeks post-education completion (pre/post-test)
	• Self-report questionnaires (SRQ) developed by researchers, Likert scale.
	• Self-efficacy scale (SES), 14 items
	
	Outcomes:
	• Knowledge of chemotherapy nursing (SRQ, 25 items)
	• Self-efficacy of chemotherapy nursing (SES)
	• Nursing performance (SRQ, 25 items)
	
	Analysis:
	• Simple statistics
		Knowledge
		• Higher score, higher knowledge level
		• Differences in pre/post-test scores
		  ○ CG: 7.14 ± 27.20
		  ○ IG: 16.61 ± 21.90
		• Statistically significant difference (p = 0.001)
		
		Self-efficacy
		• Higher score, greater self-efficacy
		• Difference in pre/post-test scores
		  ○ CG: 1.71 ± 4.62
		  ○ IG: 0.79 ± 5.24
		• Not statistically significant (p = 0.055)
		
		Performance
		• Higher score, higher performance
		• Difference in pre/post-test scores
		  ○ CG: 9.29 ± 14.43
		  ○ IG: 5.96 ± 12.35
		• Not statistically significant (p = 0.359)
			Strength: **Strong**
			
			Quality: **High**
			
			Issues:
			• Participant recruitment from a single setting
			• Researchers self-developed some instruments, however, demonstrated content validity.
			• Potential for self-report bias

Study/Design	Methods	Key Results	Comments
Authors: Sharour (2018) Design: Cross-sectional study Purpose: To assess oncology nurses' knowledge about central line, and central line care.	N: 150 oncology nurses Country/setting: Multiple oncology units at a hospital in Jordan. Data collection: • Researcher developed questionnaire, 50 multiple-choice questions. Outcomes: • Nurses level of knowledge of central lines Analysis: Simple statistics	**Knowledge Level** • Maximum score 100 • 'Satisfactory' score of 60 • 50% (n = 75) of participants received a satisfactory score • Significantly higher knowledge scores for nurses with higher education (p = 0.03). • Significantly higher knowledge scores for nurses with more clinical experience (p = 0.000*) ***p-value incorrectly reported by researchers**	Strength: **Weak** Quality: **Medium** Issues: • Participants recruited from a single setting. • Researcher developed questionnaire. Not tested for V&R, but face and content validity indicated. • Some statistics reported incorrectly (p-value)

Study/Design	Methods	Key Results	Comments
Authors: Underhill et al. (2015) Design: UCBA Purpose: To compare and describe oncology nurses' beliefs and use of evidence-based practice (EBP) before and after an EBP initiative	N: 112 oncology nurses who received EBP initiative (overview of EBP during orientation, poster presentation, and online education). Country/setting: Dana Farber Cancer Institute in the US. Data collection: • Questionnaires • Collected at baseline and post-intervention. • EBP Beliefs (EBP-B) 16 items, Likert scale • EBP Implementation (EBP-I) 18 items, Likert scale • Open-ended question, 1 item. Outcomes: • Beliefs and attitudes about EBP (EBP-B) • Nurse engagement in EBP (EBP-I) • Barriers to involvement in EBP (open-ended questions) Analysis: Spearman's correlation	**Beliefs and Attitudes about EBP** • EBP-B, higher scores indicated more positive attitudes. • Baseline: median score 56.5 (range 37-77) • Post-intervention: median score 57 (range 38-76) • No significant difference between timepoints **Nurse Engagement in EBP** • EBP-I, higher scores indicated higher perceptions of implementation. • Baseline: median 11 (range 0-70). Post-intervention: 12 (range 0-66) • No significant difference between timepoints **Nurses with higher education had significantly higher scores in EBP-B (p = 0.03) and EBP-I (p = 0.01) *** **Barriers to EBP** • Lack of time • Lack of knowledge • Lack of access to resources • Lack of awareness • Lack of education	Strength: **Weak** Quality: **Low** Issues: • Participants recruited from a single study setting. • Low response rate (32%) • Unsure whether participants who completed baseline data collection were the same participants who completed post-intervention data collection. • Considerable loss to follow-up (~40%) • Potential for self-report bias

Study/Design	Methods	Key Results	Comments
Authors: Vioral (2014) Design: UCBA Purpose: To determine if simulated electronic learning vignettes (SELVs) increased oncology nurses' knowledge of chemotherapy safety standards and to determine if participants were satisfied with electronic learning.	N: 66 registered nurses (RNs) who administer chemotherapy in inpatient and outpatient settings who received virtual chemotherapy education via 9 SELVs Country/setting: Multihospital system in the United States (US) Data collection: • Pre-test/post-test (immediately after the intervention, and 4 weeks after) • Questionnaires • Electronic learning (EL) evaluation tool Outcomes: • Knowledge scores • Participants' satisfaction with electronic learning Analysis: Simple statistics	**Mean Knowledge Scores** • Pre-test: 4.6 (SD 1.51) • Post-test: 5.3 (SD 2.06) • 4 weeks post: 4.7 (SD 1.46) • Statistically significant differences between time points ($p < 0.01$) **Satisfaction** • Overall satisfaction with EL 36.4 (SD 13.79, min 15, max 75)	Strength: **Weak** Quality: **Medium** Issues: • Lack of a control group • Potential for recall bias • Low response rate (67%)

Qualitative Literature Summary Tables

Study/Design	Methods	Key Results	Comments
Authors: Collet et al. (2022) Design: Systematic review and meta-synthesis. Purpose: To explore patients' experiences of interacting with healthcare providers (HCPs) during cancer treatment, and to identify ways HCPs can improve their cancer care provision.	Number of studies: 50 studies (n = 8 high quality, n = 18 moderate quality, n = 24 low quality) Country/setting: Review conducted in Amsterdam, the Netherlands Data collection: • Studies published between 2010-2022. • 5 databases searched. • Only studies that met quality criteria included • 2-3 researchers conducted critical appraisal. • Used Critical Appraisal Skills Programme (CASP) checklist. Analysis: Thematic meta-analysis	**Major Themes** **Support, respect, and agency.** Subtheme: Feeling respected and treated as a person **Quantity, timing, and clarity of information** Subtheme: Being provided with clear information **Confidence, honesty, and expertise** Subtheme: Being in the hands of confident and honest professionals **Findings** • Patients had overall positive experiences with HCPs when provided person-centered care, and the HCP had strong interpersonal skills. • Patients reported negative experiences when their communication preferences and personal support needs were ignored.	**Critical Appraisal** • Included in the literature review after appraisal using JBI. • Majority of included studies were low-quality. • Did not search grey literature. **Practice Implications** Continuing education and training are necessary to provide high-quality cancer care

Study/Design	Methods	Key Results	Comments
Authors: Nolan et al. 2022 Design: Action research Purpose: To develop and evaluate a hospital-based education program for nurses who are new to oncology settings.	Sample: Two cohorts of nurses participating in the education program at separate times **Group 1**: n = 6, received in-person education **Group 2**: n = 11, received virtual education due to COVID pandemic Country/setting: St. James Hospital, Dublin, Ireland. Data collection: • Post program completion. • Group discussions. • Anonymous surveys Analysis: Thematic analysis	**Themes of Program Development** • Patient safety • Oncologic emergencies • Resilience • Self-care **Impacts on Participants** • Improved confidence • Improved clinical abilities. **Program Evaluation** • Curriculum was relevant. • Preferred online learning, or a hybrid approach. • Suggested improvements to program structure, access, and content.	**Critical Appraisal** • Included in the literature review after appraisal using JBI. • Participants not included in initial program development. **Practice Implications** • Standardization of education for nurses new to oncology

Mixed Methods Research Literature Summary Tables

Study/Design	Methods	Key Results	Comments
Authors: Coolbrandt et al. (2018) Design: Explanatory sequential Purpose: To explore how adult cancer patients receiving chemotherapy experienced the CHEMO-SUPPORT intervention. ***CHEMO SUPPORT** is a coaching intervention that uses motivational interviewing to improve patients' self-efficacy, and self-management and reduce the burden of chemotherapy side-effects. Included: counseling sessions, patient information brochure, and on-call availability of intervention nursing team	N: 71 chemotherapy patients who received the CHEMO-SUPPORT intervention Country/setting: 2 outpatient, and 6 inpatient oncology units at hospitals in Belgium. Data collection: • Questionnaire (conducted first) • Semi-structured interviews (conducted second); purposive sampling (n = 9 from larger group) Outcomes: • Helpfulness of intervention • Major themes Analysis: • Descriptive analyses • Qualitative Analysis Guide of Leuven (QUAGOL) to analyze interviews. • Convergence between themes	Quantitative **Helpfulness Ratings** • Numeric rating, ranging from 0 (not helpful at all) to 10 (extremely helpful) • Initial counselling: mean rating 8.2 (SD 1.8) • On-call nursing support: mean rating 7.7 (SD 2.7) Qualitative **Major Themes** • *True support*: sympathetic, personal, and genuine support from nursing staff • *Competent care*: expert advice, high-quality information, and guidance • *Feeling reassured*: feeling at ease and better able to deal with symptoms.	**Issues** • No significant issues to report. **Practice Implications** CHEMO-SUPPORT intervention may have positive effects on patients' self-efficacy leading to lower symptom distress

Study/Design	Methods	Key Results	Comments
Authors: Coyne et al. (2019) Design: Integrative review Purpose: To synthesize the evidence about education and practice requirements for the safe administration of chemotherapy by nurses.	Number of studies: 17 studies • Qualitative (n = 12) • Quantitative (n = 3) • MMR (n = 2) Country/setting: Majority of studies from US, others from UK, Spain, Italy, Switzerland, Germany, Canada, Australia Search Criteria/Study Selection: • Two researchers, multiple databases searched. • Inclusion criteria: primary research papers, published in English, published between 2006-2017, related to key question. • Guided by PRISMA Critical Appraisal of Studies: • Critical appraisal of individual studies using the Mixed Methods Appraisal Tool (MMAT) • Level of evidence assessed using NHMRC Evidence Hierarchy scale. Analysis: • Content analysis	**Major Themes** • *Governance*: organizational safety and quality practices are critical for safe administration • *Process safeguards*: interruption in sequence of events that prevents errors from happening and promotes safety. • *Communication*: identifying high-risk points in chemotherapy administration and ensuring clear communication of information is established • *Interdisciplinary collaboration*: Understanding roles within the health care team and being able to escalate concerns. • *Education*: demonstration of competency by nurses before administration of chemotherapy	**Issues** • Minimal discussion of quantitative findings, likely due to the small number of studies **Practice Implications** • Low-level evidence exists about the education and safety requirements for nursing administration of chemotherapy. • Nurses are in a key position to influence clinical practices to promote the safe administration of chemotherapy.

Descriptive Studies Literature Summary Tables

Study/Design	Methods	Key Results	Comments
Authors: Challinor et al. (2020) Design: Narrative review Purpose: To describe oncology nursing workforce challenges, solutions, and future strategies.	Review Process • Included scholarly articles and grey literature. • Search terms listed. • Articles published between 2010-2020. • Articles published in English, Spanish, and Portuguese	**Oncology Nursing Shortages** • Difficulties with recruitment of oncology nurses • Lack of effective solutions for recruitment **Specialized Oncology Nursing Training** • Nursing training promotes patient/nurse safety. • Lack of specialized oncology nursing training • Inconsistencies between oncology nursing training **Challenges to Oncology Nursing Retention** • Occupational hazards • Nursing burnout **Oncology Nursing Advocacy, Leadership, and Policy** • Need for increased nursing leadership. • Need for national and global cancer strategic planning and action.	**Issues** • No evidence of critical appraisal of individual research studies

Study/Design	Methods	Key Results	Comments
Authors: Galassi et al. (2023) Design: Narrative review Purpose: To describe the history of oncology nursing specialization, educational interventions, and challenges affecting education and specialization.	Review Process • Included scholarly articles and grey literature. • Articles published between 2012-2022. • Articles published in English and Spanish	**Challenges in Oncology Nursing Education** • Human resource challenges • Social and cultural factors • Economic factors **Existing Educational Interventions** • Pre-licensure courses • Continuing education • Certificate programs • Diploma programs **Oncology Nursing Curriculum Development** • Competency-based education • Addressing culture, resources, and practice norms • Teaching methodologies • Learning objectives • Learner evaluation	**Issues** • No evidence of critical appraisal of individual research studies

Study/Design	Methods	Key Results	Comments
Authors: Tomaszczuk et al. (2022) Design: Quality improvement (QI) project Purpose: To redesign a clinical advancement program (CAP) to promote and strengthen competencies of clinical nurses.	Setting/country: St. Jude Children's Research Hospital in Memphis, Tennessee. QI Project Details • Project committee included nursing leadership and 15 nurses. • Guided by Benner's Novice to Expert Model • Conducted a literature review. • Benchmarking • Incorporated nursing standards for professional development • Incorporated organization's core values CAP Components • Direct patient care track • Education track • Leadership track • Mentorship • Shadowing	**Outcomes of Redesigned CAP** • Improved understanding of clinical workflow structures • Improved understanding of patient experiences • Encouraged involvement. • Improved critical thinking. • Increased knowledge of organizational guidelines • Encouraged excellence in the nursing profession. • Encouraged mentorship. • Encouraged confidence in clinical practice.	**Nursing Implications** • Nursing leadership should focus their efforts on supporting practice change, maintaining retention, and inspiring nurses to excel in their profession. • Inclusion of direct care nurses on the QI project committee was essential to the success of CAP redesign.

Appendix C

Environmental Scan and Consultation Report

Systemic therapy administration is considered a specialized nursing skill that requires additional education beyond the undergraduate preparation of registered nurses (RNs) due to the complex nature of systemic therapy (Frith & Chao, 2022). With rapidly changing systemic therapy protocols and the introduction of new systemic therapy agents, RNs must ensure they stay up to date on their knowledge and maintain competency in administration (Frith & Chao, 2022). RNs in many jurisdictions, including Newfoundland and Labrador (NL), are required to complete an initial systemic therapy certification course and maintain their competency in systemic therapy administration through frequent administration and continuing education activities. In my experience working as an RN in an outpatient systemic therapy unit, I have identified a lack of continuing education resources for RNs administering systemic therapy. In response, I have proposed to develop a continuing education resource for RNs administering systemic therapy in the local setting.

As a first step of this project, I conducted a literature review to determine whether a lack of continuing education for systemic therapy RNs was an issue globally. I identified that a lack of continuing for RNs has been associated with negative impacts for both the nurse administering the systemic therapy and the patient receiving it. Impacts on the nurse include inadvertent cytotoxic exposures which can have significant physical health consequences (Banihani et al., 2022). Patient impacts include decreased treatment efficacy related to medication errors, and adverse health outcomes such as bloodstream infections (Mun & Hwang, 2020; Sharour, 2018). Factors contributing to the lack of continuing education for RNs include ineffective approaches to self-directed learning, inconsistencies in education, and lack of accessibility to continuing

education opportunities (Banihani et al., 2022; Coyne et al., 2019; Hsu et al., 2023). To address the lack of continuing education for RNs, key interventions discussed in the literature include traditional classroom education, virtual education, and hybrid education models using strategies such as lectures, online modules, case studies, and simulation (Galassi et al., 2023; Matsubara & Domenico, 2016; Underhill et al., 2015; Vioral, 2014).

While the literature review aided my understanding of the implications of a lack of continuing education for systemic therapy RNs globally, I aimed to further explore the issue nationally and locally. I conducted an environmental scan and consultations with local key stakeholders to explore this issue further. I conducted an environmental scan to determine national continuing education recommendations for RNs administering systemic therapy and to identify whether continuing education resources existed in Canada. I identified the standards and competencies for RNs administering systemic therapy in Canada. I explored the continuing education approaches of select cancer care organizations in Canada (e.g., BC Cancer, Cancer Care Ontario, and Atlantic Canadian Cancer Care Centers). I consulted with key stakeholders to determine the educational needs of systemic therapy RNs in the local setting and their preferred methods for continuing education. In the following section, I will describe the methods I used to conduct the environmental scan and consultations.

Methods

I developed an environmental scan and consultation plan and had these approved by my supervisor before proceeding. I conducted an environmental scan of various sources including cancer care organizations in Atlantic Canada, Ontario, and British Columbia (BC), the Canadian Association of Nurses in Oncology (CANO), and the de Souza Institute in Toronto, Canada. I consulted with local frontline RNs administering systemic therapy and RNs in various leadership

roles within the organization. I will discuss the objectives, data collection, and analysis of both the environmental scan and consultations in the following sections.

Environmental Scan

I conducted the environmental scan to determine national continuing education requirements for RNs administering systemic therapy set forth by the CANO. I aimed to discover whether continuing education resources for RNs administering systemic therapy exist in Canada, specifically in the Atlantic Provinces, Ontario, and BC. These locations were chosen for several reasons. First, the Atlantic Provinces have geographic distributions and populations like NL. Therefore, it was reasonable to compare the continuing education approaches of cancer centers in these provinces to NL. I chose BC Cancer and Cancer Care Ontario (CCO) as they are larger organizations with comprehensive clinical resources that are often utilized by healthcare professionals in the Provincial Cancer Care Program at NL Health Services. It was prudent to review continuing education resources from these larger centers (BC Cancer and CCO) given some of their resources (e.g., systemic therapy protocols) are already being used in the local setting. I identified the specific objectives for the environmental scan as:

1. To determine current continuing education practices for RNs administering systemic therapy in NL, other Atlantic Provinces, and select major cancer care organizations in Canada.
2. To review systemic therapy practice standards and continuing education recommendations from CANO.

I used several sources of information to meet these objectives, including a review of websites and personal communications with representatives from key organizations. I will discuss these sources of information in detail in the following section.

Websites

I reviewed the websites of key cancer care organizations to determine continuing education approaches for RNs administering systemic therapy. I searched for information about existing continuing education resources and organizational requirements for RNs administering systemic therapy. I used keywords such as “oncology”, “nursing”, “continuing education”, “continuing competency”, “systemic therapy”, “chemotherapy”, “competencies”, and “standards”. I recorded my findings in a Word document, specifically about the continuing education requirements and resources in each organization, or the lack of information on the respective organizations' continuing education approaches. I also attempted to identify a point of contact at each organization for further inquiry while reviewing websites. I reviewed the CANO website and available documents, specifically *the Standards and Competencies for Oncology Nursing Practice in Systemic Therapy* (2022).

Personal Communications

I identified key points of contact at the respective cancer care organizations to request additional information on continuing education approaches for RNs administering systemic therapy. I identified clinical educators or nursing staff of respective cancer care organizations. If the information I was searching for was not readily available on public websites, I contacted key informants by sending an email to an address used for general inquiries at each organization requesting that they provide contact information for the appropriate individual or forward the inquiry on my behalf. I sent initial emails of inquiry and followed up one week later if I had not received a response. Please see the email of inquiry in Appendix A. I kept track of the organizations I had contacted, any responses I received, and the contact information of key informants in a Word document. If continuing education resources were available at each

organization, I inquired about and documented the key characteristics of the resource (e.g., content, length, and delivery model). I conducted a thematic content analysis on data obtained from the organizations to identify emergent themes and patterns, analyzing the findings for similarities and differences (Polit & Beck, 2021). Finally, I explored the continuing education approaches of each organization and determined whether these approaches align with CANO recommendations for the continuing education of systemic therapy RNs. I was interested in this information as I plan to develop the local educational resource to align with CANO standards and competencies for RNs administering systemic therapy.

Consultations

I conducted consultations with local key stakeholders to inform the development and delivery of the proposed continuing education resource. Specifically, I aimed to determine the learning needs of local RNs administering systemic therapy and their preferred continuing education methods. To accomplish this, I consulted frontline RNs administering systemic therapy, as well as oncology RNs in leadership roles in the local setting. Before beginning the consultations, I had identified the specific objectives of the consultations as:

1. To identify the self-reported learning needs of frontline RNs administering systemic therapy in the local practicum setting.
2. To identify the perceived learning needs of frontline RNs administering systemic therapy in the local practicum setting according to individuals in select leadership roles.
3. To identify systemic therapy RNs' preferred methods for continuing education.

During the consultation phase, I gathered data using both questionnaires and semi-structured interviews. In the following sections, I will describe these methods in detail.

Questionnaires

I conducted consultations with frontline RNs administering systemic therapy using questionnaires. I chose this method to make it more convenient for frontline RNs to participate in consultations. I developed and distributed the questionnaire in two formats: a paper copy disseminated in-person in my practice area, and virtually using a Qualtrics questionnaire. Administering the questionnaires in person and virtually made consultations more convenient for respondents. Frontline RNs who work in the local systemic therapy unit are busy and may have limited time to participate in more time-consuming data collection such as interviews. The benefits of using questionnaires include that they can be administered easily and provide anonymity to respondents (Polit & Beck, 2021). Although questionnaires are economical and convenient, the data collected can be superficial (Polit & Beck, 2021). Based on the topic of my project, questionnaires were appropriate to gather the necessary data from very busy systemic therapy RNs. I developed eight questions that included both open-ended and closed-ended responses to determine the target population's educational needs and preferred learning methods. A disclosure was provided at the beginning of the questionnaire, notifying that responses would be anonymous. Please see the questionnaire in Appendix B.

I aimed to conduct consultations with at least ten frontline RNs. I notified frontline RNs about the consultations by sending a mass message to eligible individuals and through word of mouth. Paper questionnaires were placed in an accessible area at the nursing station in the systemic therapy unit for one week along with sealed envelopes for completed questionnaires. I collected completed questionnaires daily and stored them securely in a locked filing cabinet at my home. A link to the Qualtrics questionnaire was emailed to individuals who identified this as their preferred method for completing the questionnaire. To maintain anonymity, respondents did

not include their email in the questionnaire. I maintained data quality and consistency by using the same questionnaires for all respondents. Questionnaire responses were stored in my Qualtrics account which is password-protected and only accessible to me. I received 17 total responses to my questionnaires. Responses from both formats of questionnaires were compiled into a Word document, then the originals were promptly and securely disposed of in a secure shredding bin at my workplace.

Semi-Structured Interviews

I conducted semi-structured interviews with three oncology RNs in leadership positions who have direct contact with frontline RNs administering systemic therapy regularly. I developed an interview guide consisting of three open-ended questions to determine the perceived learning needs of frontline RNs according to RNs in leadership positions and their suggestions on the best approaches to deliver continuing education to this population. Each interview lasted approximately fifteen minutes and was completed in private office and clinic spaces in the facility. I informed each respondent that their responses would be deidentified and grouped to maintain anonymity. Interviews can be difficult to arrange as they are time-consuming and require that the interviewer and respondent's schedules align. Despite these challenges, I chose interviews for data collection with this group as there were fewer individuals to consult which made this approach more feasible. Although there are drawbacks to this approach, interviews can provide rich data (Polit & Beck, 2021). The rich data I collected from interviews supplemented the data I collected using questionnaires. I maintained consistency and quality of data by using an interview guide and asking all respondents the same questions. Please see the interview guide in Appendix C. I kept detailed notes of verbal responses provided by RNs. After I completed all three interviews, responses were compiled into a single Word

document and the originals were promptly destroyed. Methods for data analysis are discussed in the next section.

Data Analysis

I compiled responses from both questionnaires and interviews into two separate Word documents to make it easier to manage the volume of data. I used descriptive statistics to analyze responses to closed-ended questions on the questionnaire. Descriptive statistics, such as percentages, are effective for synthesizing and describing categorical types of data (Polit & Beck, 2021). Specifically, I calculated the percentages of respondents who selected certain items on the questionnaire. The questionnaire also contained open-ended questions. I used thematic analysis to analyze this data as well as interview responses. Thematic analysis allows the researcher to construct and analyze recurrent patterns in a qualitative data set (Kiger & Varpio, 2020). Thematic analysis is an effective approach for examining the underlying experiences, thoughts, and behaviors that can be derived from a data set (Kiger & Varpio, 2020). Specifically, I followed an inductive thematic analysis approach where I constructed themes from the data I collected (Kiger & Varpio, 2020). Using an inductive content analysis approach, I reduced the amount of data to be handled by coding responses and then grouping similar responses to identify emergent themes and recurrent patterns (Polit & Beck, 2021).

Braun and Clark (2006) proposed a six-step process for thematic analysis that is frequently cited in the literature (Kiger & Varpio, 2020). The six steps of thematic analysis are familiarizing yourself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and finally, producing the report/manuscript (Kiger & Varpio, 2020). I followed these steps for the thematic analysis of the data from the open-ended

questions on both the questionnaire and the interview responses. Please see the thematic analysis in Appendix D.

Ethics

Ethical approval was not required for the environmental scan or consultations as part of this practicum project based on the Health Research Ethics Approval (HREA) screening tool. This practicum project is considered a quality improvement study for education purposes, making it exempt from needing ethical approval. Please see the HREA screening tool in Appendix E. The email of inquiry for the environmental scan contained appropriate information regarding how I planned to use the data collected throughout the practicum project. I asked respondents for permission to use any information obtained during the environmental scan and consultations to help guide resource development in the local practicum setting. I informed respondents that the data collected would be anonymized or de-identified wherever possible. Voluntary completion of the questionnaire by respondents indicated their implied consent (Polit & Beck, 2021). I stored data securely using password-protected files and destroyed the original data after use. Confidentiality can be maintained by ensuring that correspondence is password-protected, and promptly deleted once data collection and analysis are completed (Polit & Beck, 2021). The interviews with oncology RNs in leadership positions could be identifiable given their roles in the local practicum setting. While I could not ensure total anonymity, I informed respondents that their responses were grouped, and they were not identified by name in reports or other aspects of this practicum project. These RNs verbally agreed to participate in consultations, and their voluntary participation in the consultation process was considered implied consent. The results of the environment scan and consultations are discussed in detail in the next section.

Results

Environmental Scan

My sources for the environmental scan included CANO, the de Souza Institute, BC Cancer, CCO, and provincial cancer care organizations in NS and PEI. Results from each source are described in detail in the following sections.

CANO

While reviewing the CANO website, I located the document *Standards and Competencies for Oncology Nursing Practice in Systemic Therapy* which outlines the initial and continuing practice requirements for RNs administering systemic therapy in Canada (CANO, 2022). According to CANO, continuing education can be flexible to meet RN's learning needs and organizational requirements. Continuing education may include minimum systemic therapy practice hours and participation in continuing education activities (CANO, 2022). CANO recommends that organizations develop continuing competence programs (CCPs) to allow systemic therapy RNs to demonstrate their competence annually. A comprehensive CCP includes a self-assessment of learning needs, objective assessments of clinical practice, developing a learning plan to address identified needs, and demonstrating continuing competence (CANO, 2022). CANO suggests a variety of continuing education activities that may assist systemic therapy RNs in meeting their identified learning goals such as mentorship, attending education sessions, reviewing literature, and completing certification or competency maintenance programs. CANO also recommends several approaches for demonstrating continued competency including peer or colleague feedback, developing a professional portfolio, logging continuing

education hours, successful completion of certification or continuing education programs, reporting practice hours, written exams, and structured clinical exams.

CCPs should include specific content in several key areas related to systemic therapy administration (CANO, 2022). These areas include systemic therapy cancer agents and regimens, principles of systemic therapy administration, equipment for administration of systemic therapy agents, best practice standards, policies and procedures, symptom management, monitoring parameters throughout treatment, adverse event monitoring and management, and safe handling, spill management, and waste disposal of hazardous drugs (CANO, 2022).

The de Souza Institute

According to their website, the de Souza Institute located in Toronto, Ontario offers healthcare professionals online courses in cancer and palliative care (de Souza Institute, 2024a). In addition to an initial systemic therapy certification course, the de Souza Institute offers a *Chemotherapy Competency Maintenance Course* (CCMC). The Manager of Curriculum and Program Evaluation at the de Souza Institute described the CCMC as a standardized, up-to-date curriculum that is accessible anywhere, anytime in Canada (J. Wong, personal communication, July 12, 2024). Systemic therapy RNs are recommended to complete the CCMC every 24 months (de Souza Institute, 2024b). Topics covered in the CCMC include assessment and order verification, administration and documentation, safe handling, chemotherapy, biotherapy, immediate complications, and sexuality and fertility (de Souza Institute, 2024b). Updated regularly to include new systemic therapies and incorporate new practice evidence, the CCMC aligns with CANO standards and competencies and is a self-directed course spanning eight weeks, incorporating learning modules, supplemental readings, and collaborative discussion forums (de Souza Institute, 2024b). Participants are encouraged to spend one to two hours per

week on coursework and must complete a final exam that requires an 80% grade for successful course completion (de Souza Institute, 2024b). Representatives from the de Souza Institute work closely with provincial cancer agencies to help implement the CCMC, and to keep track of course renewal schedules (J. Wong, personal communication, July 12, 2024).

BC Cancer/Cancer Care Ontario

I reviewed the BC Cancer website for available information on continuing education programs for systemic therapy RNs. Information regarding the systemic therapy education program was readily available, including a discussion of continuing competency requirements (BC Cancer, 2024). While continuing competency in systemic therapy administration is ultimately the responsibility of the RN, BC Cancer (2024) provides recommendations on how to maintain competence. BC Cancer recommends that RNs administer at least 50 systemic therapy agents annually to maintain competency. In addition, RNs should develop and follow learning plans and engage in professional development activities to ensure continued competency in systemic therapy administration (BC Cancer, 2024). Systemic therapy RNs must submit a record of drug administration and continuing education activities annually to their clinical nurse coordinator to demonstrate continued competency (BC Cancer, 2024).

I reviewed the CCO website and located the document *Systemic Cancer Treatment Administration: Initial and Continuing Competence Standards for Registered Nurses* (2021). In this document, a maintenance of competency program is discussed that focuses on self-reflection and professional development, and maintenance of knowledge and skill (CCO, 2021). Self-reflection and professional development are achieved by completing a recommended self-assessment tool from either CANO or CCO, identifying individual learning needs, and developing an action plan (CCO, 2021). Recommendations for the maintenance of knowledge

and skills for RNs regularly administering systemic therapy include the completion of an approved systemic therapy maintenance course such as the CMCC from the de Souza Institute (CCO, 2021). For RNs administering systemic therapy less frequently, it is recommended that they complete a self-assessment and develop a collaborative professional development plan with organization leaders to maintain competency (CCO, 2021).

Both BC Cancer (2024) and CCO (2021) reported that their continuing competency processes align with the CANO standards and competencies for systemic therapy nursing practice. I reached out to both BC Cancer and CCO via email for further comment on their continuing competency approaches, however, did not receive a response despite follow-up.

Atlantic Canada

I reviewed websites for cancer care organizations in the Atlantic provinces including Nova Scotia (NS), New Brunswick (NB), and Prince Edward Island (PEI), for information on continuing education for RNs administering systemic therapy. During my search, I discovered the NB Cancer Network, however, I could not find any contact information for this organization on their website. I identified that the Horizon Health Network was the largest regional health authority in NB, providing adult oncology services across six provincial centers. I attempted to contact a representative from the Horizon Health Network via email but did not receive a response.

The Learning Institute for Health Care Providers delivers healthcare education for RNs administering systemic therapy in the Cancer Care Program at NS Health (Learning Institute, 2024). According to a nurse educator and faculty member for cancer care education programs, the Learning Institute has partnered with the de Souza Institute to provide tailored educational

content for systemic therapy RNs (K. Heighton, personal communication, July 22, 2024). RNs in NS are required to complete the de Souza Institute CCMC every 24 months to maintain their competence in systemic therapy administration (Learning Institute, 2024). In addition to the CCMC, RNs in NS are expected to maintain their competency annually by participating in continuing education activities that align with CANO standards and competencies (K. Heighton, personal communication, July 22, 2024). Similarly, systemic therapy RNs at the PEI Cancer Treatment Centre must complete the de Souza Institute CCMC every 18 months and frequently work in the systemic therapy unit to maintain competency (K. McQuaid-Duffy, personal communication, July 12, 2024).

Consultations

I used questionnaires to consult frontline systemic therapy RNs and semi-structured interviews to consult oncology RNs in leadership roles. Results from the consultations are discussed in detail in the following sections.

Questionnaires

I analyzed closed-ended responses using descriptive statistics and used thematic analysis for open-ended responses. I will discuss the findings in the following sections.

Descriptive Statistics.

I received an overwhelming response to the questionnaires from the frontline RNs in the local practicum setting resulting in rich data about their learning needs. I received 17 completed questionnaires, surpassing my initial aim of ten completed questionnaires. Most respondents (88%) reported that they currently administer systemic therapy in their practice. Respondents reported a wide range of oncology clinical experience representing a good mix of junior and

senior RNs (53% with 0-6 years' experience, 47% with 6-10 + years' experience). Respondents reported that most of the topics I had suggested for inclusion in the continuing education resource were important. Of note, all respondents reported that assessment and management of systemic therapy side effects and toxicities should be included in continuing education content. Most respondents (94%) identified that the pharmacology of systemic therapy drugs, identification and management of oncologic emergencies, and identification and management of extravasation and hypersensitivity reactions were priority areas for continuing education. Many respondents (88%) also identified that the administration of systemic therapy (e.g., safe handling, administration techniques, peripheral and central line care) and patient education should be included in continuing education. Respondents identified that principles of systemic therapy were less important to cover in continuing education (71%). Respondents reported that management of systemic therapy spills and accidental exposures were the least important to include in continuing education (53%). The question regarding additional topics to include in continuing education received few responses. However, suggestions included health assessment skills, supportive medications while receiving systemic therapy (e.g., steroids, anti-emetics, and prophylactic antibiotics), monitoring parameters for specific systemic therapy agents, and the intravenous line setups for specific drugs.

Most respondents (82%) thought that continuing education for RNs administering systemic therapy should be completed at least yearly or more frequently. Among those who thought continuing education should be completed less frequently, two respondents suggested every 2-5 years. Most respondents (76%) identified in-person education sessions led by an instructor as their preferred method of education. Fewer respondents (41%) indicated they would be open to engaging in continuing education through online self-directed learning and clinical

simulation. Very few respondents (12%) felt favorably toward using case studies and regular practice performance assessments as methods of continuing education. I provided a section for any other suggestions of methods for continuing education, however there were no responses provided.

Thematic Analysis.

I received many responses to the questions regarding systemic therapy RN's barriers to participation in continuing education and suggestions to help alleviate these barriers. I conducted a thematic analysis of these responses and identified the overall theme as the *unsuitability of continuing education.* Three subthemes were identified including *a lack of continuing education opportunities, timing of continuing education,* and *relevance of continuing education to nursing.*

Lack of Continuing Education Opportunities.

The first subtheme was a lack of continuing education opportunities. Respondents highlighted dissatisfaction with the availability of continuing education opportunities in the local setting. Respondents cited a lack of lunch-and-learn style education sessions and peer-to-peer education, as well as limited capacities for attendance at education sessions outside of business hours as contributing to the lack of continuing education opportunities. Some respondents voiced the desire for more consistency in continuing education and thought that monitoring of continuing education activities by program clinical educators could be beneficial. Some respondents requested more hands-on opportunities for clinical practice. One respondent voiced that the one-hour education sessions offered weekly in the local setting provided a great opportunity to engage in continuing education.

Timing of Continuing Education.

The second subtheme identified was the timing of continuing education. Many respondents reported that they did not have time to participate in continuing education activities. Specific concerns included not having dedicated time or sufficient staffing to allow RNs to step away from clinical practice during working hours to participate in continuing education activities. One respondent suggested that having time allotted during work hours for continuing education could increase RN engagement while another suggested increasing staffing to relieve frontline RNs so they could attend lunch and learn sessions. Some respondents stated that it was difficult to find time to attend continuing education in the evenings outside of working hours. Several respondents suggested that offering online options for these education sessions would be helpful. However, other respondents voiced that even when continuing education activities are available virtually, it is difficult to find time at home to avail of these opportunities while trying to balance home life and other commitments. One respondent suggested that an education summary could be compiled following each education session and provided to nursing staff to review at their convenience.

Relevance of Continuing Education to Nursing.

The final theme I identified is the relevance of continuing education to nursing. One respondent reported a lack of interest in the topics covered during available education opportunities while another voiced a lack of engagement in education sessions as a barrier to continuing education. One respondent stated that they thought the initial systemic therapy certification course was not overly nursing-focused and suggested that improvements be made to the course. Another respondent suggested that continuing education opportunities should be more nursing-focused and relevant to nursing practice. Although I could not clarify directly with the

respondent what “nursing focused” meant, I interpreted this response as providing continuing education opportunities solely for RNs specifically focused on nursing practice rather than an in-depth medical exploration of the topic (e.g., nursing considerations for a new systemic therapy drug versus specific pharmacology or clinical trial data).

Semi-Structured Interviews

I obtained rich data through semi-structured interviews with three oncology RNs in leadership roles, providing a unique perspective on the perceived needs of frontline RNs administering systemic therapy. I developed and used an interview guide to ensure I asked respondents the same questions and further explored or clarified their responses as needed. I conducted a thematic analysis of responses and identified prominent themes for each interview question.

I identified four themes related to the perceived needs of frontline systemic therapy RNs, *nursing skills, safety during administration, systemic therapy agents,* and *disease/treatment.* Respondents identified these as learning needs based on the questions they most frequently get asked and through observation of frontline RN's nursing practice. Specific *learning needs related to nursing skills* included the types of intravenous lines required for specific systemic therapy agents, administration of intraperitoneal chemotherapy, and care of central venous access devices. *Safety-related learning needs* included the appropriate use of personal protective equipment and closed-system transfer devices to reduce unwarranted exposures to systemic therapy, and the performance of safety checks such as independent double checks on infusion pump rates. Respondents identified *learning needs related to systemic therapy agents* as infusion times, side-effects of specific agents, acceptable lab values, monitoring parameters, and locating systemic therapy protocols. *Specific disease/treatment-related learning needs* of RNs were

primarily related to hematology such as cell therapy treatments (e.g., bone marrow transplant and stem cell transplant), blood product transfusion requirements, electrolyte imbalances, and management of infections in this population.

I asked oncology RNs in leadership roles what they thought would be the most effective approach to assist frontline RNs in maintaining their competency in systemic therapy administration. I identified three recurrent themes in this data set using thematic analysis, *regular clinical practice*, *frequent engagement in continuing education activities*, and *organizational support*. Respondents proposed that regular clinical practice, including frequently administering systemic therapy was essential to maintain competency. One respondent highlighted that frontline RNs can learn from each other in their daily practice by informally sharing their knowledge and experience.

Respondents suggested that frequent engagement in continuing education activities can assist RNs in maintaining their competency in systemic therapy administration. They suggested multiple activities that could be beneficial to RNs, such as participating in education sessions offered by the local cancer center or drug companies, attending conferences, and completing case studies. Respondents suggested that organizational support, such as the regular presence of clinical educators in the systemic therapy unit, performance assessments, and implementation of annual competency checklists could help systemic therapy RNs maintain continued competency.

I asked oncology RNs in leadership roles whether they thought a continuing education resource for RNs administering systemic therapy would be valuable. Respondents believed that a continuing education resource could be beneficial if it were developed appropriately. I identified an underlying theme of *comprehensive, accessible education* through thematic analysis. Respondents stated that since cancer therapies are constantly evolving, systemic therapy RNs

need the most current knowledge available to maintain competency. They suggested that regular updating of continuing education resource content is necessary to enable RNs to provide the best possible care to their patients. One respondent said that ensuring the continuing education resource is easy to access, use, and maintain is an important consideration during the development of the resource.

Synthesis of Results

I conducted an environmental scan and consultations with key stakeholders to explore the lack of continuing education for RNs administering systemic therapy in the local practice setting. During the literature review, I identified that a lack of continuing education was an issue globally. While conducting the environmental scan, I identified that larger organizations such as BC Cancer and CCO have formal continuing education programs for RNs administering systemic therapy in these provinces. In addition, smaller organizations in NS and PEI have similar formal continuing education programs in place. All continuing education programs identified during the environmental scan align with CANO Standards and Competencies for Oncology Nursing Practice in Systemic Therapy and utilize content from the de Souza Institute CCMC. Unfortunately, there are no formal continuing education programs for systemic therapy RNs in NL. The development of a continuing education resource locally is warranted and is supported by the existence of similar continuing education programs across Canada.

During the literature review, I determined that factors contributing to the lack of continuing education for systemic therapy RNs included ineffective approaches to self-directed learning, inconsistencies in education, and lack of accessibility to continuing education opportunities. I noted similarities between literature review findings and data collected during local consultations with frontline systemic therapy RNs and oncology RNs in leadership roles. In

the literature review, I found that oncology RNs identified ineffective approaches to self-directed learning, inconsistencies in education, and lack of accessibility to continuing education opportunities as hindering their participation in continuing education (Banihani et al., 2022; Coyne et al., 2019; Hsu et al., 2023). Similarly, frontline systemic therapy RNs in the local setting identified the unsuitability of current continuing education approaches to meet their learning needs. Specific issues included the availability of continuing education opportunities, the timing of continuing education, and the relevance of continuing education to nursing. Oncology RNs in leadership roles echoed these concerns and identified specific learning needs of frontline RNs administering systemic therapy as nursing skills, safety during systemic therapy administration, systemic therapy agents, and hematology disease/treatment principles.

I identified three main approaches to continuing education for RNs administering systemic therapy during the literature review: traditional classroom education, virtual education, and hybrid education models. In the consultation phase, systemic therapy RNs indicated their willingness to participate in traditional and virtual education as well as clinical simulation to maintain their competency in systemic therapy administration. However, more respondents preferred a traditional classroom education approach rather than virtual education, clinical simulation, or other approaches.

Conclusion

Combined findings from the literature review, environmental scan, and consultations will help guide the development of a continuing education resource for RNs administering systemic therapy locally. I may use existing continuing education programs, such as the CCMC from the de Souza Institute to guide the development of my continuing education resource. While I develop the continuing education resource, I will consider the factors contributing to a lack of

continuing education identified in the literature review, and the barriers to continuing education reported by systemic therapy RNs locally. I will aim to address the contributing factors and mitigate the barriers to continuing education during the resource development process. I plan to include content in the continuing education resource that will address the learning needs of frontline RNs identified during the literature review and consultations and aim to deliver this continuing education resource using the preferred approaches of RNs in the local setting. Finally, I will ensure that the continuing education resource that I develop reflects the continuing competency standards and competencies for systemic therapy RNs set forth by CANO.

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Appendix A
Email of Inquiry

To Whom It May Concern,

My name is Rebecca Decker, and I am a registered nurse (RN) from Newfoundland and Labrador (NL) currently completing a Master of Science in Nursing (MScN) at Memorial University of Newfoundland and Labrador. I am conducting a final practicum project to fulfill the requirements of my program under the supervision of Dr. Renee Crossman. I work in outpatient cancer care in the NL Health Services Provincial Cancer Care Program, primarily in systemic therapy administration. I have identified in my clinical area that there is a lack of formal continuing education for oncology RNs who administer systemic therapy beyond their initial certification. In response to this identified issue, I have proposed to develop a continuing education resource for oncology RNs who administer systemic therapy.

NL Health Services often coordinates educational opportunities for RNs, however engagement in continuing education for RNs throughout the province of NL is largely self-directed. I am interested in learning more about the continuing education approaches within your organization, specifically for oncology RNs who administer systemic therapy.

It would be helpful if you could kindly identify who would be the best point of contact at your organization for this inquiry or forward this email on my behalf. Any information provided will assist me in conducting a thorough environmental scan and guiding my project development. Please feel free to contact me with any additional questions or concerns. I would be happy to provide the contact information of my supervisor if you require further information. Your assistance in this matter is greatly appreciated. I can be contacted via the email listed below.

Best Regards,

Rebecca Decker BN RN
MScN Student
rsgh43@mun.ca
Memorial University

Appendix B
Questionnaire

To fulfill the requirements of the Master of Science in Nursing (MScN) Program at Memorial University of NL, I am developing a continuing education resource for oncology RNs who administer systemic therapy in NL. This questionnaire is administered as part of the consultation phase of this project, to determine the learning needs of oncology RNs who administer systemic therapy across NL and their preferred learning styles. Voluntary completion of this questionnaire will indicate implied consent to use responses for this project. To maintain confidentiality of responses, your name will not be attached to this questionnaire.

1. In your oncology nursing practice, do you currently administer systemic therapy?

☐ Yes ☐ No

2. Please indicate how many years of **oncology** nursing experience you have.

☐ 0-3 years ☐ 3-6 years ☐ 6-9 years ☐ 10 or more years

3. Please identify which topics you feel are important to be included in continuing education for oncology RNs who administer systemic therapy. (Check all that apply).

☐ Principles of systemic therapy (pathophysiology of cancer, cancer staging, treatment principles).

☐ Administration of chemotherapy (safe handling, administration techniques, peripheral and central line care).

☐ Pharmacology of systemic therapy drugs (chemotherapy, immunotherapy, targeted therapy, hormonal therapy).

☐ Assessment and management of systemic therapy side effects and toxicities.

☐ Identification and management of oncologic emergencies (sepsis, tumor lysis syndrome, superior vena cava syndrome etc.).

☐ Identification and management of extravasation, and hypersensitivity reactions.

☐ Teaching patients about their systemic therapy treatments and management of associated side-effects.

☐ Management of systemic therapy spills and accidental exposures.

4. Are there any other topics that you think should be covered in continuing education for

oncology RNs who administer systemic therapy that are not listed above?

5. As an oncology RN who administers systemic therapy, how would you prefer to engage in continuing education?

- ☐ In-person education session led by an instructor
- ☐ Self-directed learning modules (online)
- ☐ Case studies
- ☐ Clinical simulation
- ☐ Regular practice performance assessment
- ☐ Other (specify) _____

6. How often should oncology RNs complete continuing education to maintain their competency in systemic therapy administration?

☐ Never ☐ Yearly ☐ More Often ☐ Less often

7. As an oncology RN, what challenges have you faced with participating in continuing education activities?

8. What would help you overcome any challenges identified in question 7?

Appendix C
Interview Guide

1. Based on your experience and interactions with frontline oncology RNs who administer systemic therapy, have you identified any areas in which they could benefit from additional education? How do you know this? What questions from frontline oncology RNs do you most frequently get asked?

2. Based on your experience, what would be the most effective approach to assist frontline oncology RNs in maintaining their competency in systemic therapy administration? Why?

3. Based on your experience, do you think that providing a continuing education resource for oncology RNs who administer systemic therapy would be valuable? Why or why not?

Appendix D
Thematic Analysis Example

Part A - Questionnaires
Overall Theme: Unsuitability of continuing education Subthemes: • Lack of continuing education opportunities. • Timing of continuing education • Relevance of continuing education to nursing
Part B – Semi-Structured Interviews
Themes (Learning Needs) • Nursing skills • Safety during administration • Systemic therapy agents • Disease/treatment
Themes (Approaches to Continuing Education) • Frequent clinical practice • Frequent engagement in continuing education activities • Organizational requirements.
Theme (Value of Continuing Education) • The need for a comprehensive and accessible continuing education resource

Appendix E
Health Research Ethics Authority (HREA) Screening Tool

Student Name: Rebecca Decker

Title of Practicum Project: Development of a Continuing Education Resource for Oncology Registered Nurses who Administer Systemic Therapy

Date Checklist Completed: July 25th, 2024.

This project is exempt from Health Research Ethics Board approval because it matches item number _____**3**____ from the list below.

1. Research that relies exclusively on publicly available information when the information is legally accessible to the public and appropriately protected by law; or the information is publicly accessible and there is no reasonable expectation of privacy.
2. Research involving naturalistic observation in public places (where it does not involve any intervention staged by the researcher, or direct interaction with the individual or groups; individuals or groups targeted for observation have no reasonable expectation of privacy; and any dissemination of research results does not allow identification of specific individuals).
3. Quality assurance and quality improvement studies, program evaluation activities, performance reviews, and testing within normal educational requirements if there is no research question involved (used exclusively for assessment, management or improvement purposes).
4. Research based on review of published/publicly reported literature.
5. Research exclusively involving secondary use of anonymous information or anonymous human biological materials, so long as the process of data linkage or recording or dissemination of results does not generate identifiable information.
6. Research based solely on the researcher's personal reflections and self-observation (e.g. auto-ethnography).
7. Case reports.
8. Creative practice activities (where an artist makes or interprets a work or works of art).

For more information please visit the Health Research Ethics Authority (HREA) at https://rpresources.mun.ca/triage/is-your-project-exempt-from-review/

Appendix D

Educational Resource PowerPoint

Continuing Education for Registered Nurses who Administer Systemic Therapy in the Outpatient Setting

Rebecca Decker BNRN

December 2024

Introduction to Course

The Canadian Association of Nurses in Oncology (CANO) sets guidelines and recommends implementing a Systemic Therapy Continuing Competence Program to maintain registered nurses' (RNs) competency in administering systemic therapy. CANO recommends that RNs demonstrate their continued competence in systemic therapy annually. This continuing education resource was developed as a quality improvement initiative to address the lack of continuing education for registered nurses who administer systemic therapy in the outpatient setting following CANO recommendations. CANO identified participation in a continuing education program as an acceptable modality to assist RNs in maintaining their systemic therapy competency.

Course Objective

To assist RNs in maintaining systemic therapy competency by providing education in the following areas based on CANO recommendations:

1. Principles of systemic therapy administration
2. Systemic therapy cancer agents and regimens
3. Equipment for administering systemic therapy agents
4. Best practice standards, policies, and procedures
5. Symptom management
6. Monitoring parameters throughout treatment
7. Adverse event monitoring and management
8. Safe handling, spill management, and waste disposal of hazardous drugs

Section 1:
Principles of Systemic Therapy Administration

Overview of Topics

- Goals of Systemic Therapy
- Treatment Modalities
- Cancer Staging
- Cancer Grading
- The Cell Cycle

Goals of Systemic Therapy

- Curative intent
- Palliative intent

Treatment Modalities

- First line treatment
- Salvage therapy
- Adjuvant
- Neoadjuvant

Treatment Modalities

- Induction
- Consolidation/Intensification
- Maintenance/Continuation
- Central nervous system (CNS) Prophylaxis

Cancer Staging

TNM Staging System

- **T**umor – size/growth of primary tumor
- **N**odes – whether spread to lymph nodes in present
- **M**etastasis – whether spread to other areas has occurred

Cancer Staging

- Localized
- Advanced
- Distant
- Metastatic

Cancer Grading

Grading refers to the microscopic features of cancer cells

- Well differentiated
- Poorly differentiated
- Moderately differentiated

The Cell Cycle

Process of cellular growth and division

- Cell cycle-specific agents
- Cell cycle non-specific agents

Case Discussion

Janice is a 63-year-old female diagnosed with metastatic breast cancer. Their metastases are small, and the prognosis is good. Their oncologist offered them "palliative chemotherapy." When you see Janice for their first treatment in the systemic therapy unit, they start to cry, stating "I need to get my affairs in order, the doctor told me I'm palliative so that means I am going to die soon." How would you respond to Janice?

Section 2: Systemic Therapy Cancer Agents

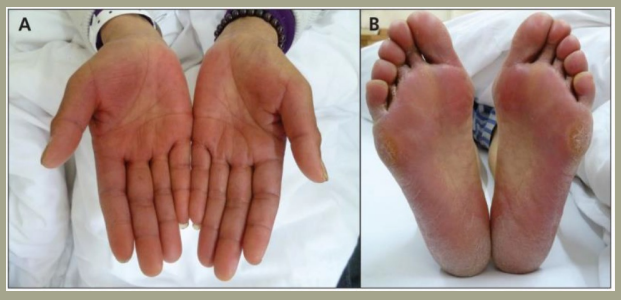
Overview of Topics

- Systemic Therapy Side-Effects
- Systemic Therapy Agents
- Special Considerations for Key Systemic Therapy Agents

Common Systemic Therapy Side-Effects

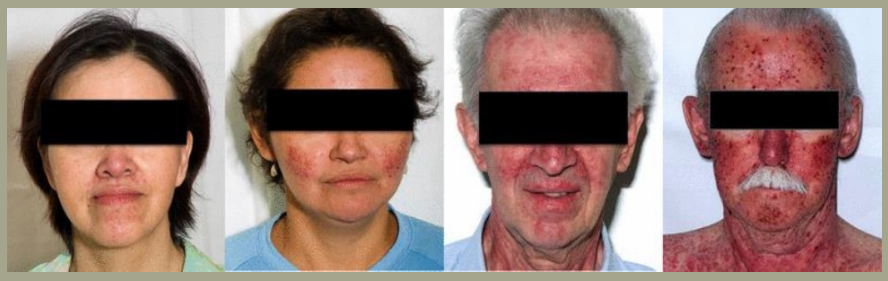
- Myelosuppression
- Fatigue
- Nausea and vomiting
- Decreased appetite
- Alopecia
- Diarrhea, constipation
- Stomatitis/mucositis
- Skin changes
- Cognitive difficulties
- Sexual difficulties
- Infertility
- Risk of secondary cancers
- Neuropathy

Palmar-Plantar Erythrodysesthesia (PPE)



Source: BC Cancer (2019, January)

Acneiform Rash



Source: BC Cancer (2016, February)

Systemic Therapy Agent Overview

- Alkylating agents
- Antimetabolites
- Anti-tumor antibiotics
- Topoisomerase inhibitors
- Mitotic inhibitors
- Immunotherapy
- Monoclonal antibodies
- Targeted therapy
- Hormonal therapy
- Supportive medications

Alkylating Agents

- Cell cycle non-specific
- Prevent cancer cell from reproducing by damaging DNA
- Includes bendamustine, carboplatin, cisplatin, cyclophosphamide, dacarbazine, temozolomide, ifosfamide, oxaliplatin

Clinical Considerations: Alkylating Agents

Cisplatin: nephrotoxicity, ototoxicity, peripheral neuropathy

Cyclophosphamide: hemorrhagic cystitis

Ifosfamide: neurotoxicity, hemorrhagic cystitis

Oxaliplatin: peripheral sensory neuropathy, pharyngolaryngeal dysesthesia

Dacarbazine: burning with infusion

Antimetabolites

- Cell-cycle specific
- Replaces building blocks of DNA/RNA, interfering with their formation, causing cellular death
- Includes azacitidine, 5-fluorouracil, capecitabine, gemcitabine, methotrexate, pemetrexed

Clinical Considerations: Antimetabolites

Cytarabine: neurological symptoms, PPE

Fluorouracil: cardiotoxicity, PPE, stomatitis, diarrhea

Capecitabine: PPE, diarrhea

Pemetrexed: requires pre-medication, rash

Fludarabine: immunosuppression, must receive irradiated blood products

Anti-tumor Antibiotics

- Cell cycle non-specific (exception: asparaginase)
- Alter DNA to prevent growth and multiplication
- Includes dactinomycin, mitomycin, bleomycin, asparaginase
- Also includes the subtype anthracyclines

Clinical Considerations: Anti-tumor Antibiotics

Bleomycin: pulmonary toxicity, fever during administration, skin changes

Dactinomycin: vesicant, rash

Mitomycin: vesicant, myelosuppression

Anthracyclines

- Interferes with enzymes necessary for copying of DNA
- Binds with DNA to prevent cellular reproduction
- Includes doxorubicin, epirubicin, daunorubicin, mitoxantrone

Clinical Considerations: Anthracyclines

- Lifetime dosing limits
- Cardiac toxicity
- **Doxorubicin, epirubicin**: red urine
- **Mitoxantrone**: blue-green urine

Topoisomerase Inhibitors

- Part of plant alkaloid family
- Interferes with topoisomerase enzyme, preventing copying of DNA
- Topoisomerase I inhibitors (camptothecins). Includes irinotecan, topotecan
- Topoisomerase II inhibitors (epipodophyllotoxins). Includes etoposide

Clinical Considerations: Topoisomerase Inhibitors

Irinotecan: cholinergic symptoms, diarrhea, myelosuppression

Topotecan: myelosuppression

Etoposide: requires non-PVC, filter tubing, risk of hypersensitivity reaction

Mitotic Inhibitors

- Part of plant alkaloid family
- Cell cycle-specific
- Prevents protein formation, cell reproduction, and cell division
- Includes taxanes (paclitaxel, docetaxel, cabazitaxel, nab-Paclitaxel) and vinca alkaloids (vincristine, vinblastine, vinorelbine)

Clinical Considerations: Taxanes

- Myelosuppression
- Neurological toxicities
- Hypersensitivity reactions
- **Docetaxel**: fluid retention, pre-treatment with steroids, nail loss
- **Paclitaxel/Cabazitaxel**: filtered IV line
- **Nab-paclitaxel**: ECG changes

Clinical Considerations: Vinca Alkaloids

All vinca alkaloids are vesicants

Vinorelbine: myelosuppression, elevation of AST/bili, peripheral neuropathy

Vincristine: peripheral neuropathy

Vinblastine: leukopenia, paresthesia

Immunotherapy

- May also be referred to as "biologic therapy"
- Stimulates the immune system to identify and attack cancer cells
- Includes checkpoint inhibitors, monoclonal antibodies, CAR T-cell therapy, and immunomodulators

Checkpoint Inhibitors

- "Checkpoint" proteins on immune cells must be switched on (or off) to mount immune response
- Stimulate the immune system to locate and kill more cancer cells
- Include pembrolizumab, nivolumab, durvalumab, ipilimumab

Clinical Considerations: Checkpoint Inhibitors

- Gastrointestinal symptoms
- Fatigue, muscle and joint pain
- Rash, pruritis
- Autoimmune reactions**
- Infusion reactions

CAR T-cell Therapy

- Chimeric antigen receptor T-cell therapy
- Involves altering T-cells in a lab to recognize and kill cancer cells
- T-cells are removed from the blood, altered, then reinfused
- Includes tisagenlecleucel, axicabtagene ciloleucel

Clinical Considerations: CAR T-cell Therapy

- Cytokine release syndrome
- Nervous system side-effects
- Allergic reactions
- Electrolyte imbalances
- Myelosuppression

Immunomodulators

- Directly target the immune system to ramp up or down proteins
- Used to treat specific cancers including multiple myeloma, bladder cancer, and some early-stage skin cancers.
- Include thalidomide, lenalidomide, pomalidomide, Bacillus Calmette-Guérin [BCG]), imiquimod).

Clinical Considerations: Immunomodulators

-lidomides: fatigue, drowsiness, constipation, low blood counts, neuropathy, birth defects

BCG: flu-like symptoms, localized burning (instilled in the bladder)

Imiquimod: skin reactions

Monoclonal Antibodies (MoAbs)

- Antibodies developed in a lab to target specific cancer cell antigens
- Help trigger an immune system response
- Includes "naked" MoAbs. (rituximab), conjugated MoAbs. (brentuximab vedotin, ado-trastuzumab emtansine), and bispecific MoAbs (bispecific T-cell engagers [BiTE therapy, e.g. teclistimab])

Targeted Therapies

- Differs from traditional chemotherapy
- Target specific proteins or receptors on cancer cells
- Block signals that affect cancer cell production
- Signal cancer cells to destroy themselves
- Normal cells are not affected by these therapies

Types of Targeted Therapies

- Angiogenesis inhibitors (e.g., bevacizumab, sunitinib)
- Monoclonal antibodies (e.g., trastuzumab)
- Proteasome inhibitors (e.g., bortezomib)
- Tyrosine kinase inhibitors (e.g., imatinib)
- Poly ADP-ribose polymerase (PARP) inhibitors (e.g., olaparib)

Clinical Considerations: Targeted Therapies

- Skin changes
- High blood pressure (angiogenesis inhibitors)
- Side-effects similar to traditional chemotherapy

Biosimilars

- Mimics the function of a “brand name” biologic drug
- Considered safe, effectives alternatives to biologic drugs
- May be less expensive
- Includes Mvasi, Zirabev, Ruxience, Kanjinti

Hormonal Therapies

- Interferes with hormones that contribute to cancer growth
- May slow or stop cancer growth
- May prevent cancer cells from using a specific hormone or prevent the body from producing the hormone
- Frequently used for breast, prostate, and gynecologic cancers

Hormonal Therapy – Breast Cancer

- Aromatase inhibitors (AIs) (anastrozole, letrozole, exemestane)
- Selective estrogen receptor modulators (tamoxifen)
- Estrogen receptor antagonists (fulvestrant)
- Luteinizing hormone-releasing hormone agonist (LHRH) (goserelin)

Hormonal Therapy – Prostate Cancer

- Androgen deprivation therapy (apalutamide, enzalutamide, bicalutamide)
- LHRH agonists (goserelin, leuprolide)
- Gonadotropin-releasing hormone antagonists (degarelix)
- CYP17 inhibitors (abiraterone)

Hormonal Therapy – Endometrial Cancer

- Progestins (medroxyprogesterone acetate, megestrol acetate)
- Tamoxifen
- LHRH agonists (goserelin, leuprolide)
- AIs (letrozole, anastrozole, exemestane)

Miscellaneous Agents

- **All-trans retinoic acid (ATRA, tretinoin)** is a "differentiation-inducing agent" used in the treatment of acute promyelocytic leukemia (APL).
- **Arsenic trioxide** has various mechanisms of action and is also used in treatment of APL.

Supportive Medications

- Corticosteroids
- Colony stimulating factors
- Bisphosphonates
- Allopurinol
- Mesna

Colony Stimulating Factors

- Stimulate bone marrow to produce RBCs and WBCs
- Improve ability to fight infection, anemia
- Granulocyte colony-stimulating factor (G-CSF) (Filgrastim, Pegfilgrastim)
- Erythrocyte growth factors (Erythropoietin, Darbepoetin)

Administration of GCSF

- Rotate injection sites
- Most common side-effect is bone pain
- Filgrastim 300 or 480mg SQ daily 24-48H post treatment
- Pegfilgrastim 6mg SQ x 1 24-72 hours post treatment

Bisphosphonates

- "Bone strengthening" agents
- Slows down action of osteoclasts
- Used I patients with metastatic cancer with bone metastases, multiple myeloma, and long-term corticosteroid or hormonal therapy use
- Includes pamidronate, zoledronic acid

Case Discussion

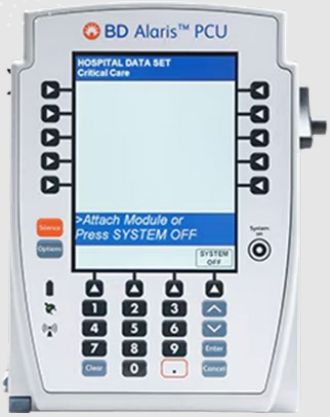
George is a 58-year-old male diagnosed with colon cancer and receiving treatment with capecitabine and oxaliplatin. You saw them in the outpatient clinic last week, where they complained of some mild tenderness in their palms. When George arrives for oxaliplatin, they report soreness and tenderness of their palms, and you notice mild redness and swelling on both hands. What may be causing these issues? What should you do?

Section 3: Equipment for Administration of Systemic Therapy Agents

Overview of Topics

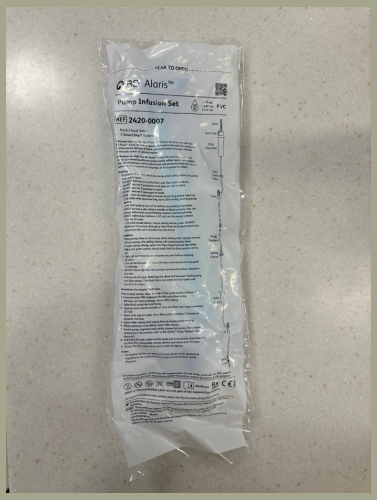
- IV infusion pumps
- IV lines
- Closed system transfer devices (e.g. PhaSeal)
- Elastomeric infusor

IV Infusion Pump

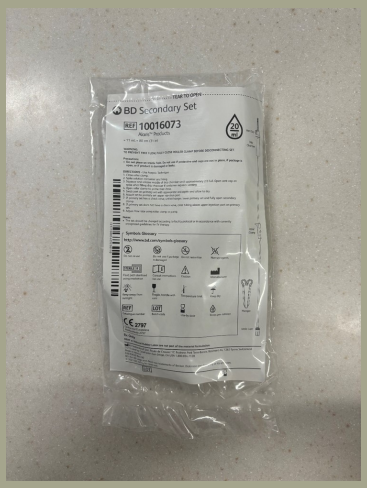


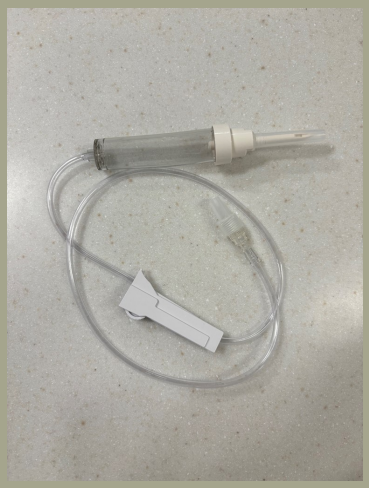
Source: BD (2024)

IV Lines: Primary Set

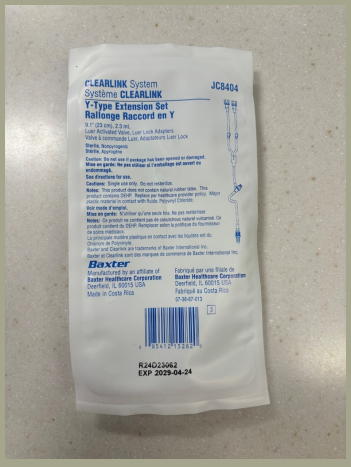


IV Lines: Secondary Set

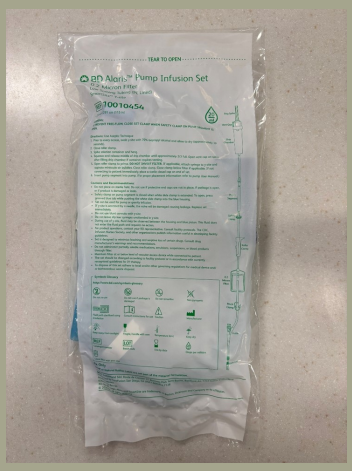




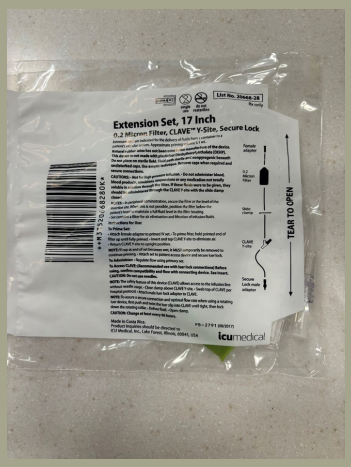
IV Lines: Y Type Extension Set

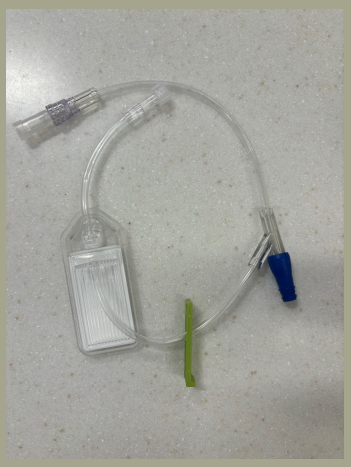


IV Lines: Micron Filter Lines



IV Lines: Micron Filter Extension Set



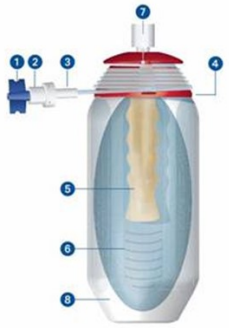


Closed System Transfer Devices

Source: BD (2024)

Elastomeric Infusor

1. **Winged Luer Cap** protects the opening and stops the flow of medication.
2. **Luer Lock Connector** at the end of the tubing attaches the Infusor/Intermate to the catheter/port.
3. **Flow Restrictor** controls the infusion rate of the medication.
4. **Tubing** is kink-resistant and carries the medication from the device into the patient's body.
5. **Balloon Reservoir** holds the medication.
6. **Progression Lines** may be horizontal or vertical on the plastic housing. These show you the progress of the infusion.
7. **Fill Port Cap** protects the Infusor/Intermate device.
8. **Plastic Housing**.



Source: Baxter (2010)

Nursing Considerations: Elastomeric Infusor

- Ensure all clamps are open on the device once connected
- Initial patient education is provided by the home infusion program coordinator
- RN to review teaching with patient
- Arrange community health disconnection time
- Ensure patient is prepared for emergencies

Case Discussion

You are the RN assigned to orientate a new RN who has transferred from another area to your systemic therapy unit. They observe you programming your BD™ Alaris Pump to administer systemic therapy, using the Guardrails™ function. The RN asks why you use Guardrails, as they are unfamiliar with it. How would you best describe this function?

Section 4:
Best Practice Standards, Policies, and Procedures

Overview of policies

- Administration of parenteral chemotherapy
- Administration of vesicants
- Implanted ports
- Tunnelled central venous devices
- Administration of intraperitoneal chemotherapy

Systemic Therapy Administration

Includes all aspects of care related to systemic therapy administration:

- Patient assessment
- Verifying drug
- Initiating and maintaining vascular access
- Administering the systemic therapy
- Monitoring and managing side effects and toxicities
- Coordinating treatment-related follow-up care

RN Responsibilities Pre-Treatment

- Review patient information
- Verify consent for treatment
- Review labs
- Ensure weight is documented before each cycle
- Review systemic therapy orders
- Complete nursing assessment including vital signs

RN Responsibilities During Treatment

- Establish vascular access
- Perform independent double checks
- Wear appropriate PPE
- Use closed system transfer devices
- Use appropriate administration techniques
- Have emergency supplies available
- Monitor patient at least hourly while systemic therapy infusing

RN Responsibilities Post-Treatment

- Discard of supplies appropriately
- Assess patient status
- Provide post-treatment teaching
- Ensure patient has follow-up arrangements

Peripheral Venous Access

- Choose the most appropriate access site
- Avoid antecubital fossa where possible
- Ensure brisk blood return
- Choose a large vein if administering vesicants/irritants
- Flush with saline to ensure patency before initiating systemic therapy

Central Venous Access Devices (CVADs)

Implanted Port

- Surgically implanted
- Aseptic technique
- Lock with 5ml of heparin (100 uts/ml) after use

Source: BD (2024)

CVADs

Tunnelled Central Venous Access Device

- Aseptic technique
- Notify physician if tunneled cuff becomes exposed
- Lock with 2.5ml heparin (100 uts/ml) after use

Source: BD (2024)

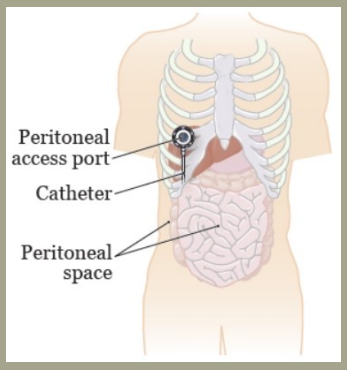
Administration of Vesicants

- Vesicants include vinca alkaloids and anti-tumor anti-biotics
- If multiple systemic therapy agents are ordered, administer vesicant first
- Check blood return and monitor IV site frequently
- Allow IV fluid to run freely via gravity during administration
- Administer at a rate of 2-3 ml/min
- Immediately stop the infusion if signs of extravasation occur

Intraperitoneal Chemotherapy

- Intraperitoneal (IP) instillation of high doses of chemotherapy into the abdominal cavity
- Used for treatment of some ovarian cancers
- Administered through an implanted abdominal port
- Assess for ascites before administration

IP Chemotherapy



Source: NL Health Services Policy 340-NG-170 (2023)

IP Chemotherapy Administration

- Patient should empty bladder prior to accessing IP port
- Fluids and chemotherapy must be warmed prior to administration
- Administer treatment as ordered free flow by gravity ONLY
- Patient to remain on bedrest during instillation
- Monitor for tolerance to treatment

Post Administration of IP Chemo

- De-access IP port immediately after administration of post-fluids
- Lock port with 10 mls of heparin solution (10 units/ml)
- Apply sterile gauze and transparent dsg to the site
- Instruct on positioning Q15 mins x 1 hour
- Patient teaching

Case Discussion

Glenda is a 55-year-old female with ovarian cancer who presents to the systemic therapy unit for intraperitoneal chemotherapy treatment. During instillation, what complications should the RN assess for?

Section 5: Symptom Management

Overview of Symptoms

- Fatigue
- Myelosuppression
- Nausea & vomiting
- Decreased appetite, anorexia
- Constipation
- Diarrhea
- Stomatitis
- Alopecia
- Skin changes
- Sexuality & intimacy
- Infertility
- Peripheral neuropathy
- Cognitive changes

Fatigue

- Determine the severity of fatigue
- Assess for underlying causes
- Encourage light physical activity
- Encourage energy conservation, prioritization of tasks
- Encourage good sleep hygiene
- Encourage adequate nutrition and hydration
- Provide psychosocial support

Myelosuppression

- Dosage modifications may be warranted
- Encourage the patient to take preventative measures
- May require blood products (i.e., blood, platelets)
- May require GCSF to stimulate white blood cell production

Nausea & Vomiting

- Encourage the patient to eat small, bland meals and avoid large fluid intake at mealtimes
- Avoid solid foods for 30-60 mins after vomiting
- Encourage the patient to maintain good oral health
- Encourage use of distraction techniques for anticipatory nausea
- Counsel on appropriate anti-emetic use
- Administer IV fluids or electrolyte replacements as ordered

Decrease Appetite, Anorexia

- Encourage patient to increase liquid intake (e.g., soup, smoothies, nutritional shakes) as tolerated
- Encourage high-calorie, high-protein foods (e.g., cheese, eggs, yogurt, nut butter)
- Encourage patient to eat frequent, small meals (5-6 per day)
- Encourage patient to sit upright 30-60 mins after eating to aid in digestion
- Monitor weight loss
- Refer to dietician as needed

Constipation

- Encourage physical activity
- Encourage adequate fluid intake
- Suggest dietary changes (e.g., increased fiber intake)
- Counsel to avoid other medications that cause constipation
- Educate regarding symptoms that require medical attention
- Recommend sennosides and polyethylene glycol 3350 (PEG) for systemic therapy/opioid-related constipation

Diarrhea

- Encourage the patient to maintain adequate oral hydration
- Encourage to avoid potential triggers (e.g., spicy, greasy foods)
- Counsel to temporarily discontinue laxatives
- Encourage good hygiene and use of sitz baths for soreness
- Counsel on taking loperamide
- Notify the physician if diarrhea occurs while on immunotherapy
- Educate patient on symptoms that require medical attention

Loperamide Dosing

Standard loperamide dosing:

4mg then 2mg Q4H or after each loose BM. Max 16mg/day (unless otherwise directed by pharmacist or physician).

Loperamide for diarrhea associated with **irinotecan** may exceed package directions:

4 mg then 2mg Q2H until diarrhea has subsided for 12H. Can take 4mg Q4H overnight.

Stomatitis (Oral Mucositis)

- Encourage patient to practice good oral hygiene using a soft, manual toothbrush
- Encourage oral rinses 4x daily (baking soda, or saltwater rinses)
- Discuss with physician if prescription mouthwash may be required
- Encourage to avoid commercial mouthwash containing alcohol
- Encourage to increase oral hydration, avoid dry/hard/spicy foods
- Monitor for complications (e.g., thrush)

Mouths Rinses for Stomatitis

Saline rinse:	Baking soda rinse:
½ tsp salt in	¼ - ½ tsp baking soda
1 cup of water	in 1 cup water

Alopecia

- Provide education regarding hair loss and regrowth
- Encourage patient to limit hair washing, and use gentle products/tools
- Encourage use of an electric razor
- Encourage the patient to wear a hat, scarf, or head covering to keep warm or protect from the sun
- Discuss wigs and hair alternatives
- Discuss supportive resources

General Skin Care Recommendations

- Use mild soaps, wash skin gently
- Avoid scratching
- Apply unscented moisturizers frequently
- Apply cool compresses
- Avoid extreme heat/cold
- Wear loose clothing
- Avoid sun exposure/apply sun protection

Acneiform Rash

- Encourage patient to follow general skin care recommendations
- Counsel to avoid over the counter acne treatments
- Further medical management may be required if rash worsens

Palmar-Plantar Erythrodysesthesia (PPE)

- Encourage to use non-urea-based creams preventatively
- If mild symptoms occur, advise a switch to a lanolin-based cream
- Encourage to reduce friction to hands and feet
- May require further management if worsens (e.g. topical steroids, anti-biotics, pain management)

Peripheral Neuropathy

- Assess severity of neuropathy (e.g. impact on ADLs, ambulation)
- Encourage the patient to monitor the skin integrity on their hands and feet often
- Suggest to avoid tight-fitting shoes
- Encourage to remove obstacles to ambulation in the home
- Encourage to use ambulation aid if required
- Discuss further medical management or treatment changes with the physician

Cognitive Changes

- Consider a referral to occupational therapy
- Offer referral to supportive counselling
- Suggest coping strategies
- Encourage patient to engage in mentally stimulating activities
- Encourage patient to engage in physical activity
- Encouraged patient to decrease stress

Sexuality & Intimacy

- Provide an open and safe environment for discussion
- Provide education regarding the impacts of illness and treatment
- Educate on preventing pregnancy and bodily fluid exposure while receiving systemic therapy
- Offer referral for sexual health counseling
- Encourage the patient to discuss medical management with the physician

Infertility

- Provide education on the potential for infertility with systemic therapy
- Encourage an early, and open discussion of fertility with the healthcare team
- Consider referral to fertility specialist/clinic
- Discuss if delaying treatment start for fertility preservation measures is possible

Case Discussion

Tony is receiving systemic therapy for metastatic cancer and is taking morphine regularly for bone pain. You assess Tony pre-treatment in the systemic therapy unit. Tony reports that they are experiencing worsening constipation and asks how to manage constipation at home best. What would the RN suggest?

Chapter 6:
Monitoring Parameters Throughout Treatment

Overview of Topics

- Lab values
- Urine protein
- Special considerations: bevacizumab
- Special considerations: rituximab
- Vital signs monitoring

Myelosuppression

- Hematologic toxicities are the most common cause of treatment delays
- **Nadir**: the period after drug administration when the lowest blood counts are observed
- Drugs often have a predictable nadir
- Most nadirs for white blood cells (WBCs) occur in 7-14 days
- Cell counts typically recover in 21-28 days

WBCs

Elevated WBCs (leukocytosis and neutrophilia) may be caused by:

- Infection
- Myeloproliferative disorders
- Inflammation
- Corticosteroids
- Colony stimulating factors

WBCs

- Low WBCs (leukocytopenia + neutropenia) may be caused by:
  - Bone marrow invasion (i.e. leukemia)
  - Systemic therapy agents

Neutrophils

- Absolute neutrophil count (ANC): total # of circulating neutrophils
- Normal ANC 2 – 7.5 × 10^9 neutrophils/L of blood
- May not fully recover between cycles, resulting in dose reductions or treatment delays
- Generally, the threshold for tx is ANC ≥ 1.5 × 10^9
- Some protocols may warrant the use of GCSF
- Educate patients on the signs of febrile neutropenia

Platelets

Elevated platelets (thrombocytosis) may be caused by:

- Certain types of cancer
- Inflammatory disease
- Splenectomy

Platelets

Low platelets (thrombocytopenia) may be caused by:

- Viral infections
- Bone marrow invasion (e.g. leukemia, lymphoma)
- Systemic therapy agents

Platelets

- Normal platelet count 150 – 400 × 10^9 platelets/L of blood.
- May not fully recover between cycles, resulting in dose reductions or treatment delays
- Generally, the threshold for tx is 100 × 10^9 platelets/L
- Dosage adjustments may not be necessary if thrombocytopenia is disease-related

Red Blood Cells

- Least affected by systemic therapy due to their longer life span
- Effects are cumulative, and anemia may occur with more cycles of treatment
- Patient may be symptomatic (e.g., fatigue, weakness)
- Multiple factors may contribute to anemia
- Cisplatin is commonly associated with anemia

Liver Function Tests (LFTs)

- Alanine Aminotransferase (ALT)
- Aspartate Aminotransferase (AST)
- Alkaline Phosphate (ALP)
- Lactate Dehydrogenase (LDH)
- Total bilirubin

LFTs

Elevations in LFTs may be caused by:

- Liver cancer
- Liver metastases
- Hepatitis
- Cholestasis
- Gallstones
- Pancreatic cancer
- Drug-related hepatocellular injury

Renal Function Tests

- Serum creatinine
- Creatinine clearance (CrCl)
- Glomerular filtration rate (GFR)
- Urea, nitrogen
- Urine protein

Clinical Considerations: Renal Function Tests

- Decreased CrCl may indicate decreased renal function
- Low CrCl may warrant dose delays or reductions
- Important to review individual protocols in the presence of decreased kidney function
- Caution with systemic therapy agents primarily excreted by kidneys
- Baseline thresholds for some agents (e.g., cisplatin)

Electrolytes

- Sodium
- Potassium
- Chloride
- Bicarbonate
- Calcium
- Magnesium
- Phosphate

Electrolyte Imbalances

Can be caused by:

- Cancer
- Systemic therapy agents
- Treatment-related side effects (e.g., diarrhea, vomiting)
- Dehydration
- Other medications (e.g., diuretics)

Clinical Considerations: Electrolytes

- Electrolyte imbalances can cause cardiac arrhythmias
- Acute, significant changes require intervention
- Hypercalcemia is common in advanced cancers and may require treatment
- Hypomagnesemia is common with cisplatin, and panitumumab

Urine Protein

- Can be measured using a dipstick, urine sample, or 24H urine collection
- Increased urine protein may be seen with
  - Multiple myeloma
  - Nephrotoxic medications
- Special considerations for bevacizumab

Special Considerations: Bevacizumab

- Monitor urine protein using a dipstick
- **Gynecology** protocol: monitor EVERY cycle
- **Gastrointestinal** protocol: monitor Q2 cycles (even # cycles)

Urine Protein Monitoring: Bevacizumab

Urine Protein Result	Action
1+	Proceed with tx
2+ or 3+	Proceed with tx, 24H urine (within 3 days of next dose)
4+	Hold tx, 24H urine

Blood Pressure Monitoring: Bevacizumab

- Acute hypertension (HTN) may occur during administration
- Stop the infusion, then reassess blood pressure (BP)
- Symptomatic HTN (e.g., change in LOC, headache) or BP 180/110 that does not improve in one hour after stopping infusion requires further intervention

BP Monitoring: Bevacizumab

Gastrointestinal Protocols

Blood Pressure (mmHg)	Action
≤ 160/100	Proceed with tx
≥ 160/100	Notify physician, may initiate anti-hypertensives
Acute hypertensive crisis	Discontinue tx

BP Monitoring: Bevacizumab

Gynecology Protocols

*Note the difference in systolic BP threshold from GI protocols

BP (mmHg)	Action
≤ 150/100	Proceed with tx
≥ 150/100 (asymptomatic)	Notify physician, may initiate anti-hypertensives
Acute hypertensive crisis	Discontinue tx

Special Considerations: Rituximab

- Rituximab can cause hypotension
- Risk of tumor lysis syndrome with first dose
- Risk of hypersensitivity reaction
- First dose is given at a reduced/graduated infusion rate
- Premedication with antihistamine and antipyretic
- In some protocols, SQ rituximab replaces IV after the first dose

Pre-Medication for Rituximab

IV Infusion:

- Diphenhydramine 50mg PO before, then Q4H if infusion exceeds 4H
- Acetaminophen 650-975mg PO before, then Q4H if infusion exceeds 4H

SQ Administration:

- Diphenhydramine 50mg PO before
- Aacetaminophen 650-975 mg PO before

Rituximab IV Infusion Rates

First dose

- Start infusion at 50 mg/hr for the first hour
- Increase rate by 50mg/hr Q30 mins
- Max rate of 400 mg/hr

Subsequent doses

- If no sign of hypersensitivity reaction, administer over 90 mins (20% of dose in the first 30 mins, remaining 80% over 60 mins)

Vital Sign Monitoring

- Increased vital sign (VS) monitoring may be warranted for agents that are associated with a higher risk of a hypersensitivity reaction
- **Paclitaxel:** frequent monitoring of VS during 1st hour of infusion is recommended
- **Docetaxel: p**atients should be observed closely for 1st and 2nd infusions.
- Q15 minute vitals for first infusion of paclitaxel or docetaxel in the local setting

Case Discussion

Lisa is in the systemic therapy unit receiving their first dose of R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone) for their lymphoma. What adverse reactions may occur with the first dose of rituximab? What interventions are used to decrease the risk of these adverse reactions?

Section 7:
Adverse Event Monitoring and Management

Overview of Topics

- Extravasation
- Hypersensitivity reactions

Extravasation

- The leakage or infiltration of a vesicant agent into surrounding SQ tissue
- Can cause discomfort, tissue damage, and functional impairment of the limb
- Early signs of extravasation include pain and burning at IV site, blotchy redness, changes to infusion quality, or no blood return
- Extravasation tray should be readily available

Extravasation

If extravasation is suspected:

- Stop drug and fluid infusion immediately. Disconnect tubing
- Aspirate residual drug from peripheral IV using a 3ml syringe
- Aspirate residual drug from CVAD using 10ml syringe
- Notify the physician, obtain extravasation supplies
- Leave IV in place until determined whether antidote administration is required

Management of Extravasation

- Physician to administer extravasation antidote if required
- Outline the affected area to monitor extravasation
- Physician may want to take photographs of the site for monitoring
- Document extravasation on health record
- Complete occurrence reports as per hospital policy

Extravasation Antidotes

Vinca alkaloids: hyaluronidase SQ. Increases systemic absorption

Anthracyclines: dimethyl sulfoxide (DMSO) topical QID x 7 days. Increases systemic absorption and neutralizes free radicals. Do not cover or apply pressure to the site once the antidote applied

Patient Education for Extravasation

- **Vinca alkaloids, oxaliplatin:**
  - Warm compress for 15 mins 4-5x daily for 48H
- **Anthracyclines, docetaxel, paclitaxel:**
  - Cold compress (ice pack) for 15 mins 4-5x daily for 48H

Hypersensitivity Reactions

- Immune-mediated response to a systemic therapy agent
- May be related to the drug or the admixture
- May occur at first exposure, or with repeated exposures to the drug
- Agents associated with a higher risk of hypersensitivity rxn include taxanes, platinum drugs, epipodophyllotoxins, MoAbs, bleomycin, and some immunotherapies.

Signs of Hypersensitivity Reaction

General: fever, chills, flushing, sweating, fatigue, agitation, metallic taste

Cutaneous: rash, urticaria, pruritis, angioedema

Respiratory: dyspnea, wheezing, stridor, rhinitis, cough, chest tightness, laryngeal edema

Cardiovascular: tachycardia, hypo/hypertension

Gastrointestinal: nausea, vomiting, diarrhea, abdominal cramping

Renal: flank pain, back pain, hematuria

Neurological: headache, agitation, decreased LOC, seizures

Management of Hypersensitivity Reaction

- Stop infusion immediately
- Infuse IV fluids
- Assess vital signs
- Administer rescue medications
- Notify physician
- Provide supportive care
- Document reaction

Hypersensitivity Medications

- Diphenhydramine 50mg IV push over 2 minutes
- Hydrocortisone 100mg IV push over 2 minutes
- Famotidine 20mg IV push over 2 minutes
- For Grade 3 reaction not resolved with respiratory distress, or grade 4 reaction
  - Epinephrine 0.01 mg/kg (max dose 0.5mg) IM to thigh Q5 mins (max 3 doses)

Re-challenging After Hypersensitivity

If resuming infusion on the same day following a reaction, follow the graduated infusion rate as per policy unless otherwise directed by the physician.

- 25% of the initial rate for 5 minutes
- If tolerated, 50% of the rate for 5 minutes
- If tolerated, 75% of the rate for 5 minutes
- If tolerated, 100% of the rate for the remainder

Case Discussion

You are administering vincristine through a peripheral IV to your patient Joan. Joan is complaining of burning and pain at their IV site. On assessment, you find Joan's arm is reddened and there is no blood return from the IV site. You suspect extravasation has occurred. How should you proceed? What antidote is required? What patient education is required at discharge after an extravasation?

Section 8: Safe Handling, Spill Management, and Waste Disposal of Hazardous Drugs

Overview of Topics

- Personal Protective Equipment
- Safe Handling
- Hazardous Drug Exposures
- Spill Clean-Up

Personal Protective Equipment

- Gown: chemotherapy safe, impermeable, with a back closure and cuffed sleeve
- Gloves: chemotherapy safe, double gloving
- Gowns and gloves should be worn when preparing, administering, disconnecting, and disposing of chemotherapy, handling linens/supplies contaminated with drug or bodily fluids of patients receiving treatment, and cleaning up a spill
- Facial protection is required if there is a risk of aerosolization or splashing
- Shoe covers may be required when cleaning up a spill

Example of Personal Protective Equipment

Source: Halyard (2018)

Safe Handling Recommendations

- Use needleless and closed systems wherever possible
- Prime all IV tubing with IV fluids, not the systemic therapy agent
- Do not remove IV tubing from an IV bag containing a hazardous drug
- Do not disconnect tubing at any connection point unless thoroughly flushed
- Remove the IV set fully assembled for disposal
- Discard all personal protective equipment in designated hazardous waste receptacles

Safe Handling for Patients

- Caregivers should handle oral chemotherapy with gloves
- Do not break, crush, or chew oral medication
- Safe handling of body fluids is required for 48 hours after treatment
- Flush twice when using the washroom
- Soiled laundry should be washed twice (once alone)

Hazardous Drug Exposures

If an accidental clothing/skin exposure occurs

- Immediately remove contaminated clothing
- Wash the affected area with soap and water
- Continue to rinse x 15 minutes
- Use a decontamination shower if available
- Seek medical attention for further management

Hazardous Drug Exposures

If an accidental eye exposure occurs:

- Flush eyes at an eye wash station
- If not available, flush eyes with sterile 0.9% NS
- Contact lenses should be removed before using an eyewash
- Seek medical attention for further management
- Complete the required documentation

Hazardous Drug Exposures

If a needle stick injury occurs:

- Allow the wound to bleed freely
- Gently and thoroughly wash the area with soap under running water
- Seek medical attention for further management

Management of Hazardous Drug Spills

- Spill kits should be readily available
- Spills must be cleaned up immediately and never left unsupervised
- Personnel handling the hazardous medication are responsible for spill clean-up

Procedure for Spill Clean Up

- Obtain spill kit
- Contain area
- Don personal protective equipment (double gloves, gown, head cover, shoe coverings, respirator, face shield/goggles)
- Place warning sign
- Initiate clean-up

Procedure for Spill Clean Up

- Place absorbent material over the spill
- Use the dustpan to clean up broken glass
- Use Accel wipes to clean contaminated surfaces 3x
- Dispose of all contaminated materials in a red cytotoxic bag
- Arrange for the replacement of the spill kit and/or supplies

Case Discussion

You are working in the systemic therapy unit when your patient Betty accidentally dislodges the needle access device from their implanted port while ambulating to the bathroom. While Betty was not exposed, there was a significant chemotherapy spill on the floor. Discuss how you would initiate a hazardous spill cleanup.

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Thank You.

Questions/Comments/Feedback??

Appendix E

Educational Resource Participant Manual

Continuing Education for Registered Nurses Administering Systemic Therapy in the Outpatient Setting

Participant Manual

Rebecca Decker BNRN

December 2024

Introduction to Course

The Canadian Association of Nurses in Oncology (CANO) sets guidelines and recommends implementing a Systemic Therapy Continuing Competence Program to maintain registered nurses' (RNs) competency in administering systemic therapy. CANO recommends that RNs demonstrate their continued competence in systemic therapy annually.

This continuing education resource was developed as a quality improvement initiative to address the lack of continuing education for RNs administering systemic therapy in the outpatient setting following CANO recommendations.

CANO identified participation in a continuing education program as an acceptable modality to assist RNs in maintaining their systemic therapy competency.

Course Objective

To assist RNs in maintaining systemic therapy competency by providing education in the following areas based on CANO recommendations:

1. Principles of systemic therapy administration
2. Systemic therapy cancer agents and regimens
3. Equipment for administering systemic therapy agents
4. Best practice standards, policies, and procedures
5. Symptom management
6. Monitoring parameters throughout treatment
7. Adverse event monitoring and management
8. Safe handling, spill management, and waste disposal of hazardous drugs

Section 1:
Principles of Systemic Therapy Administration

Goals of Systemic Therapy

Systemic therapy may be indicated for **curative intent** where the goal is to eradicate the cancer. When a cure is not possible, systemic therapy is used for **palliative intent**. The goals of palliative systemic therapy are to extend a patient's life, provide symptom control, and improve their quality of life.

Treatment Modalities

First-line treatment is also referred to as primary therapy or primary treatment. This refers to the initial, standard, or preferred cancer treatment. **Salvage treatment** is given when first-line treatments fail, or a patient has a cancer recurrence.

Systemic therapy may be used in combination with surgery and/or radiation therapy to improve outcomes. When a tumor is too big to be surgically removed initially, systemic therapy may be given pre-surgery to shrink a tumor to improve surgical resection **(neoadjuvant).** Systemic therapy may be given post-surgery to kill any remaining cancer cells to decrease the chances of recurrence **(adjuvant).**

The following treatment modalities are used to describe hematology cancers:

Induction is the first phase of treatment aimed at destroying the maximum number of cancer cells to achieve remission. Remission is the reduction or disappearance of signs or symptoms of cancer. Remission can be described as complete, or partial.

Consolidation is the second phase of treatment, aimed at killing any remaining cancer cells.

Maintenance is the third phase of treatment, aimed at preventing relapse after induction and consolidation. This tends to be lower doses of chemotherapy with fewer side effects.

Central nervous system (CNS) prophylaxis involves administering systemic therapy directly into the cerebrospinal fluid, via lumbar puncture or an Ommaya reservoir. CNS prophylaxis is given to given to prevent the spread of cancer to the brain and spinal cord.

Cancer Staging

The TNM Staging System is most used in Canada to stage solid tumors.

The TNM acronym stands for:

Tumor – size/growth of primary tumor

Nodes – whether spread to lymph nodes is present.

Metastasis – whether spread to other areas has occurred.

Tumor: Describes the size of the primary tumor and whether the cancer has invaded other areas of the organ or surrounding tissue. TX indicates primary tumor cannot be measured. T0 indicates primary tumor cannot be found. Numeric grading from 1-4 with a higher number indicating a tumor is larger or has deeply invaded tissues.

Nodes: Describes whether cancer has spread to lymph nodes. Numeric grading 0-4. NX indicates lymph nodes cannot be assessed. N0 = no spread to lymph nodes. N1-3 = varying degree of spread to lymph nodes. The number, size, and location of nodes may also be described.

Metastasis: Describes whether spread to other areas of the body is present. Numeric grading with two options. M0 = no spread, M1 = spread to other areas. MX indicates metastasis cannot be measured.

Other staging systems may be used for certain cancers including gynecologic cancers (International Federation of Gynecology and Obstetrics staging system), and hematologic cancers such as non-Hodgkin lymphoma (Ann Arbor staging system), Hodgkin lymphoma (Cotswold staging system), chronic lymphocytic leukemia (Rai and Binet staging systems), and multiple myeloma (the International and the Durie-Salmon staging systems).

The TNM staging system is often used to assign an overall cancer stage between 1-4. These stages correspond with how extensive the disease is.

Stage 0: "Carcinoma in situ" or a precancerous change. Abnormal cells are present.

Stage 1: The tumor is generally small and localized to the organ.

Stages 2-3: The tumor is larger and has extended outside the organ it originated from. A higher number indicates a higher spread.

Stage 4: Metastatic cancer that has spread to other areas of the body via the blood or lymphatic systems.

Other terminology frequently used to describe cancer staging include local/localized (no spread), regionally or locally advanced (spread around or near the primary organ site), and distant/advanced/metastatic (spread to areas further away from the primary site).

Cancer Grading

Grading refers to the microscopic features of cancer cells. May be assigned a number, a lower number = a lower grade.

In **low-grade** or **well-differentiated** cancers, the cells retain more of the appearance and behavior of normal cells. Low-grade cancers tend to be slower-growing and less aggressive.

In **high-grade** or **poorly differentiated** cancers, the cells appear more abnormal and do not behave as normal cells. High-grade cancers tend to be faster growing and more aggressive.

In **moderately differentiated cancers**, the cells have an appearance and behavior somewhere between well and poorly differentiated.

The Cell Cycle

The cell cycle refers to the normal process of cellular growth and division subdivided into phases. Cancer cells do not function like normal cells as they have gene mutations that result in the uncontrolled growth and division of the cells. Systemic therapy agents can be classified as cell cycle-specific or cell cycle non-specific. **Cell cycle-specific agents** attack the cancer cells at only specific points during the cell cycle. **Cell cycle non-specific agents** attack the cancer cells at any point during the cell cycle.

Section 2: Systemic Therapy Cancer Agents

Common Systemic Therapy Side Effects

Systemic therapy targets fast-growing cancer cells but affects healthy cells as well. The greatest impacts are generally on fast-growing healthy cells (blood-forming cells in bone marrow, hair follicles, and cells lining the gastrointestinal (GI) tract) Specific systemic therapy agents may cause cellular damage in the heart, kidneys, bladder, lungs, and nervous system. The management of symptoms will be discussed in Section 5.

Myelosuppression is the most common side-effect of systemic therapy, resulting in reduced numbers of RBCs, WBCs, and platelets. The lowest blood counts (**nadir**) are typically seen 7-14 days after systemic therapy treatment. This may result in treatment delays.

Fatigue generally occurs within the first few days of treatment but may persist for weeks. Fatigue often interferes with activities of daily living (ADLs) and sleep.

Nausea and vomiting may begin shortly after and last for the first few days after treatment, however, delayed nausea and vomiting may occur with some regimens.

Loss of appetite may be related to N&V or smell/taste alterations associated with treatment. Subsequent weight loss may occur.

Alopecia (hair loss) is common with many regimens and may begin days to a few weeks after starting treatment.

Diarrhea may be caused by irritation of the cells of the GI system.

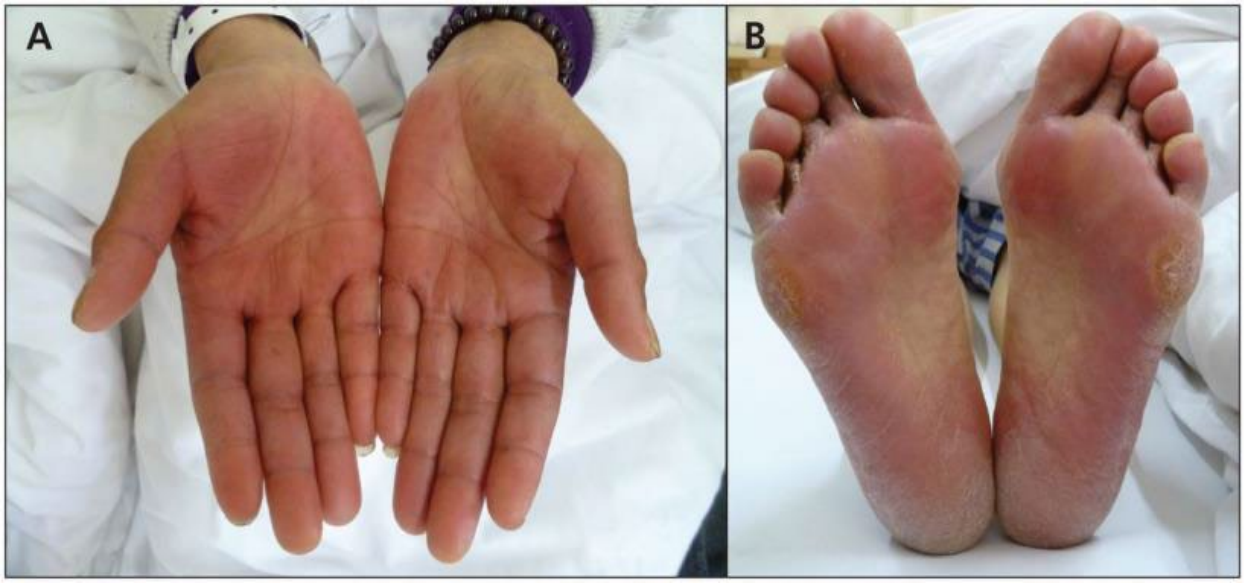
Constipation may be caused by systemic therapy agents, or supportive medications such as anti-emetics.

Mucositis (irritation to any mucus membrane: mouth, nose, rectum, vagina) or ***stomatitis*** (oral mucositis) may be caused by systemic therapy agents damaging the cells of mucus membranes and may present as irritated mucus membranes, or sores/ulcers. Generally, starts 5-10 days after treatment begins and may persist until a few weeks after treatment. Prevention and management are necessary to prevent bleeding and infection.

Skin changes including skin irritation, dryness, redness, rashes, and nail changes are common. Some agents may cause rarer skin changes such as palmar-plantar erythrodysesthesia (PPE), or acneiform rash. PPE, also known as “hand-foot syndrome” is a dermatological toxicity characterized by tingling, tenderness, redness, swelling, and pain in the palms and soles. Acneiform rash is characterized by the development of erythema, edema, and papulopustular lesions on the face,

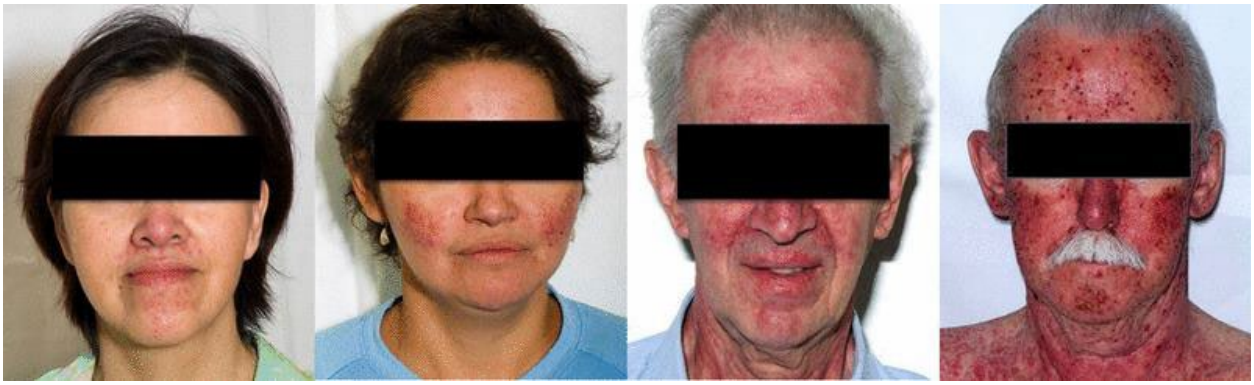
chest, or scalp and subsequent dryness and crusting of lesions. See the photos below.

Figure 2: Palmar-Plantar Erythrodysesthesia



Source: BC Cancer (2019, January)

Figure 2: Acneiform Rash



Source: BC Cancer (2016, February)

Cognitive difficulties may include brain fog, sometimes referred to as "chemo brain." Decreased mental clarity, difficulty concentrating, or memory problems are common. It may persist for up to 1 year after treatment.

Sexual difficulties such as decreased sex drive, impotence, and infertility may result as systemic therapy may cause damage to the reproductive system.

An increased risk of developing ***secondary cancer*** later in life may result from systemic therapy. However, this is rare, and the benefit of treatment often outweighs this potential risk.

Peripheral neuropathy (i.e., numbness, tingling, burning, pain) in the hands and feet is common with some treatments.

Systemic Therapy Agents

Alkylating Agents

Alkylating agents are cell cycle non-specific and prevent cancer cells from reproducing by damaging DNA. They are used to treat various disease sites including lung, breast, ovarian, sarcoma, and hematologic cancers. Some common examples of alkylating agents include **bendamustine, carboplatin, cisplatin, cyclophosphamide, dacarbazine, temozolomide, ifosfamide,** and **oxaliplatin**.

Clinical Considerations for Alkylating Agents

Myelosuppression, nausea, and ***vomiting*** are common side effects of alkylating agents. Myelosuppression is a dose-limiting toxicity. A dose-limiting toxicity is a serious side-effect that prevents continuing with a treatment.

Cisplatin is a platinum-based drug that can cause ***nephrotoxicity***. Hydration is required for higher doses of cisplatin as per protocol to minimize the risk of nephrotoxicity (this may include pre-/post hydration with or without mannitol for high doses). Hydration and mannitol are used to cause forced diuresis. Forced diuresis is the process of expediting the urinary excretion of drugs and fluid through the kidney. Mannitol is an osmotic diuretic that increases urinary flow by preventing the reabsorption of water and sodium in the kidney. Intravenous (IV) hydration and the use of mannitol have been shown to decrease the risk of nephrotoxicity by preventing toxic concentrations of cisplatin from accumulating in the kidney. ***Ototoxicity*** can be caused by cisplatin, the effects of which are cumulative and permanent. Caution is advised in the treatment of patients with pre-existing renal or hearing impairment. A baseline hearing test may be completed before starting cisplatin. Dosage reductions or complete discontinuation of cisplatin are warranted depending on the severity of these side effects.

Nephrotoxicity is less likely with the platinum-based drug **carboplatin** and does not require routine hydration. Caution should be taken if the patient is receiving carboplatin after previously receiving cisplatin as there is a higher risk of potential side-effects and toxicities.

Cyclophosphamide and **ifosfamide** produce the metabolite acrolein which is associated with ***hemorrhagic cystitis.*** **Cyclophosphamide** should be administered as early as possible in the day to avoid the drug sitting in the bladder for an extended period overnight. **Mesna** (sodium 2-mercaptoethane sulphonate) may be administered with high-dose protocols of cyclophosphamid**e** and ***must*** be administered with ifosfamide. Mesna is a uroprotectant that binds with acrolein and expedites renal excretion of this metabolite. Encouraging the patient to increase oral fluid intake is important, and IV hydration may be required depending on the protocol.

Drug-induced encephalopathy may occur in 10-50% of patients receiving **ifosfamide** and can vary in severity. Confusion, disorientation, hallucinations, and somnolence are some side-effects.

Peripheral sensory neuropathy is a cumulative, but usually reversible side-effect of **oxaliplatin**. Neuropathy may present as paresthesia (numbness, tingling) or dysesthesia (abnormal sensations) in hands, feet, or lips. These feelings may be worsened by cold (cold sensitivity). ***Acute pharyngolaryngeal dysesthesia*** may occur during/after drug infusion and presents as decreased throat sensation and difficulty breathing or swallowing, often triggered by cold sensitivity. Counsel patients on preventing unnecessary cold exposure (avoid ice water, frozen foods, and deep breathing in cold outside air).

Venous irritation may be noted with peripheral administration of **dacarbazine**. Decreasing the infusion rate or diluting dacarbazine by administering additional IV fluids concurrently may be necessary to decrease discomfort.

Antimetabolites

Antimetabolites are cell-cycle specific which damage cancer cells by replacing building blocks of DNA/RNA, interfering with their formation, and causing cellular death. Antimetabolites are used to treat various disease sites including leukemia, breast, gastrointestinal, and lung cancers. Examples of antimetabolites include **azacitidine, 5-fluorouracil, cytarabine, capecitabine, gemcitabine, methotrexate, and pemetrexed.**

Clinical Considerations for Antimetabolites

Cytarabine has been associated with significant ***neurological symptoms***, especially when administered at high doses (tremors, seizures, ataxia, somnolence, confusion). ***Rashes*** to palms and soles are also common with cytarabine, leading to possible desquamation.

Fluorouracil may cause ***coronary vasospasm*** leading to electrocardiogram (ECG) changes, angina, MI, pulmonary edema, and arrhythmia. ***Hand-foot syndrome*** (***PPE***) described in the previous section is also possible. ***Stomatitis*** and ***diarrhea*** are especially common with fluorouracil. Oral cryotherapy may be used during fluorouracil bolus administration. Oral cryotherapy involves sucking on ice chips during treatment administration to encourage vasoconstriction of the oral cavity. This vasoconstriction may reduce the concentration of fluorouracil reaching oral mucosa and thus decrease the occurrence and severity of stomatitis by 50%. Oral cryotherapy is ***not*** advised for regimens containing oxaliplatin due to the risk of cold-induced pharyngolaryngeal dysesthesia.

Diarrhea and ***PPE*** occur with **capecitabine** in about half of patients. Both side effects may require dose reductions or discontinuation of the agent depending on severity.

A ***skin rash*** is common with **pemetrexed**; pre-medication with oral steroids (dexamethasone, 4mg PO BID x 3 days (one day prior, day of treatment, one day after) can decrease incidence and severity of same. Pre-medication with folic acid (daily at least 5-7 days before treatment and until 21 days post-treatment completion) and vitamin B12 (IM 1 week before treatment, then Q9weeks until 21 days post-treatment) decreases the incidence of neutropenia, febrile neutropenia, infections, and gastrointestinal toxicities.

Patients who receive **fludarabine** must receive irradiated blood products due to the risk of ***autoimmune hemolytic anemia*** and ***graft-versus-host disease***. Long-term ***immunosuppression*** may occur after having fludarabine, resulting in an increased risk of opportunistic infections.

Anti-tumor Antibiotics

Anti-tumor antibiotics are cell cycle non-specific (except for asparaginase) that alter DNA to prevent growth and multiplication. Examples include **dactinomycin, mitomycin, and bleomycin. Asparaginase (and peg asparaginase)** are used primarily for acute lymphoblastic leukemia. These agents are cell-cycle specific and destroy amino acids that are required for cell survival. Anti-tumor antibiotics also include the subtype anthracyclines which are described below.

Clinical Considerations for Anti-tumor Antibiotics

With **bleomycin**, a "***febrile reaction***" may be seen in up to 50% of patients and can be managed with pre-medications (antipyretics, antihistamines, and steroids). ***Skin changes*** are also seen in about 50% of patients receiving bleomycin and may present as erythema, hyperpigmentation, rash, or tenderness of skin. It is important

with bleomycin that patients are counseled on the risks of ***pulmonary toxicity*** that may be characterized as pneumonitis and pulmonary fibrosis. Extreme caution must be taken with oxygen administration in patients who have received bleomycin. High-flow oxygen such as during scuba diving can be dangerous. Patients may receive supplemental oxygen as needed using the minimum amounts necessary. It is recommended that patients carry a card or wear a medic alert bracelet after having received bleomycin. Pre-operative anesthesia consult is warranted for patients having received bleomycin.

IV sites must be monitored closely with **dactinomycin** and **mitomycin** to prevent ***tissue damage,*** as they are both vesicants. It is important to ensure adequate blood return from the IV site while administering these agents. ***Rashes*** may occur with **dactinomycin,** which may be worsened by radiation and sun exposure. ***Myelosuppression*** with **mitomycin** is cumulative and delayed and may be seen up to 8 weeks post-treatment.

Anthracyclines

Anthracyclines are a subtype of antitumor antibiotics that interfere with the enzymes necessary for copying DNA. They bind with DNA to prevent cellular reproduction. Examples include **doxorubicin, epirubicin, daunorubicin, and mitoxantrone**.

Clinical Considerations for Anthracyclines

Cardiac effects are common with anthracyclines and may be due to these agents' production of free radicals that damage the myocardium. Early or late cardiac effects can be seen. Early effects include ECG changes and arrhythmias. Late, and more significant cardiac toxicities include decreased left ventricular ejection fraction and congestive heart failure. These effects are cumulative and permanent. A baseline assessment of cardiac function and continued monitoring throughout treatment is warranted (with an ECG or MUGA scan). A MUGA (multigated acquisition) scan is a diagnostic nuclear medicine imaging test used to evaluate heart function. These agents should be used cautiously when treating patients with underlying cardiac issues.

Lifetime dosing limits are in place for many anthracyclines to decrease the risk of significant cardiac toxicity. Dosing limits exist for **daunorubicin, doxorubicin, epirubicin, idarubicin, mitoxantrone**. Maximum lifetime dosing limits may also consider any prior treatment with other anthracyclines.

Doxorubicin may cause ***red-pink urine*** color for 24-48 hours post-administration. **Mitoxantrone** may cause ***blue-green urine*** color for up to 24 hours post-administration.

Topoisomerase Inhibitors

Topoisomerase inhibitors are cell cycle-specific agents that interfere with topoisomerase enzymes, preventing the copying of DNA. They are a part of the plant alkaloid family and are used to treat leukemia, lung, ovarian, gastrointestinal, colorectal, and pancreatic cancer. Topoisomerase inhibitors include two subtypes, classified based on which enzyme is affected. Topoisomerase I inhibitors are also known as camptothecins; examples include **irinotecan** and **topotecan.** Topoisomerase II inhibitors are also known as epipodophyllotoxins and include **etoposide**.

Clinical Considerations for Topoisomerase Inhibitors

Cholinergic symptoms may occur during **irinotecan** administration including runny nose, watery eyes, diaphoresis, flushing, and abdominal cramping. Atropine is administered to treat these symptoms during treatment. ***Early or late diarrhea*** is possible with **irinotecan**. Early diarrhea may be related to cholinergic-type symptoms; however, late diarrhea is more problematic as it may lead to electrolyte imbalances and dehydration. Appropriate management with loperamide is warranted for late diarrhea. IV hydration and electrolyte replacement may be necessary in severe cases. Significant ***myelosuppression*** is reported with **irinotecan** and **topotecan**, especially neutropenia.

Hypersensitivity reactions have been seen with **etoposide** and may be associated with the polysorbate 80 additive. These reactions are most frequently seen in the first 5-10 minutes of the infusion and resolve with discontinuing the infusion. Supportive care medications such as antihistamines and corticosteroids may be required. If a significant hypersensitivity occurs, switching to etoposide phosphate, which does not include the polysorbate 80 additive, may be considered. Etoposide must be administered using non-polyvinyl chloride (PVC) tubing due to the risk of the drug leaching chemicals from PVC tubing. A micron filter is also required to administer **etoposide** as there is a potential risk of precipitate forming in diluted etoposide. However, a filter is not required for etoposide phosphate.

Mitotic Inhibitors

Mitotic inhibitors are cell cycle-specific agents that are part of the plant alkaloid family. Mitotic inhibitors are used to treat breast, lung, and hematologic cancers.

They prevent protein formation and inhibit cancer cell reproduction and division. Mitotic inhibitors include taxanes (**paclitaxel, docetaxel, cabazitaxel, and nab-paclitaxel**) and vinca alkaloids (**vincristine, vinblastine, and vinorelbine**).

Clinical Considerations for Taxanes

Myelosuppression is significant with **cabazitaxel**, and **paclitaxel**. IV premedication is required for agents with a high risk of hypersensitivity including **cabazitaxel** and **paclitaxel**. Pre-medications include an antihistamine, corticosteroid, and H2 antagonist (such as diphenhydramine, dexamethasone, and famotidine) to decrease the risk or severity of hypersensitivity reactions. ***Hypersensitivity reactions*** generally occur within the first few minutes of infusion and are characterized by flushing, rash, erythema, hypotension, bronchospasm, tachycardia, and hypertension. Close monitoring during the first 1-2 cycles is warranted for these agents. The severity of the reaction dictates whether patients may be rechallenged with the systemic therapy agent. A rechallenge refers to administering a systemic therapy agent to a patient who has previously had a hypersensitivity reaction to that specific agent. Rechallenges may require additional pre-medication, close monitoring, and slower infusion rates. Hypersensitivity with **paclitaxel** may be related to polyoxyl 35 castor oil (Cremophor® EL), an additive in the formulation of paclitaxel.

Pre-treatment with steroids is required for **docetaxel** to decrease the risk of ***hypersensitivity*** and ***fluid retention*** (dexamethasone 8mg PO BID starting the day before docetaxel [3 doses pre-tx] then dexamethasone 8mg PO BID x 2 days after treatment). If the patient has not taken pre-steroids appropriately, consult with the physician or pharmacist for the next steps as they may require IV pre-medication with steroids. ***Nail changes*** and ***nail loss*** may occur with **docetaxel**. Cold-induced vasoconstriction (cryotherapy) such as wearing frozen gloves (or submerging fingers in an ice bath during infusion as is done in the local setting), can reduce the severity of these symptoms.

Routine pre-medication is not required for **nab-paclitaxel**. ***ECG changes*** and ***cardiovascular events*** may occur with **nab-paclitaxel**. While baseline ECG is not required for all patients receiving **nab-paclitaxel**, routine ECG may be warranted if treating patients with underlying cardiac conditions.

Clinical Considerations for Vinca Alkaloids

All vinca alkaloids are vesicants. Common side effects of **vinorelbine** are ***myelosuppression***, ***elevation of aspartate transaminase (AST) and/or bilirubin,*** and ***peripheral neuropathy***. Common side effects of **vinblastine** include

leukopenia and ***paresthesia***. ***Peripheral neuropathy*** occurs in most patients receiving **vincristine**. Most neuropathy resolves after treatment is discontinued but may persist in severe cases which can be debilitating. ***Neurotoxicity*** with vinca alkaloids should be monitored closely. Mild to moderate paresthesia may occur but close monitoring for significant symptoms (e.g., ototoxicity, ocular dysfunction, loss of deep tendon reflexes, headache, dizziness, seizures, bowel/bladder dysfunction, foot drop, and gait changes) is required. These symptoms usually resolve with discontinuation of the agent.

Administration of vinca alkaloids in a syringe via IV push is contraindicated, and instead, these agents are prepared for administration in IV mini-bags. This is a safety precaution to prevent accidental intrathecal administration of agents, which can be fatal. Small-volume mini bags are used, with an administration time of 5-15 minutes. As vinca alkaloids are vesicants, frequent IV site monitoring is required for blood return. Adequate flushing of IV lines is necessary after administration of these agents. Peripheral administration is via gravity flow IV, allowing for passive infusion; using an infusion pump may increase the risk of extravasation. ***Extravasation*** may occur with vesicants, characterized by irritation, discomfort, thrombophlebitis, and tissue necrosis. Management of extravasations will be discussed in a later section.

Immunotherapy

Immunotherapy may also be referred to as “biologic therapy” which stimulates the immune system to identify and attack cancer cells. There are several functions of immunotherapy such as slowing or stopping the growth of cancer, preventing the spread of cancer, improving immune system function, and delivering systemic therapy directly to cancer cells. Immunotherapy includes checkpoint inhibitors, chimeric antigen receptor (CAR) T-cell therapy, immunomodulators, and monoclonal antibodies.

Checkpoint Inhibitors

Checkpoint inhibitors do not directly kill cancer cells but instead stimulate the immune system to locate and kill more cancer cells. They are used to treat various cancers including melanoma, non-small cell lung cancer, kidney cancer, and Hodgkin lymphoma. Immune system responses are influenced by checkpoint proteins on immune system cells. Cancer cells have ways in which they may evade these checkpoints and avoid being attacked by the immune system. These checkpoints must be turned on (or off) to control an immune response, essentially, checkpoints are the “brakes” of the immune system. Checkpoint inhibitors “take the brakes off” the immune system and mount an increased immune system

response against cancer cells. There are various subtypes of checkpoint inhibitors, named for the proteins they target. Examples of checkpoint inhibitors include **pembrolizumab, nivolumab, durvalumab, and ipilimumab**.

Clinical Considerations for Checkpoint Inhibitors

Checkpoint inhibitors have many of the same side effects as traditional chemotherapies including nausea, vomiting, decreased appetite, diarrhea, constipation, fatigue, muscle/joint pain, rash, and pruritis. However, more serious side effects including ***autoimmune reactions*** and ***infusion-related reactions*** may occur. Autoimmune reactions occur as checkpoint inhibitors remove one of the safeguards of the immune system. The immune system reacts by going into overdrive and attacking other parts of the body causing serious effects in many major organs such as the lungs, liver, and intestines (i.e., pneumonitis, hepatitis, colitis). Immunotherapy is held or discontinued if serious side effects occur, and treatment involves high-dose steroids to suppress the immune system.

CAR T-cell Therapy

CAR T-cell therapy involves altering T-cells in a lab so they can recognize and kill cancer cells. The patient's T-cells are removed from the blood through leukapheresis, and a gene receptor is added. It may take several weeks for enough CAR T-cells to be produced, then the cells are returned to the patient. Examples of CAR T-cell therapy include **tisagenlecleucel** and **axicabtagene ciloleucel**.

Clinical Considerations for CAR T-cell Therapy

Administration of CAR T-cell therapy is associated with a risk of ***cytokine release syndrome (CRS***). Symptoms of CRS include fever/chills, shortness of breath, nausea, vomiting, diarrhea, dizziness, headaches, tachycardia, fatigue, muscle, and joint pain. ***Nervous system side-effects*** may also occur, including headache, decreased level of consciousness, confusion, agitation, seizures, tremors, aphasia, and feeling off-balance. ***Allergic reactions***, ***electrolyte imbalances***, ***myelosuppression***, and increased ***risk of infections*** are also common with CAR T-cell therapy.

Immunomodulators

Immunomodulators directly target the immune system to ramp up or down proteins. They are used to treat specific cancers such as multiple myeloma (**thalidomide, lenalidomide,** and **pomalidomide),** bladder cancer (**bacillus Calmette-Guérin [BCG]),** and some early-stage skin cancers (**imiquimod**).

Clinical Considerations for Immunomodulators

Side effects of –**lidomides** include ***fatigue, drowsiness, constipation, low blood counts, neuropathy,*** and ***birth defects***. Side effects of **BCG** include ***flu-like symptoms,*** and ***localized bladder irritation*** as the agent is instilled in the bladder. Side effects of **imiquimod** include ***skin reactions*** (e.g., erythema, itching, burning, erosion, excoriation/flaking, and edema).

Monoclonal Antibodies

Monoclonal antibodies (MoAbs) comprise human and/or mouse proteins. Some monoclonal antibodies are classified as immunotherapy while some are classified as targeted therapies dependent on their mechanism of action. MoAbs are developed in a lab to target specific antigens on cancer cells to help trigger an immune system response and include several subtypes.

"Naked" MoAbs work in several ways; one example is **rituximab** which attaches to the antigen on a cancer cell and marks it for destruction by the immune system. Conjugated MoAbs include **brentuximab vedotin** and **ado-trastuzumab emtansine**. These agents are MoAbs that are connected to chemotherapy drugs. They bind with antigens on the cancer cell's surface and bring the chemotherapeutic agent directly to the cell. Bispecific MoAbs include bispecific T-cell engagers (BiTE therapy) such as **teclistimab**. These agents contain components of two different MoAbs meaning they can bind with two different proteins simultaneously. BiTE therapies bind to proteins on both cancer cells and immune system T-cells and bring them together. Doing so encourages a more effective immune response against these cancer cells.

Targeted Therapies

Targeted therapies differ from traditional chemotherapy as normal cells are not affected by these therapies. They are sometimes referred to as "precision medicine." These agents target specific proteins or receptors on cancer cells. Targeted therapies can block signals that affect cancer cell production, or signal cancer cells to destroy themselves. After a biopsy or surgery, tumors may be tested for "markers" to determine the best course of treatment and whether targeted therapies can be used.

There are several types of targeted therapies including angiogenesis inhibitors (e.g., **bevacizumab** and **sunitinib**). They prevent the formation of new blood vessels that feed cancer cells. MoAbs (e.g., **trastuzumab**) seek specific targets on

the surface of cancer cells, attaching to and killing them. Proteasome inhibitors (e.g., **bortezomib**) inhibit normal cell function causing cell death. Tyrosine kinase inhibitors, also called signal transduction inhibitors (e.g., **imatinib**), prevent the tyrosine kinase enzyme from sending the cellular signals required for the growth of cancer cells. Poly ADP-ribose polymerase (PARP) inhibitors (e.g., **olaparib**), damage DNA and prevent cell repair, leading to cellular death.

Clinical Considerations for Targeted Therapies

Some targeted therapies may cause ***skin changes***, including dry skin, rash, photosensitivity, itching, hand-foot syndrome (PPE), and hair changes. Angiogenesis inhibitors (e.g., **bevacizumab**) can cause ***increased blood pressure, bleeding, blood clots***, and ***poor wound healing***. Many other side effects such as those seen with traditional chemotherapy are possible including fever, chills, fatigue, nausea/vomiting, constipation/diarrhea, headache, mouth soreness, and rashes.

Biosimilars

Biosimilars mimic the function of a "brand name" biologic drug but are cheaper alternatives. While biosimilars are not identical to the biologic drugs they mimic, they are very similar. Biosimilars are considered safe, effective alternatives to biologic drugs that may reduce the healthcare costs associated with using more expensive "brand name" biologic drugs. Biosimilars may need special approvals to be considered interchangeable with biologic drugs and may need to be explicitly ordered by the physician. Some examples of biosimilars include **Mvasi/Zirabev, Ruxience**, and **Kanjinti**. Biosimilars also exist for **filgrastim, pegfilgrastim,** and **denosumab**.

Hormonal Therapies

Hormone therapies interfere with the hormones that contribute to cancer growth and are frequently used for breast, prostate, and gynecologic cancers. These agents function either by slowing/stopping cancer growth, preventing cancer cells from using a specific hormone or preventing the body from producing the hormone.

Typical side effects of these therapies include ***hot flashes, vaginal dryness, menstrual cycle changes, night sweats, muscle/joint/bone pain, mood swings, weight gain, decreased sexual functions, gynecomastia, osteoporosis, depression,*** and ***fatigue***. Management of these symptoms is typically supportive, for example, avoiding caffeine/alcohol/spicy foods, dressing in layers, keeping the environment cool to manage hot flashes and taking analgesia (e.g., acetaminophen) for

muscle/joint/bone pain. Patients may also take vitamin supplementation (e.g., vitamin D and calcium) to decrease the risk of osteoporosis as prescribed by their physician. The physician may also consider additional pharmacological management.

Hormonal Therapy – Breast Cancer

Hormonal therapies for breast cancer include aromatase inhibitors (AI) (e.g., **anastrozole, letrozole, exemestane**), selective estrogen receptor modulators (e.g., tamoxifen), estrogen receptor antagonists (e.g., **fulvestrant**), and luteinizing hormone-releasing hormone (LHRH) agonists (e.g., **goserelin**).

Hormonal Therapy – Prostate Cancer

Hormonal therapies for prostate cancer include androgen deprivation therapy (ADT) (e.g., **apalutamide, enzalutamide, bicalutamide**), LHRH agonists (e.g., **goserelin, leuprolide**), gonadotropin-releasing hormone antagonists (e.g., **degarelix**), and CYP17 inhibitors (e.g., **abiraterone**). **Abiraterone** can cause high blood pressure.

Hormonal Therapy – Endometrial Cancer

Hormone therapies for endometrial cancer include progestins (e.g., **medroxyprogesterone acetate, megestrol acetate**), selective estrogen receptor modulators (e.g., **tamoxifen**), LHRH agonists (e.g., **goserelin, leuprolide**), and AIs (e.g., **letrozole, anastrozole, exemestane**).

Miscellaneous Agents

Some systemic therapy agents do not fit into these categories. **All-trans retinoic acid (ATRA, tretinoin)** is a "differentiation-inducing agent" used in the treatment of acute promyelocytic leukemia which induces the maturation of leukemic cells. **Arsenic trioxide** is also used in the treatment of APL and has various mechanisms of action. Arsenic trioxide can cause ***QT prolongation*** and ***tachycardia***; thus, caution should be taken while treating patients with cardiac history. Regular ECG and LBC monitoring are required, and electrolyte imbalances should be corrected before the administration of arsenic.

Supportive Medications

While not systemic therapy agents themselves, supportive medications are often given with systemic therapy protocols to help manage side effects and complications associated with these therapies.

Supportive medications may include corticosteroids (e.g., **dexamethasone, prednisone**) that are used for the management of nausea and vomiting, prevention of hypersensitivity reactions, and decrease intracranial pressure and cerebral edema, **allopurinol** that decreases uric acid levels, and **mesna** that protect urinary tract and bladder. Supportive medications also include **colony-stimulating factors** and **bisphosphonates** which are discussed below.

Colony Stimulating Factors

Colony-stimulating factors stimulate the bone marrow to produce red and white blood cells that help improve the ability to fight infection and anemia. These medications can help prevent systemic therapy dose delays. Examples of colony-stimulating factors are granulocyte colony-stimulating factor (GCSF) (e.g., **filgrastim, pegfilgrastim**), and erythrocyte growth factors (e.g., **erythropoietin, darbepoetin**).

Administration of GCSF

Patients should rotate injection sites while receiving GCSF. Bone pain is the most common side-effect of GCSF, and long-term use of these medications may cause splenomegaly.

Filgrastim (Neupogen, Grastofil). Must be administered at least 24 hours after systemic therapy treatment. Generally administered daily for 5-7 days (for protocols > or = 14 days) or until neutrophils recovery for protocols given < 14 days apart.

Filgrastim 300 or 480mg SQ daily 24-48H post-treatment

Pegfilgrastim (Neulasta, Lapelga). Given as a one-time dose 24-48 hours after systemic therapy tx. Pegfilgrastim has longer-lasting effects. It can only be given for protocols in which cycles are at least 14 days apart.

Pegfilgrastim 6mg SQ x 1 24-72 hours post-treatment.

Bisphosphonates

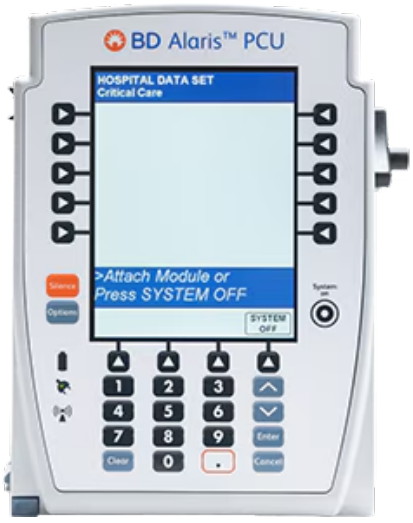
Bisphosphonates (e.g., **pamidronate, zoledronic acid**) are IV medications known as “bone strengthening” agents. These medications are often used for patients with metastatic cancer with bone metastases, multiple myeloma, or long-term corticosteroid or hormonal therapy. If patients have bony metastases, osteoclasts may be overactive and destroy bone leading to fragility of bones. Myeloma cells produce a by-product that causes bone destruction. Bisphosphonates slow down the action of osteoclasts. Side effects of bisphosphonates include fatigue, bone

pain, flu-like symptoms, hypocalcemia, osteonecrosis of the jawbone, and decreased kidney function. It is important to monitor kidney function and calcium levels due to the risks of decreased kidney function and hypocalcemia associated with bisphosphonates.

Section 3:
Equipment for Administration of Systemic Therapy Agents

IV Infusion Pump

Figure 3: BD Alaris™ Infusion Pump



Source: BD (2024)

An essential feature of this infusion pump is **BD Alaris™ Guardrails™,** a software program preinstalled in the infusion pumps. These programs can be programmed for specialized practice areas (such as oncology) to create a custom drug library, which provides safety alerts for acceptable dosage limits and guidelines for administering specific systemic therapy agents. Guardrails consist of both hard and soft limits. Soft limits can be overridden by the clinician, while hard limits require the clinician to reprogram the infusion pump to proceed. These functions aim to increase patient safety by minimizing medication errors and streamlining administration for the clinician. A BD Alaris pump quick-start guide should be available to review step-by-step functions in practice areas.

IV Lines

Standard IV Setup

The standard IV setup includes a primary and secondary line, used to administer IV fluids, supportive medications, and single-agent systemic therapy. Can be used with a closed systemic transfer device on the secondary line, if multiple systemic therapy agents are to be administered.

Figure 4a: Primary Set Packaging

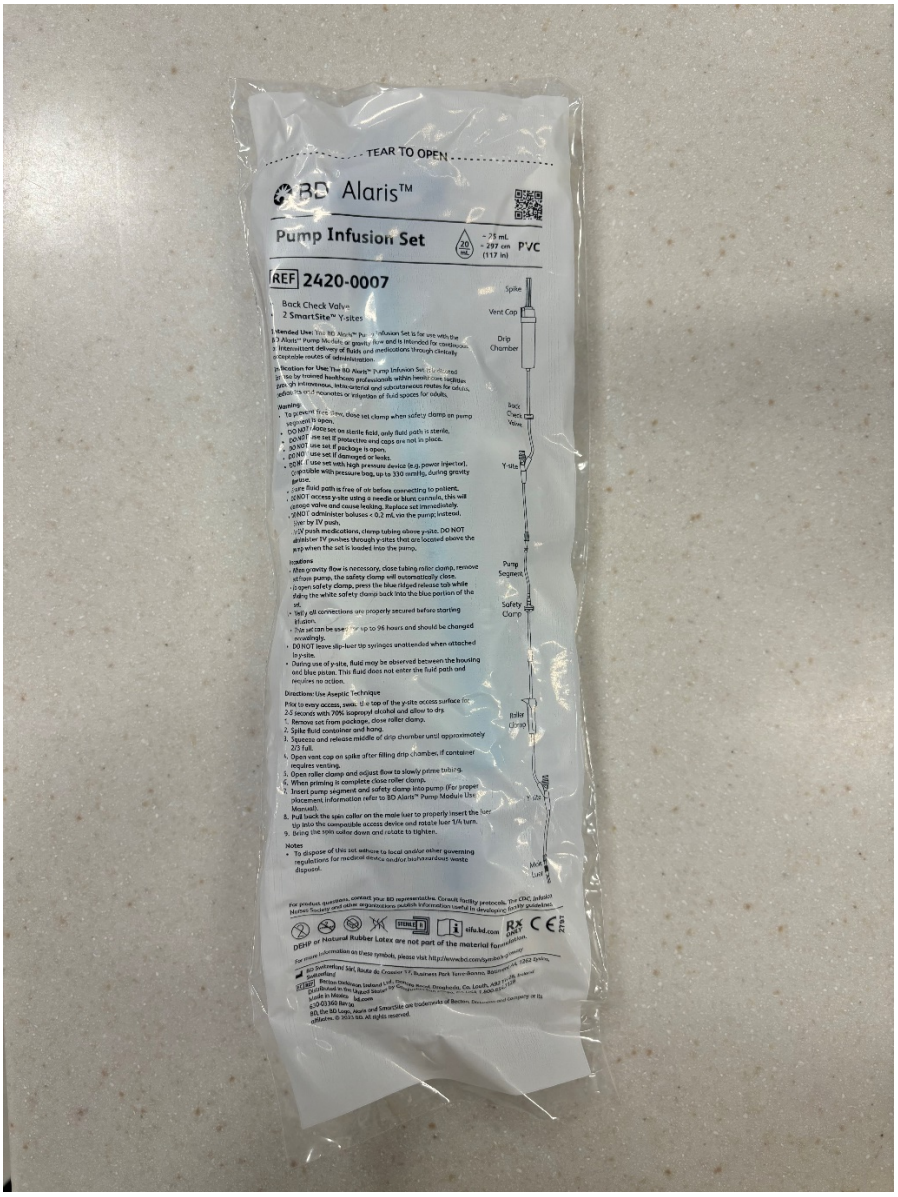


Figure 4b: Primary Set

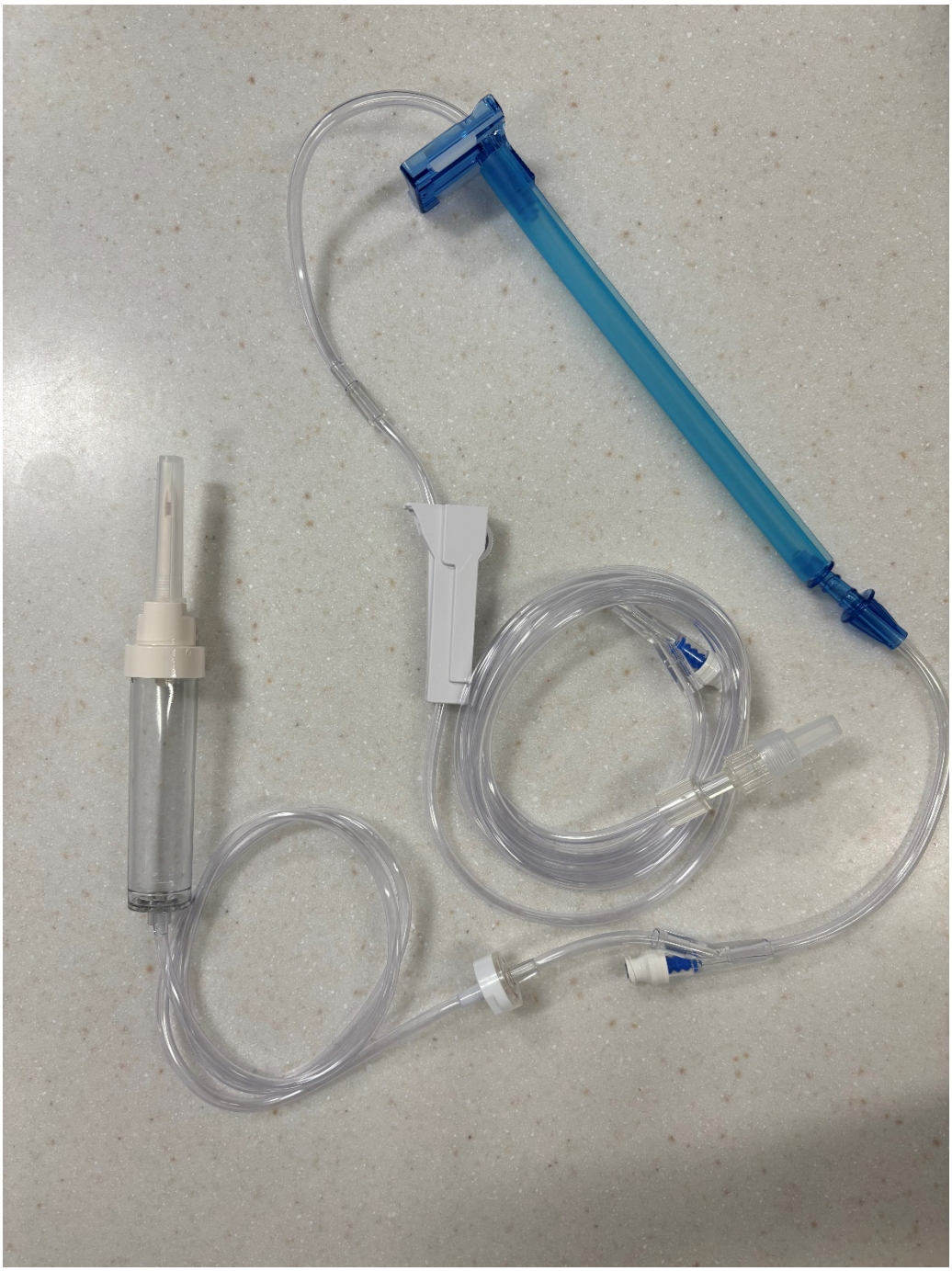


Figure 5a: Secondary Set Packaging

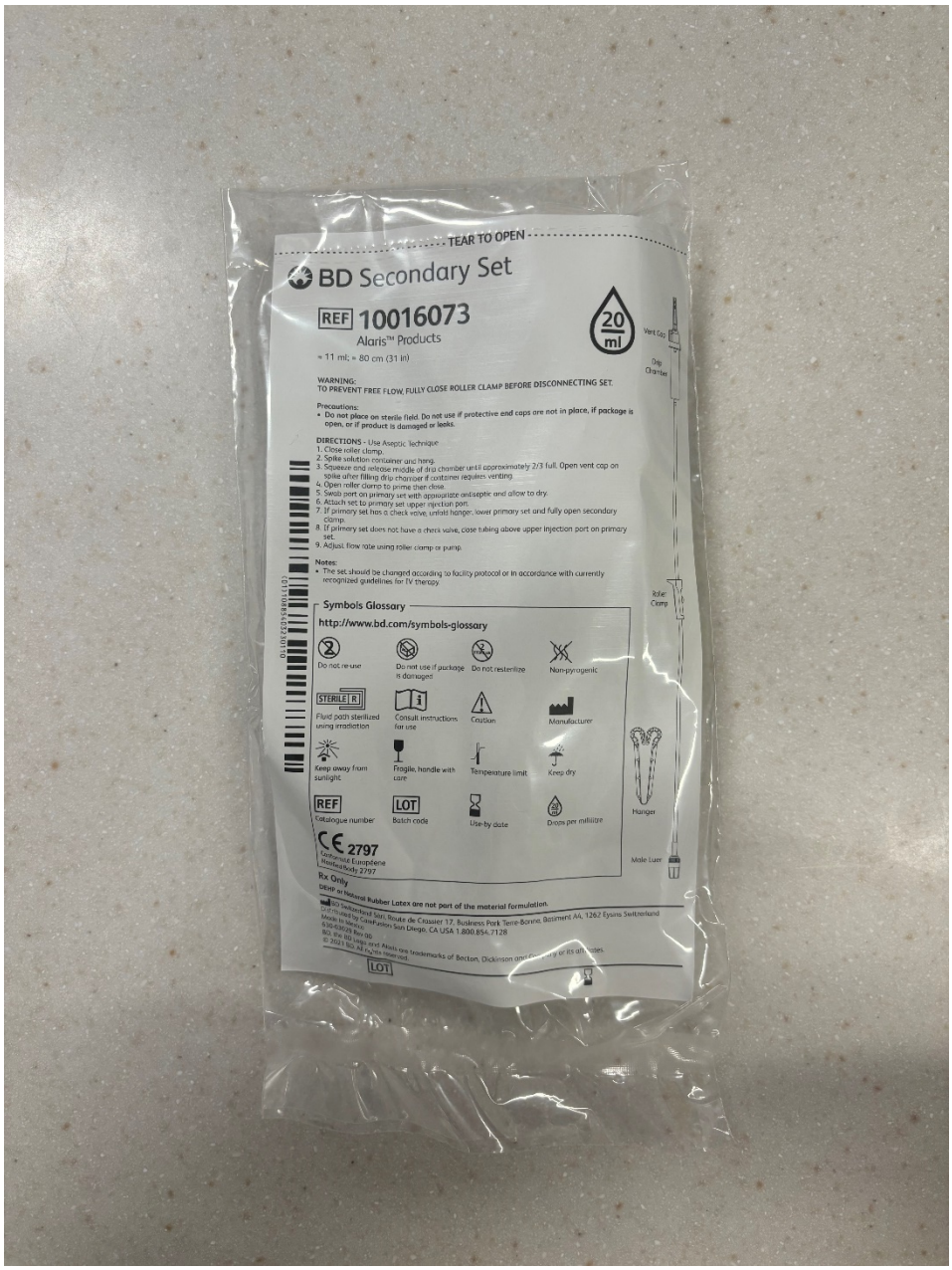
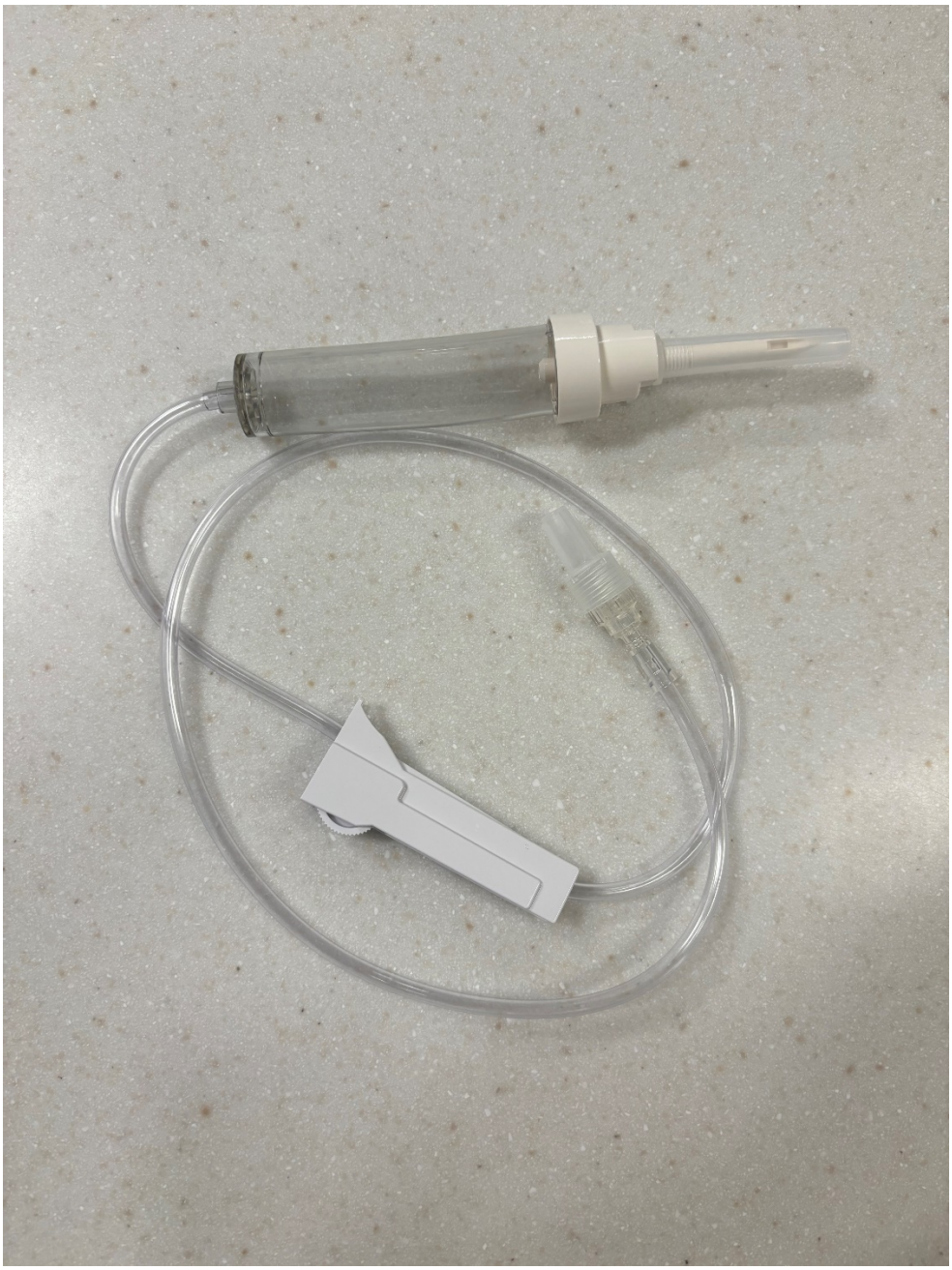


Figure 5b: Secondary Set



Y-Type Extension Set

Y-type extension sets are used to connect two standard IV sets to administer medications concurrently (e.g., leucovorin and oxaliplatin/irinotecan).

Figure 6a: Y-Type Extension Set Packaging

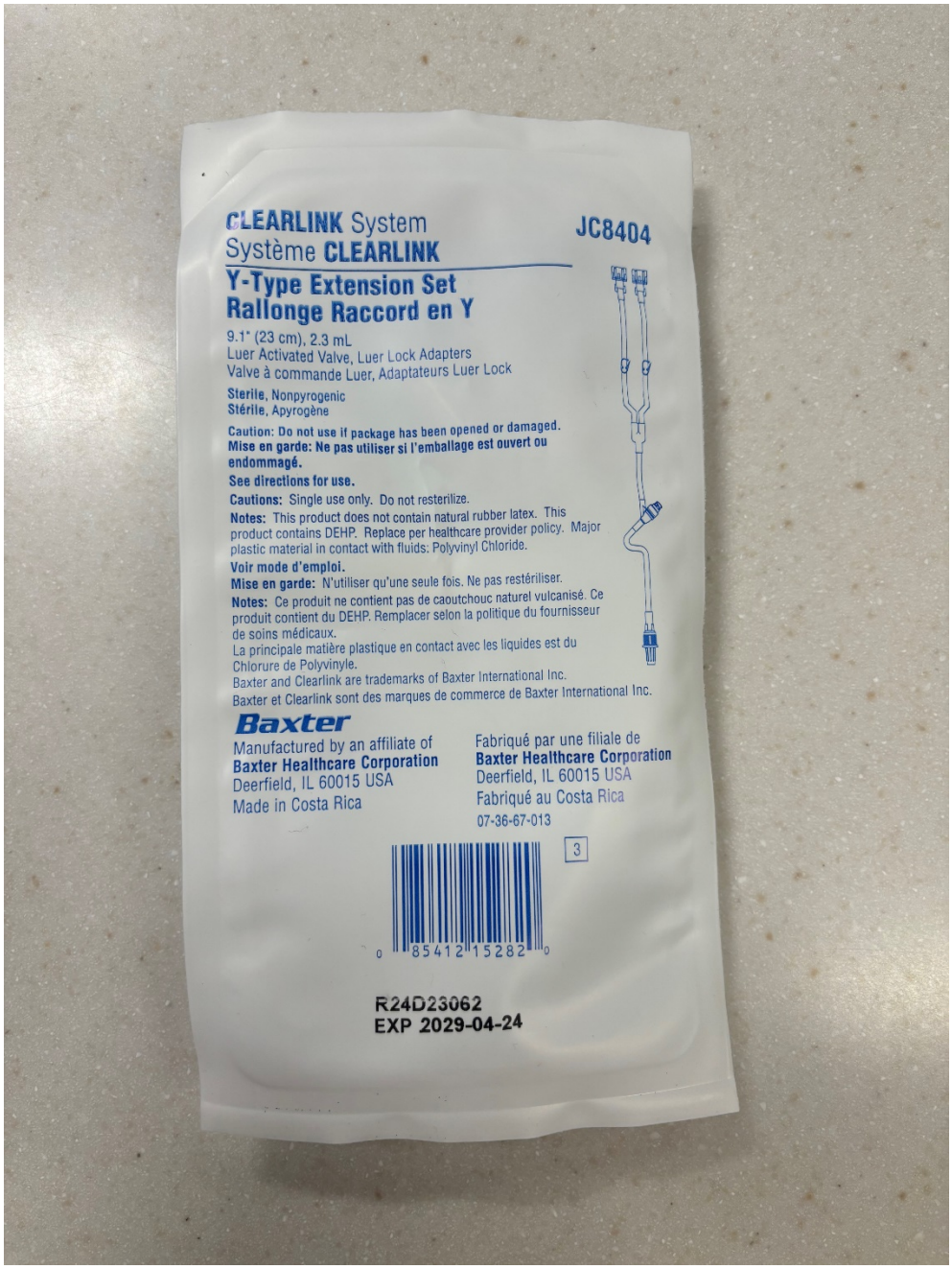


Figure 6b: Y-Type Extension Set

Micron Filter Lines

Some IV medications require using a micron filter to remove particulates or precipitates from the solution during administration. A 0.2-micron filter line is used for large-volume systemic therapy agents (e.g., etoposide, and paclitaxel).

Figure 7a: 0.2-Micron Filter Infusion Set Packaging

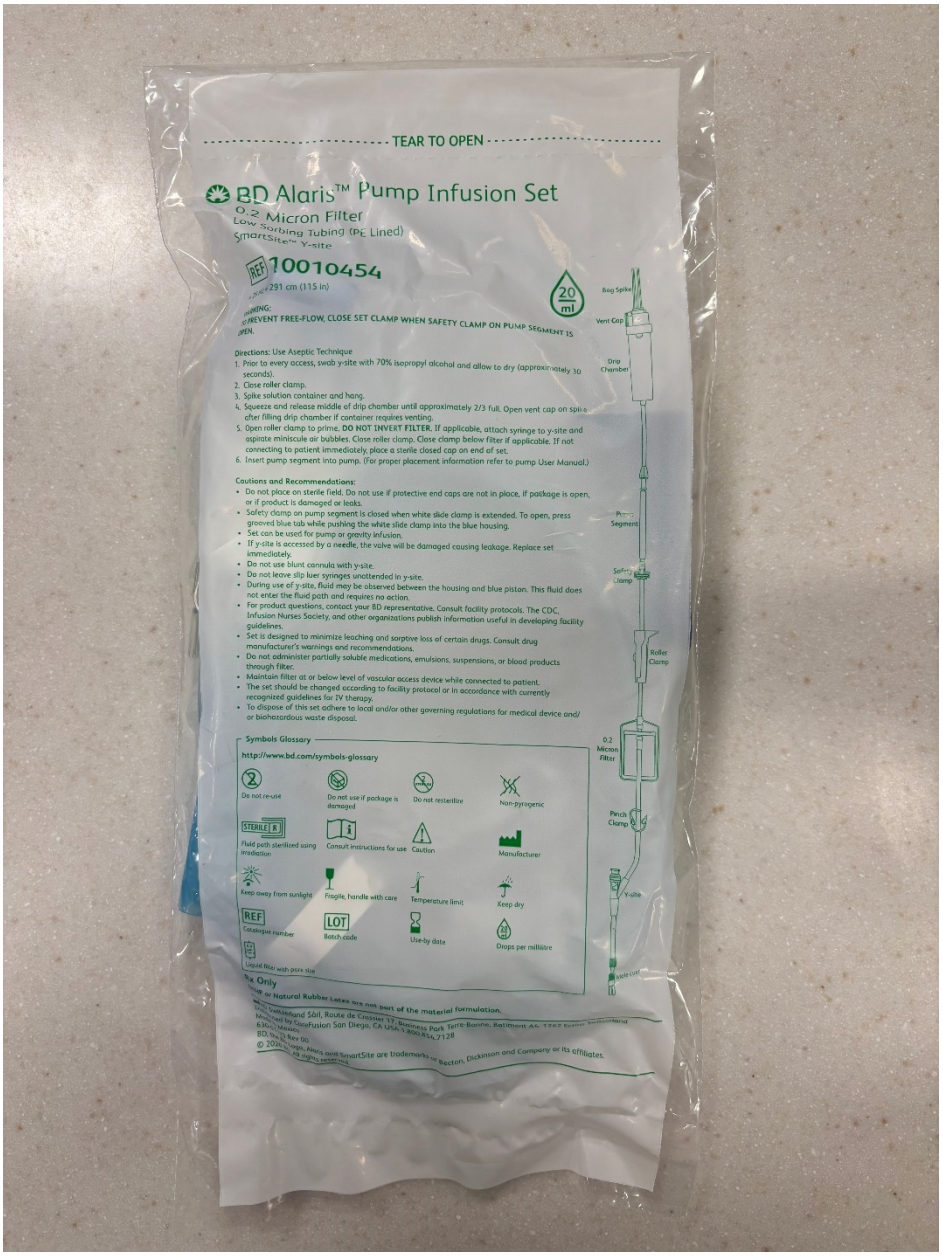


Figure 7b: 0.2-Micron Filter Infusion Set

Micron Filter Extension Set

A 0.2-micron filter extension set can be added to the end of a primary infusion set to obtain a filtered line setup. These are generally used for small-volume medications that require a filter (e.g., pembrolizumab and nivolumab).

Figure 8a: Micron Filter Extension Set Packaging

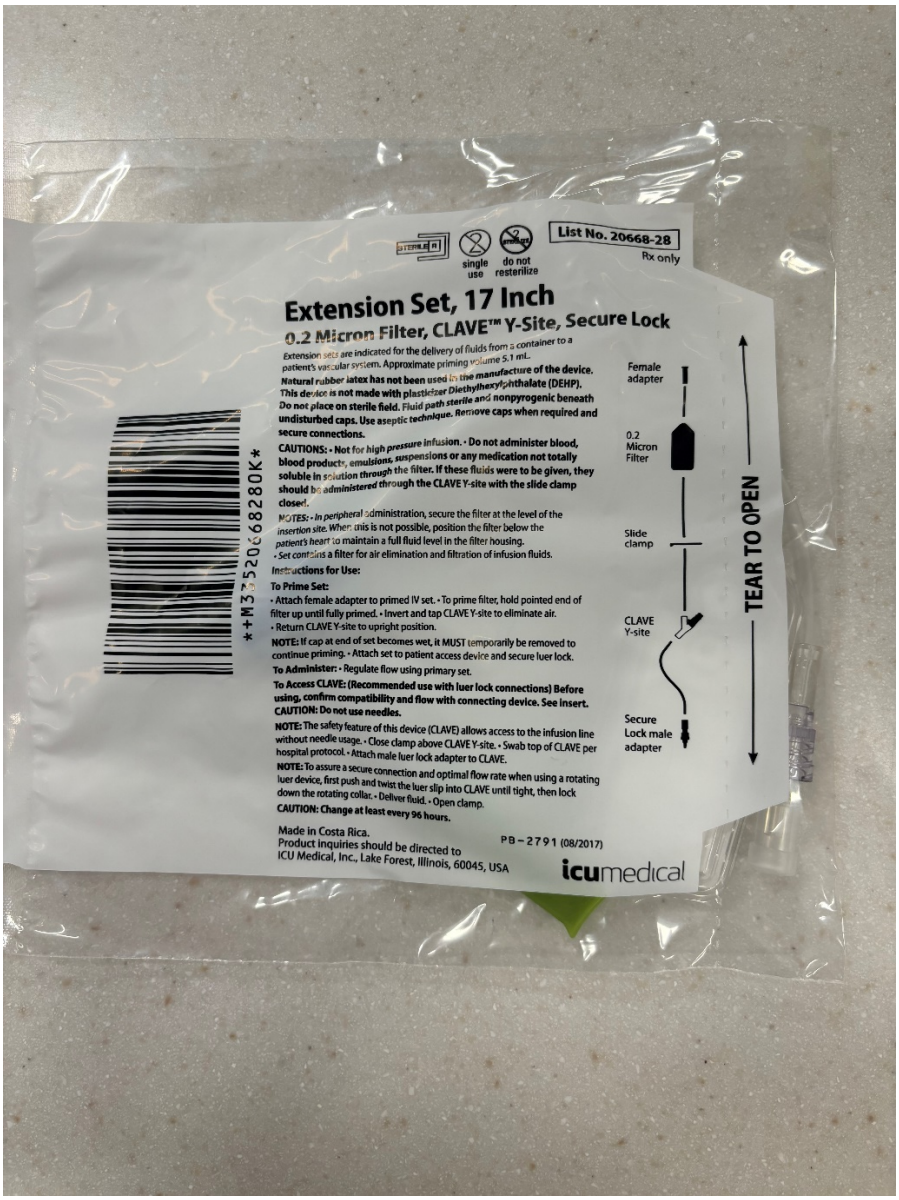
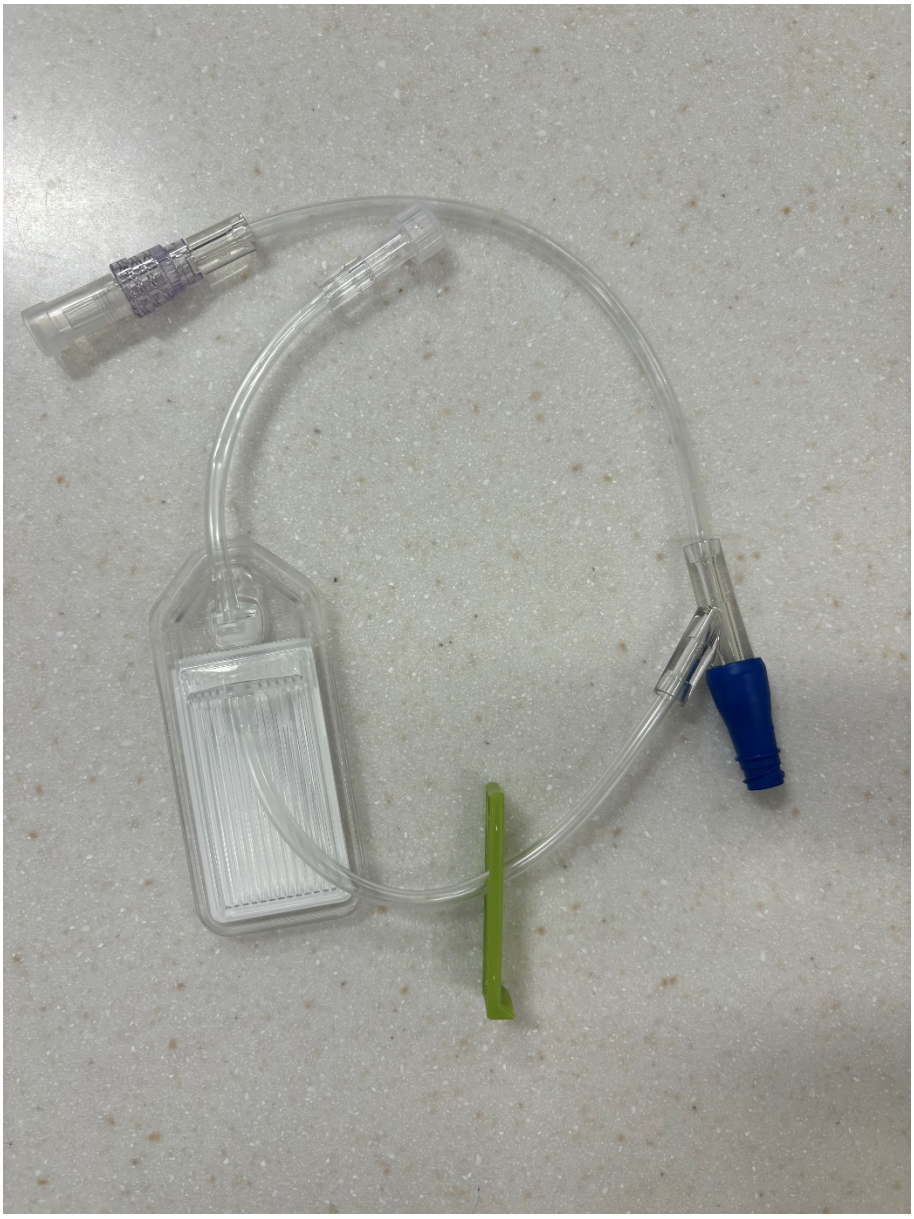


Figure 8b: Micron Filter Extension Set



Closed System Transfer Devices

BD PhaSeal™ Optima System is used in the local setting. A closed system transfer device used for IV lines and medication syringes reduces the risk of exposure to hazardous systemic therapy drugs. Using a closed system transfer device promotes the health and safety of nurses administering systemic therapy. PhaSeal™ Optima system consists of an airtight and leakproof system with self-sealing membranes that prevent the escape of hazardous liquid and vapor from the closed system.

Figure 9: Closed System Transfer Devices

Source: BD (2024)

Elastomeric Infusor

The Baxter Elastomeric Pumps provide an ambulatory infusion of chemotherapy. They are used in the local setting for Home Infusion Program (HIP) patients to provide slow infusion of fluorouracil for various systemic therapy protocols. These devices can be used with any central venous access device.

Figure 10: Baxter Elastomeric Infusor

1. **Winged Luer Cap** protects the opening and stops the flow of medication.
2. **Luer Lock Connector** at the end of the tubing attaches the Infusor/Intermate to the catheter/port.
3. **Flow Restrictor** controls the infusion rate of the medication.
4. **Tubing** is kink-resistant and carries the medication from the device into the patient's body.
5. **Balloon Reservoir** holds the medication.
6. **Progression Lines** may be horizontal or vertical on the plastic housing. These show you the progress of the infusion.
7. **Fill Port Cap** protects the Infusor/Intermate device.
8. **Plastic Housing.**

Source: Baxter (2010)

Nursing Considerations for Elastomeric Infusor

It is important to clamp the CVAD before the infusor is connected. Remove the infusor winged cap and ensure that the liquid is visible at the end of the tubing. Connect to CVAD with ¼ clockwise turn. Tape the Leur Lock connector to the patient's skin over the breastbone to achieve the appropriate temperature required for infusor flow. Unclamp CVAD and any clamps on the infusor. Assist the patient in carrying the infusor in a belt bag or pocket with the top of the device as close as possible to the level of the Leur Lock connector to maintain an accurate flow rate. Initial education for patients receiving treatment via elastomeric infusor is provided HIP coordinator in the local setting. Reinforcing this education is the responsibility of the RN administering systemic therapy. It includes reviewing safety precautions, arranging community health infusor disconnection, and ensuring the patient has emergency supplies (e.g., systemic therapy spill kit) and emergency contact information (e.g., 24-hour emergency phone numbers for community health team).

Section 4: Best Practice Standards, Policies, and Procedures

Systemic Therapy Administration

Refer to policy 204(NUR)-8-010: ADMINISTRATION OF PARENTERAL CHEMOTHERAPY AGENTS TO ONCOLOGY CLIENTS.

Responsibilities of the RN for the administration of systemic therapy include completing patient assessments (pre- and post-treatment), verifying systemic therapy agents and doses, initiating, and maintaining vascular access, administering systemic therapy, monitoring and managing side effects and toxicities, and coordinating treatment-related follow-up care.

RN Responsibilities Pre-Treatment

There are several essential responsibilities of the RN pre-treatment. The RN must review patient information, including ***diagnosis, medical history, allergies, medications, and tolerance/toxicities to prior treatments***. They must verify that ***consent for treatment*** is signed for the applicable systemic therapy regimen. The RN must ***review labs*** before each treatment to ensure they are within acceptable parameters. They must ensure that the patient's weight is documented before each cycle as drug dosages are calculated based on height/weight (body surface area). The RN then reviews systemic therapy orders, including the physician's order to proceed with treatment, and the systemic therapy protocol (i.e., systemic therapy agents and supportive medications required). Finally, the RN completes their nursing assessment including vital signs before initiating treatment.

RN Responsibilities During Treatment

There are several important responsibilities of the RN during treatment administration. They must establish appropriate vascular access, perform independent double-checks of the systemic therapy agent, and ensure they use the correct administration technique (intermittent IV infusion, IV push). The RN must wear appropriate personal protective equipment (e.g., gown, gloves, and/or mask, shield as required). Personal protective equipment will be discussed in detail in another section. They should use closed system transfer devices (i.e. PhaSeal ™ Optima system), and ensure an extravasation tray, spill kit, and "rescue" or emergency medications are readily available. The RN must monitor the patient at least hourly while systemic therapy is infusing. Infusion pumps are to be used for all systemic therapy administration, except peripheral vesicants which must be administered via gravity as previously discussed.

RN Responsibilities Post-Treatment

There are several responsibilities of the RN after administration of systemic therapy. They must discard equipment, including personal protective equipment and IV tubing in appropriate cytotoxic receptacles. The RN must assess patient status, provide post-treatment teaching (e.g., side effect management, supportive medications), and ensure the patient has follow-up arrangements or contact information for the appropriate healthcare professionals (e.g., physician, pharmacist, nurse) should any issues arise.

Peripheral Venous Access

Refer to policy 204(NUR)-8-010: ADMINISTRATION OF PARENTERAL CHEMOTHERAPY AGENTS TO ONCOLOGY CLIENTS.

To initiate peripheral venous access, the RN must choose the most appropriate access site and avoid sites with recent venipunctures, limbs with prior axillary lymph node dissection, and sclerotic, significantly radiated, or bruised areas. They should avoid the antecubital fossa, and minimize venipuncture attempts whenever possible. The RN should choose a large vein if administering vesicants or irritants. Once peripheral venous access is initiated, they must ensure brisk blood return and no bruising or swelling at the site. They must flush with saline to ensure patency before initiating systemic therapy.

Central Venous Access Devices

Central venous access devices (CVADs) include implanted ports, and tunneled central venous catheters (e.g., Hickman and Permacath).

Implanted Port

Refer to policy 204(NUR)-17-030: IMPLANTED PORT

The implanted port is surgically implanted under the skin, generally in the chest. The RN must use sterile gloves and an aseptic technique to access the port. They must cleanse the site with 2% chlorhexidine with 70% alcohol. If the port becomes blocked, notify the nurse practitioner (NP) or physician to discuss further management. Lock with 5ml heparin (100 units/ml) solution before removing the non-coring needle access device after use.

Figure 11: Implanted Power Port ™

Source: BD (2024)

Tunneled Central Access Devices

Refer to policy 204(NUR)-17-020: TUNNELED CENTRAL VENOUS ACCESS DEVICES

These long-term access devices (e.g., Hickman™, or permacath) are tunneled under the skin in the chest. The RN must wear sterile gloves and use an aseptic technique when the catheter hub is exposed. They must cleanse the site with 2% chlorhexidine with 70% alcohol. After cleansing the exit site, cleanse 5cm of the external tubing. Lock with 2.5 mls Heparin (100 units/ml) after use. If the catheter becomes blocked or the tunnelled cuff is exposed, notify the NP or physician to discuss further management.

Figure 12: Hickman™ Central Catheter

Source: BD (2024)

Administration of Vesicants

REFER TO POLICY 204(NUR)-8-020: ADMINISTRATION OF VESICANT CHEMOTHERAPY DRUGS TO ONCOLOGY CLIENTS (ADULT ONLY)

Vesicants include vinca alkaloids and antitumor anti-biotics. If multiple systemic therapy agents are ordered, vesicants should be administered first (unless ordered otherwise) as they are most likely to cause irritation and potential tissue damage. Administering vesicants first may decrease the risk of venous irritation. Some exceptions may apply to specific regimens.

While administering vesicants, it is important to check blood return frequently. The RN must verify blood return from the vascular access device before initiating administration of vesicants and continue to check blood return frequently throughout administration (every 2-3mls). The RN can check for blood return in a peripheral IV site by pinching and releasing the IV tubing and watching for blood return in the hub of the angiocath. They can check blood return from a CVAD by attaching a syringe and gently withdrawing. The RN must monitor for signs of venous irritation or extravasation. If this occurs, they must immediately discontinue the infusion and follow NL Health Services' extravasation management policy discussed in the next section.

While administering vesicants, the RN should allow IV fluid to run freely via gravity flow during direct injection of vesicants. They should be administered at a rate of 2-3 ml/min unless otherwise directed in the product monograph, using slow, steady pressure on the syringe’s plunger. A peripheral IV site must be monitored constantly during the administration of vesicants due to the high risk for extravasation.

Vinca alkaloids must be administered via gravity infusion through a peripheral IV site. An infusion pump can be used to administer vinca alkaloids through a CVAD. Venous access sites should be assessed post-infusion and lines flushed thoroughly with 50-125mls of IV fluid.

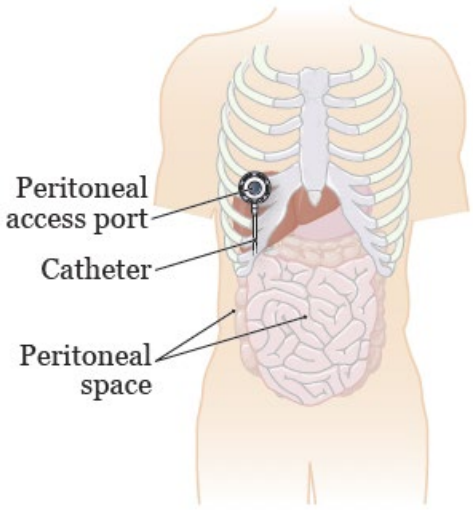
Intraperitoneal Chemotherapy

Refer to policy 340-NG-170 INTRAPERITONEAL CHEMOTHERAPY ADMINISTRATION.

Intraperitoneal (IP) chemotherapy is the instillation of high doses of chemotherapy into the abdominal cavity that is used in the treatment of some ovarian cancers. These treatments are administered through an implanted abdominal port. **See Figure 13.** The RN must use sterile gloves and an aseptic technique to access the

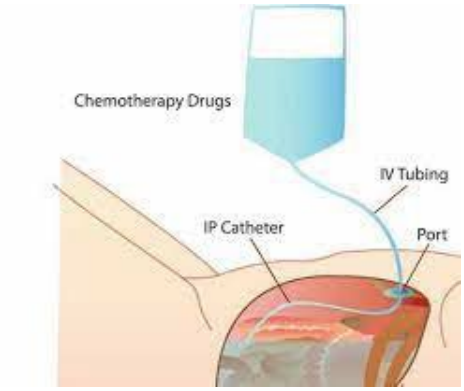
port. It is critical to assess for ascites before administration. Ascites is caused by an abnormal accumulation of peritoneal fluid in the abdomen and is often seen in patients with ovarian cancer. If ascites is present, do not proceed with the treatment, and notify the physician for further direction. Therapeutic paracentesis may be warranted to drain the excess, depending on the severity of the ascites and the patient's status.

Figure 13: IP Port



Source: NL Health Services Policy 340-NG-170 (2023)

Figure 14: IP Chemotherapy Administration



Source: NL Health Services Policy 340-NG-170 (2023)

IP Chemotherapy Administration

Before the RN accesses the implanted port, the patient should empty their bladder. Once the implanted port is accessed, flush the port with 20 mls of normal saline (NS). If resistance is felt with port flushing, notify the physician for further management. There will be no blood return from the abdominal implanted port as it is placed directly into the abdominal cavity.

Pre-hydration IV fluids and chemotherapy must be warmed by immersing the bags in water before administration. Treatments should be administered free-flowing via gravity without an infusion pump. IV fluids and chemotherapy should be administered as rapidly as possible as the patient must remain on bed rest during the instillation of the treatment.

The patient must remain in a supine or semi-fowler position (with head of bed < 30 degrees) during instillation to decrease the risk of needle dislodgement. Patients can use a bedpan during this time and the RN must reassess needle position afterward to ensure no accidental dislodgement has occurred by visually inspecting the site for leakage and verifying that fluid flow has not been impeded. The RN will monitor for tolerance to treatment by assessing the abdomen for any unusual swelling and assessing the access site for any swelling, pain, discoloration, or fluid leakage. Stop the infusion and notify the physician if pain occurs during installation.

Post Administration of IP Chemotherapy

The RN will de-access the implanted port immediately after administration of post-fluids. Lock the port with 10 mls of heparin solution (10 units/ml), using a turbulent (start-stop) technique. The heparin solution can be obtained by drawing 1 ml of heparin 100 units/ml solution into a 9 ml syringe of NS. After de-accessing the port, the RN will apply sterile gauze and a transparent dressing to the site. The patient may remove this dressing at home in 24H.

To appropriately distribute IP fluid, the RN must instruct the patient on proper positioning Q15 mins x 1 hour. The positioning includes slight Trendelenburg, right lateral, left lateral, and head of the bed at 30 degrees. The RN must provide patient teaching including monitoring the IP port site for signs of infection or leakage, side-effect management, knowing when to seek medical attention, and making follow-up arrangements.

Section 5: Symptom Management

Fatigue

Cancer-related fatigue is defined by BC Cancer (2018) as "a distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning" (p.1).

It is important to determine the severity of fatigue (i.e., whether it is impacting activities of daily living [ADLs]) and assess for any other underlying causes (e.g., anemia). The RN can encourage the patient to engage in light activity as tolerated and counsel them on energy conservation and prioritizing important tasks. The patient should maintain good sleep hygiene (i.e., limit daytime napping < 1 hour) and avoid caffeine or exercise before bed). The RN should encourage the patient to maintain adequate nutrition and hydration and avail of available psychosocial support. Psychosocial support may include accepting help from family and friends, and emotional support from health care providers.

Myelosuppression

Depending on the severity of the myelosuppression, dosage modifications may be warranted (refer to specific protocols for guidance).

It is important to encourage preventative measures while a patient is experiencing myelosuppression. Specific guidance includes avoiding contact sports, gently blowing the nose, avoiding forceful coughing, maintaining nutrition and hydration, practicing food safety (e.g., ensuring meats are fully cooked, avoiding cross-contamination, washing fruits/vegetables thoroughly before consuming), getting adequate rest, good mouth care, avoiding people who are sick, and avoiding large crowds.

In some cases, blood product transfusions (i.e., red blood cells, platelets) and medications (i.e., GCSF to stimulate white blood cell production) may be required to manage myelosuppression effectively.

Nausea & Vomiting

There are several recommendations the RN can make to help the patient manage nausea and vomiting.

- Encourage the patient to eat small, bland meals, and sip fluids throughout the day, avoid large fluid intake at mealtime, and avoid eating solid foods for 30-60 minutes after vomiting.

- If vomiting is severe, IV hydration and electrolyte replacement may be warranted. The RN should counsel the patient on appropriate anti-emetic use.
- Pharmacological management of nausea in cancer patients typically includes ondansetron, dexamethasone, metoclopramide, prochlorperazine, and aprepitant/fosaprepitant for highly emetogenic protocols.

The RN should also assess for anticipatory nausea (nausea that occurs in anticipation of receiving systemic therapy before the treatment is administered). Anticipatory nausea may be caused by cognitive triggers related to the sights, smells, or sounds associated with treatment. Encouraging the patient to engage in distraction techniques may be helpful for the management of anticipatory nausea.

Decreased Appetite & Anorexia

There are several recommendations the RN can make to assist the patient in managing their decreased appetite.

- Encourage the patient to increase their liquid intake (e.g., soup, smoothies, nutritional shakes) as tolerated, and choose high-calorie, high-protein foods (e.g., cheese, eggs, yogurt, nut butter) when possible.
- Eating frequent, small meals (5-6 per day), and sitting upright 30-60 mins after eating may also aid digestion.
- The RN and patient need to monitor weight loss and ensure early referral to a dietician as needed for further guidance.
- Patients at high risk for weight loss (e.g., head and neck, esophageal, stomach cancer receiving active treatment) should be automatically referred to a dietician and other patients exhibiting signs of decreased oral intake should be referred as needed.

Constipation

There are several recommendations the RN can make to assist the patient in managing their constipation. Encourage the patient to engage in light physical activity as tolerated, maintain adequate fluid intake, and make dietary changes if possible. Dietary suggestions include increasing fibre intake and consumption of "natural laxatives" (e.g., prunes, dates, figs, raisins, bran). If possible, patients should avoid other medications that cause constipation (e.g., ondansetron). It may be necessary to discuss alternative options to these medications with the pharmacy team. The RN should educate the patient regarding symptoms that require medical attention (e.g., fever, severe cramping/abdominal pain/distension, vomiting) as these may indicate possible bowel obstruction and further intervention may be required.

Sennosides and polyethylene glycol (PEG) 3350 (RestoraLAX ®) are recommended for systemic therapy and opioid-related constipation. Counsel patients with neutropenia or thrombocytopenia to avoid suppositories or enemas due to the increased risks of infection, or bleeding.

A BC Cancer patient handout for management of constipation is available via:

http://www.bccancer.bc.ca/managing-symptoms-site/Documents/Constipation-Caused-By-Your-Medications.pdf

Diarrhea

There are several recommendations the RN can make to assist the patient in managing their diarrhea.

- Encourage patients to maintain adequate oral hydration, avoid potential triggers (e.g., spicy, greasy foods), temporarily discontinue laxatives, and take loperamide as directed.
- The patient should practice good hygiene and be encouraged to take sitz baths if soreness occurs.
- It is important to notify the physician if diarrhea occurs while on immunotherapy. This diarrhea could be a sign of an immune-related adverse reaction (i.e., enterocolitis) and may require treatment with steroids.
- The RN should educate the patient regarding symptoms that require medical attention (e.g., fever, bloody stool, severe cramping/abdominal pain, dehydration, and uncontrolled diarrhea despite the use of loperamide).

Loperamide Dosing

As loperamide is recommended to treat diarrhea in most systemic therapy protocols, it is essential to teach patients how to take it appropriately.

Standard loperamide dosing:

4mg then 2mg Q4H or after each loose BM. Max 16mg/day (unless otherwise directed by pharmacist or physician).

Loperamide for diarrhea associated with **irinotecan** may exceed package directions:

4 mg then 2mg Q2H until diarrhea has subsided for 12H. Can take 4mg Q4H overnight.

Stomatitis (Oral Mucositis)

There are several recommendations the RN can make to assist the patient in managing their stomatitis. Encourage the patient to practice good oral hygiene, using a soft, manual toothbrush to brush teeth 2-4 times daily. Flossing can be continued if this was already a regular habit pre-treatment but should be avoided if it causes bleeding, or the patient has thrombocytopenia. Encourage the patient to complete oral rinses 4 times daily using baking soda, or saltwater rinses, or prescription mouthwash if prescribed by their physician; they should avoid commercial mouthwashes containing alcohol (e.g., Listerine). The patient should increase their oral hydration, and avoid dry, hard, or spicy foods whenever possible. The RN should monitor for complications (e.g., thrush) that may need further management by the physician NP.

Saline rinse:	Baking soda rinse:
½ tsp salt in 1 cup of water	¼ - ½ tsp baking soda in 1 cup water

Alopecia

There are several recommendations the RN can make to assist the patient in managing their alopecia. It is important to provide education regarding potential hair loss early in the patient's treatment. Hair loss typically begins in the first 2-4 weeks of treatments. Not all treatments cause hair loss, and the degree of hair loss may vary with different protocols. The scalp may also feel tender before or during hair loss. Encourage the patient to limit hair washing, if possible, and use gentle products and brushes/combs. Patients should avoid hot styling tools, hair dyes, bleach, or perms. Preventative measures such as these may help avoid damage to hair and decrease the risk of scalp irritation.

If the patient plans to shave their hair, encourage them to use an electric razor to avoid scalp irritation. Encouraged the patient to wear a hat, scarf, or head covering to keep warm and protect the scalp from the sun. The patient may wish to discuss wigs and hair alternatives; these may be covered under insurance with a prescription. The RN can discuss available supportive resources such as the Look Good Feel Better Program®. This program aims to increase confidence, and well-being, and promote positive self-image through psychosocial support, and education to patients. Provide the patient with education regarding hair regrowth as

well. Hair typically starts growing back between 2-6 months after treatment is finished. Counsel the patient that their hair may grow back with a different color or texture than they had before treatment.

Skin Changes

There are several skin care recommendations the RN can make to help the patient manage their skin changes. General skin care recommendations include using mild soaps, washing skin gently, avoiding scratching, applying unscented moisturizers frequently, applying cool compresses, avoiding extreme heat/cold, wearing loose clothing, avoiding sun exposure, and applying sun protection.

To manage **acneiform rash,** encourage the patient to follow general skin care recommendations, and avoid over-the-counter acne treatments. Discuss a worsening acneiform rash with the physician as it may require further medical management.

To manage **hand-foot syndrome (PPE)**, encourage the patient to reduce friction to hands and feet, and use non-urea-based creams preventatively to keep the skin soft. Urea-based creams may cause unnecessary debridement of skin. Encourage the patient to switch to a lanolin-based cream if mild symptoms occur. Discuss with the physician if symptoms worsen as they may require further management (e.g., topical steroids, prescription creams, anti-biotics, analgesia).

Peripheral Neuropathy

It is important to assess the severity of peripheral neuropathy (e.g., impact on ADLs and ambulation). There are several recommendations the RN can make to assist the patient in managing their peripheral neuropathy. Encourage the patient to monitor the skin integrity of their hands and feet frequently, avoid tight-fitting shoes, remove tripping hazards in the home, and use an ambulation aid if required. Discuss with the physician if symptoms worsen, as further medical management or treatment changes may be required.

Cognitive Changes

While “brain fog” may resolve after treatment, it can persist for some patients. There are several recommendations the RN can make to help the patient to manage their cognitive changes. Consider a referral to an occupational therapist, as occupational therapy may be helpful with managing day-to-day activities or job-related duties such as managing workload and meeting deadlines. Counseling and emotional support may help the individual cope with their cognitive changes. Patients often feel frustrated, embarrassed, or defensive about their symptoms. The

RN can provide emotional support where possible and consider social work referrals for supportive counseling if the patient is interested.

Encourage the patient to use coping strategies at home (e.g., using a calendar or organizer, setting alerts and reminders on their phone, and focusing on one task at a time). Encourage them to engage in stimulating activities (e.g., puzzles, painting, playing musical instruments, and learning new hobbies) as these may help "exercise" the brain. Suggest physical activity such as swimming, gardening, and walking to improve mental clarity. Encourage them to decrease their stress where possible, by practicing relaxation and mindfulness (e.g., yoga, meditation) to assist with thinking more clearly.

Sexuality & Intimacy

There are several strategies the RN can implement to help the patient manage their sexuality and intimacy needs. It is crucial to provide an open and safe environment for discussion and education regarding the impacts of illness and treatment. The RN should educate the patient on preventing pregnancy and the risk of bodily fluid exposures while receiving systemic therapy. The RN can offer social work referrals for sexual health counseling and encourage the patient to discuss medical management (e.g., sildenafil, and hormone replacement therapies) with their physician.

Infertility

Patients must receive education on the potential for infertility after receiving systemic therapy. Encourage an early, and open discussion with the healthcare team regarding a patient's fertility needs. The patient may require a referral to a fertility specialist or clinic. Depending on the patient's treatment plan, the physician may determine if it is possible to delay treatment start to allow fertility preservation measures (e.g., freezing of eggs or sperm) if the patient wishes to do so.

Section 6: Monitoring Parameters During Treatment

Lab Values

Alterations in lab values are common while receiving systemic therapy.

Myelosuppression

Hematologic toxicities are the most common cause of systemic therapy treatment delays. Individual drugs and regimens can cause varying degrees of myelosuppression. The **nadir** refers to the period after treatment administration when the lowest blood counts are observed, reflecting the blood cells' maturation cycle. Individual drugs often have a predictable nadir. Most nadirs for **white blood cells** (WBCs) occur in 7-14 days. Some exceptions may apply, as certain drugs may have delayed nadirs and prolonged recovery times. Recovery of cell counts usually occurs within 21-28 days. Many protocols are based on a 21- or 28-day cycle to reflect the recovery time from nadir to normal (or near normal) cell counts. It is important also to consider patient-specific factors (e.g., age, type of cancer, whether they have had previous treatment with radiation or systemic therapy) and how these factors may potentially impact the severity of myelosuppression.

WBCs

Elevated WBCs (i.e., leukocytosis and neutrophilia) may be caused by infection, myeloproliferative disorders, inflammation, corticosteroids, or colony-stimulating factors. Low WBCs (i.e., leukocytopenia and neutropenia) may be caused by bone marrow invasion (i.e., leukemia), or the effects of systemic therapy agents.

Neutrophils

Absolute neutrophil count (ANC): total # of circulating neutrophils

Normal ANC 2 – 7.5 × 10^9 neutrophils/L of blood

Neutrophils may not fully recover between cycles, resulting in dose reductions or treatment delays. Neutrophils are most susceptible to the effects of systemic therapy agents due to their short life span.

Generally, the threshold for tx is ANC ≥ 1.5 × 10^9. Some protocols may have a lower ANC threshold; thus, it is important to review individual protocols. Some protocols may warrant using GCSF for neutropenia while febrile neutropenia is considered a medical emergency.

Febrile neutropenia is defined by BC Cancer (n.d.) as "the presence of neutropenia plus concurrent fever (ANC < 1 x 10^9/L and a single oral temperature of ≥ 38.3C

orally or a temperature of ≥ 38C over 1 h)" (p. 1). Febrile neutropenia requires treatment with antibiotics and supportive medications.

Patients must be educated by their healthcare team that a fever > 38.0C while receiving systemic therapy warrants immediate medical attention. Patients should proceed to the nearest emergency department for further assessment and treatment of potential febrile neutropenia.

Platelets

Elevated platelets (thrombocytosis) may be caused by certain types of cancer, inflammatory disease, or splenectomy. Low platelets (thrombocytopenia) may be caused by viral infections, bone marrow invasion (e.g., leukemia, lymphoma), or the effects of systemic therapy agents.

A normal platelet count is 150 – 400 × 10^9 platelets/L of blood.

Platelets may not fully recover between cycles, resulting in dose reductions or treatment delays. Platelets are less susceptible than neutrophils to the effects of systemic therapy agents. Generally, the threshold for treatment is 100 × 10^9 platelets/L. However, this may vary depending on the regimen. Therefore, it is essential to review individual protocols.

While systemic therapy agents may cause thrombocytopenia, there may also be disease-related causes, especially for hematologic cancers. Dosage adjustments may not be necessary if the thrombocytopenia is disease-related. It is especially important to review protocols for hematology regimens as platelet thresholds are often significantly lower depending on the protocol.

Red Blood Cells (RBCs)

RBCs are least affected by systemic therapy due to their longer life span; however, the effects are cumulative, and anemia may occur with subsequent treatment cycles. The patient may be present as symptomatic with fatigue, and weakness. Multiple factors may contribute to anemia including systemic therapy agents, chronic disease, blood loss, poor nutrition, bony involvement, previous systemic therapy, or radiation. **Cisplatin** is commonly associated with anemia.

Liver Function Tests

Liver function tests (LFTs) include alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphate (ALP), lactate dehydrogenase (LDH), and total bilirubin.

Elevations in LFTs may be caused by liver cancer, liver metastases hepatitis, cholestasis, gallstones, pancreatic cancer, or drug-related hepatocellular injury. As there are many possible causes behind elevated LFTs, elevations should be discussed with the physician and/or pharmacist. It is also important to review individual protocols for treatment guidance in the presence of elevated LFTs.

Renal Function Tests

Renal function tests include serum creatinine, creatinine clearance (CrCl), glomerular filtration rate (GFR), urea, nitrogen, and urine protein.

A decreased CrCl may indicate decreased renal function and warrant treatment delays or dose reductions. It is important to review individual protocols in the presence of decreased kidney function. Special consideration is warranted in patients receiving systemic therapy agents primarily excreted by kidneys. Baseline thresholds may exist for specific agents (e.g., minimum CrCl of 45 ml/min to administer cisplatin safely).

Electrolytes

Electrolytes include sodium, potassium, chloride, bicarbonate, calcium, magnesium, and phosphate.

Electrolyte imbalances can be caused by cancer, systemic therapy agents, treatment-related side effects (e.g., diarrhea, vomiting), dehydration, and other medications (e.g., diuretics).

Electrolyte imbalances can cause cardiac arrhythmias; acute, significant changes require intervention. Hypercalcemia is common in patients with advanced cancers (e.g., metastatic cancers that have spread to the bone). Hypomagnesemia is common in patients receiving treatment with **cisplatin** and **panitumumab**.

Urine Protein

Urine protein can be measured with a urine dipstick, urine sample, or 24H urine collection. Increased urine protein may be seen in patients with multiple myeloma, or those on nephrotoxic medications. Urine protein should be monitored regularly for patients receiving **bevacizumab**; see the table below.

Special Considerations for Bevacizumab

Monitor urine protein using a dipstick. For **gynecology** protocols (i.e., treatment of gynecologic cancers with bevacizumab), urine protein monitoring is completed EVERY cycle. For **gastrointestinal** protocols (i.e., treatment of gastrointestinal

cancers with bevacizumab), urine protein monitoring is generally performed every second cycle, on even # cycles. However, there may be some exceptions, thus, it is critical to review individual protocols for guidance.

Urine Protein Result	Action
1+	Proceed with treatment
2+ or 3+	Proceed with treatment, 24H urine (within 3 days of next dose)
4+	Hold treatment, 24H urine

The physician will determine a plan for subsequent treatment (e.g., dose reduction, discontinuation) that is required based on the results of 24H urine.

Blood Pressure Monitoring for Bevacizumab

Acute HTN, characterized by an increase of 20 mmHg in systolic blood pressure (BP) or BP > 160/100, may occur during the administration of **bevacizumab**.

If acute HTN occurs, stop the infusion, then reassess the patient's BP. Discuss the HTN with the physician for further direction (e.g., slower administration rate), and any further management if required. Symptomatic HTN (e.g., change in level of consciousness or headache) requires immediate intervention. A BP of 180/110 that does not improve in one hour after stopping infusion requires further intervention.

Gastrointestinal Protocols

Blood Pressure (mmHg)	Action
≤ 160/100	Proceed with tx
≥ 160/100	Notify physician, may initiate anti-hypertensives
Acute uncontrolled HTN	Discontinue tx

Antihypertensive therapy may include hydrochlorothiazide 12.5 to 25 mg PO once daily, ramipril 2.5 to 5 mg PO once daily, and/or amlodipine 5 to 10 mg PO once daily (as directed by the physician).

Gynecology Protocols

*** Note the difference in systolic BP threshold from GI protocols ***

BP (mmHg)	Action
≤ 150/100	Proceed with tx
≥ 150/100 (asymptomatic)	Notify physician, may initiate anti-hypertensives
Acute uncontrolled HTN	Discontinue tx

*** Anti-hypertensives are the same as with GI protocols ***

Special Considerations: Rituximab

Rituximab can cause hypotension, requiring caution with patients on anti-hypertensives. The physician may consider holding anti-hypertensives 12 hours pre-rituximab. There is a risk of tumor lysis syndrome (TLS) during the first dose of rituximab requiring close patient monitoring. TLS occurs when cancer cells break down and die, expelling an overabundance of intracellular components into the bloodstream resulting in electrolyte imbalances (e.g., elevated uric acid, potassium, and phosphate levels, and low calcium levels). Life-threatening complications associated with electrolyte imbalance may occur (e.g., neurological changes, arrhythmia, and nephrotoxicity). Extreme caution is warranted for patients with high disease burden (i.e., high numbers of cancer cells present). The physician may decide to premedicate patients with high tumor burden (e.g., steroid) or omit rituximab from the first cycle to decrease the risk.

Administration of rituximab requires premedication with an antihistamine and an antipyretic. The first dose is given at a reduced/graduated infusion rate to decrease the risk of a hypersensitivity reaction. Hypersensitivity is seen in up to 77% of patients during their first dose of rituximab and is thought to be related to cytokine release. Patients should be monitored very closely throughout the first infusion. Symptoms of an infusion reaction include hypotension, fever, chills, rigors,

urticaria, bronchospasm, tongue/throat swelling, nausea, fatigue, headache, pruritis, dyspnea, rhinitis, vomiting, and flushing. Severe reactions may progress to acute respiratory distress and angioedema.

In some protocols, SQ Rituximab replaces IV if the first dose is tolerated well. If there are more than 6 months between doses, the patient must receive IV rituximab again before consideration of SQ rituximab.

Pre-Medication for Rituximab

IV Infusion:

Diphenhydramine 50mg PO before, then Q4H if infusion exceeds 4H

Acetaminophen 650-975mg PO before, then Q4H if infusion exceeds 4H

SQ Administration:

Diphenhydramine 50mg PO before

Acetaminophen 650-975 mg PO before

*** It is important to follow specific orders as these pre-medications may vary for individual protocols ***

Rituximab IV Infusion Rates

For the **first** dose of rituximab, start infusion at 50 mg/hr for the first hour, and increase the rate by 50mg/hr Q30 mins to a max rate of 400 mg/hr.

For **subsequent** doses of rituximab, if there is no sign of hypersensitivity reaction, administer over 90 mins (20% of the dose in the first 30 mins, remaining 80% over 60 mins), unless otherwise directed by the physician.

Vital Signs Monitoring

It is important to follow practice area-specific guidelines for routine vital sign (VS) monitoring for patients receiving systemic therapy in the outpatient setting. At a minimum, VS monitoring is required pre-treatment with the nursing assessment. In addition to routine VS monitoring practices, some systemic therapy agents warrant closer monitoring of VS (primarily during the first dose or subsequent doses if the patient has had a previous hypersensitivity reaction). Increased VS monitoring may be warranted for agents that are associated with a higher risk of a hypersensitivity reaction such as **paclitaxel** (frequent monitoring of VS during 1st hour of infusion is recommended) and **docetaxel** (patients should be observed closely for 1st and 2nd

infusions). Q15-minute vital signs are completed for the first hour of the first dose of paclitaxel and docetaxel in the local practice setting.

Section 7: Adverse Event Monitoring & Management

Extravasation

Refer to policy PRC-092 MANAGEMENT OF EXTRAVASATION OF CHEMOTHERAPEUTIC VESICANT AGENTS-ADULT.

Extravasation is the leakage/infiltration of a vesicant agent into the surrounding subcutaneous tissues that can cause discomfort, local tissue damage, and subsequent functional impairment of the affected limb. Appropriate, frequent monitoring of the IV site by the RN especially with vesicants can decrease the risk of injury to the patient. The RN should monitor for signs of venous spasm or flare reaction (e.g., erythema, blotches, streaking, and/or wheals on the skin over the affected vein). If such an irritation occurs, stop the drug immediately, infuse fluids, and apply a warm compress. When settled, assess the IV site, and check for blood return. If the site is healthy, the RN may resume the systemic therapy (a slower rate may be necessary). If this irritation persists, the IV should be resited.

Early signs of extravasation include pain and burning at the IV site, blotchy redness, changes to infusion quality, and no blood return. An extravasation tray should be readily available in the systemic therapy treatment area. The extravasation tray contains the appropriate supplies and antidotes for the management of a vesicant extravasation. See the steps for extravasation management below. Vesicants cause discomfort and tissue damage. Irritants cause discomfort but generally not tissue damage. In some instances, irritants may cause tissue damage, but this is less likely than with vesicants.

If extravasation is suspected, stop the drug and fluid infusion, disconnect the tubing, aspirate residual drug from peripheral IV using a 3ml syringe, or aspirate residual drug from a CVAD using a 10ml syringe. Notify the physician immediately and obtain the extravasation tray. Leave the IV in place until the physician assesses the patient, and they determine whether antidote administration is required. Aspiration of the drug from the SQ tissues may be required.

Management of Extravasation

The physician will administer an extravasation antidote (see below) if required. The RN can outline the affected area to monitor extravasation with a pen or marker to monitor the extravasation and allow the physician to assess the resolution or progression of symptoms. The physician may want to take photographs of the extravasation site. Written consent is required from the patient if photographs are to be taken. The RN should document extravasation on the patient’s health record and complete occurrence reports as per organizational policy.

Extravasation Antidotes

Extravasation antidotes vary depending on which systemic therapy agent is involved. It is the responsibility of the physician to administer IV or SQ antidotes. A local anesthetic may be used before antidote administration.

For **vinca alkaloids,** hyaluronidase is injected SQ into the extravasation site to increase systemic absorption of the agent. [Hyaluronidase 1500 units in 1ml NS/sterile water]

For **anthracyclines**, dimethyl sulfoxide (DMSO) topical is applied QID x 7 days. DMSO 99% solution is applied to the site twice the size of the extravasation. DMSO increases systemic absorption and neutralizes free radicals. It is important to NOT cover the extravasation site with a dressing once the antidote is applied as this may cause blistering; instead, leave it open to air. Do not apply pressure to the site after the antidote is administered.

A list of required contents of the extravasation tray and the process for obtaining antidotes can be found in the NL Health Services policy listed above.

Patient Education for Extravasation

For **vinca alkaloids** or **oxaliplatin**, encourage the patient to apply a warm compress for 15 minutes 4-5 times daily for 48 hours.

For **anthracyclines**, **docetaxel**, or **paclitaxel**, encourage the patient to apply a cold compress or ice pack for 15 minutes 4-5 times daily for 48 hours.

A patient teaching handout for extravasation management is available in the NL Health Services policy listed above.

https://paradigm-nlhss.msappproxy.net/P3web_Policy/ViewDocument.aspx?ItemID=22066&IsItemID=false&ItemStatus=9

Hypersensitivity Reactions

Refer to policy PRC-094 MANAGEMENT OF HYPERSENSITIVITY REACTIONS TO ANTINEOPLASTIC AGENTS (ADULT)

A hypersensitivity reaction is an immune-mediated response to a systemic therapy agent, which may be related to the drug or the admixture. This reaction may occur during the first exposure, or with repeated exposures to the agent. Agents associated with a higher risk of a hypersensitivity reaction include **taxanes,**

platinum drugs, epipodophyllotoxins, MoAbs, bleomycin, and some **immunotherapies**.

Signs of Hypersensitivity Reactions

General signs include fever, chills, flushing, sweating, fatigue, agitation, and/or metallic taste. **Cutaneous** signs include rash, urticaria, pruritis, and/or angioedema. **Respiratory** signs include dyspnea, wheezing, stridor, rhinitis, cough, chest tightness, and/or laryngeal edema. **Cardiovascular** signs include tachycardia, and/or hypo/hypertension. **Gastrointestinal** signs include nausea, vomiting, diarrhea, and/or abdominal cramping. **Renal** signs include flank pain, back pain, and/or hematuria. **Neurological** signs include headache, impending doom, agitation, decreased level of consciousness, and/or seizures.

Management of Hypersensitivity Reactions

Refer to medical directive PRC-MD-020 CANCER CARE PROGRAM ANTINEOPLASTIC HYPERSENSITIVITY REACTIONS ADULT.

If a hypersensitivity reaction occurs, stop the infusion immediately and infuse IV fluids. Assess VS at least Q10 minutes until symptoms are resolved. Administer rescue medications (see below) and notify the physician. Provide supportive care as needed (e.g., oxygen and IV fluids). A 500 ml NS bolus may be administered for hypotension. Administer O2 2L via nasal prongs if the patient is experiencing respiratory distress. ****Caution with oxaliplatin****. Do not administer cool, humidified, oxygen which may exacerbate the patient's symptoms. A non-rebreathing mask connected directly to the oxygen flow meter is recommended if supplemental O2 is required for patients receiving oxaliplatin.

Document the hypersensitivity reaction as per organizational practices.

Hypersensitivity Medications

Diphenhydramine 50mg IV push over 2 minutes

Hydrocortisone 100mg IV push over 2 minutes

Famotidine 20mg IV push over 2 minutes

For Grade 3 reactions that are not resolved and involve respiratory distress or a Grade 4 reaction, administer epinephrine 0.01 mg/kg (max dose 0.5mg) intramuscularly (IM) to thigh Q5 mins (to a max 3 doses)

These medications may not necessarily be used for hematologic hypersensitivity reactions – follow the specific protocol or seek direction from the physician as needed

Rechallenging after Hypersensitivity

If the physician plans to rechallenge a patient by continuing with the same systemic therapy agent following a hypersensitivity reaction, they must write an order on the patient's chart to resume treatment. The physician must remain in the clinical area until the infusion is at the maximum rate and there are no signs of further hypersensitivity reaction. If the treatment is to be delayed due to the reaction, the physician must also write orders to reflect this. Future administration of an agent that caused hypersensitivity reaction may include a slower infusion rate, and/or pre-medications with an antihistamine, corticosteroid, and H2 antagonist. This is at the discretion of the ordering physician.

If resuming the infusion on the same day as the reaction, follow the standard graduated infusion rate as per policy unless otherwise directed by the physician. 25% of the initial rate for 5 minutes. If tolerated, 50% of the rate for 5 minutes. If tolerated, 75% of the rate for 5 minutes. If tolerated, 100% of the rate for the remainder of the infusion.

Section 8:

Safe Handling, Spill Management, and Waste Disposal of Hazardous Drugs

Personal Protective Equipment

Gowns must be chemotherapy-safe and impermeable, with a back closure and a cuffed sleeve. Gowns should only be worn once and for a maximum of 30 minutes. Replace the gown if it is soiled or damaged.

Gloves must be chemotherapy-safe. Double gloving is recommended, with the first pair applied underneath the gown cuffs, while the second pair should be applied over the gown cuff. Gloves must only be worn once and for a maximum of 30 minutes. Replace gloves if they are soiled or damaged.

Facial protection is required if there is a risk of aerosolization or splashing. Wear a properly fitted respirator if there is a risk of aerosolization. Wear a mask and face shield if there is a risk of splashing.

It is recommended to wear personal protective equipment for all handling of chemotherapy medications, including opening the outer storage bag, assembling the delivery equipment, administering the agent, and disposing of the equipment.

Gowns and gloves should be worn when preparing, administering, disconnecting, and disposing of chemotherapy, handling linens or supplies contaminated with the agent or bodily fluids of patients receiving treatment, and when cleaning up a spill.

See Figure 15 for examples of various chemotherapy personal protective equipment.

Figure 15: Personal Protective Equipment

Source: Halyard (2018)

Safe Handling Recommendations

There are several recommendations for RNs to increase the safe handling and administration of systemic therapy in their practice. They should use needleless and closed systems wherever possible and prime all IV tubing with IV fluids (not the systemic therapy agent). The RN should prepare all IV lines before connecting hazardous drugs and not remove IV tubing from the IV bag that contains a hazardous drug once it has been spiked. Do not disconnect tubing at any connection point unless IV lines have been thoroughly flushed with IV fluid. Remove the IV bag and IV tubing, which are still connected wherever possible. Discard all equipment in designated hazardous waste receptacles after the administration is complete. After any handling or administration of hazardous drugs, complete adequate handwashing.

Safe Handling for Patients

There are several recommendations the RN can make to promote the safe handling of systemic therapy and bodily fluids by the patient. Advise the patient who takes oral systemic therapy medications that they do not need to wear gloves when handling their medication but should perform good hand hygiene afterward. However, their caregivers should handle these oral medications with gloves. Patients mustn't break, crush, or chew oral chemotherapy medications unless directed that it is safe to do so by a clinical pharmacist.

Educate the patient that the safe handling of body fluids (e.g., urine, stool, mucus, saliva, vomit, semen, or vaginal fluid) is required for 48 hours after a dose of systemic therapy as fluids may contain trace amounts of systemic therapy that could cause accidental exposure for a partner, family member, or caregiver. Caregivers should wear gloves if cleaning any body fluid spills or handling laundry or supplies that may be soiled with body fluids (e.g., bedding or dressings). Men are encouraged to sit down while urinating to minimize surface contamination. To minimize exposure, all patients should close the toilet cover when flushing, and flush twice when using the washroom. It is important to clean up any body fluid spills promptly using soapy water, while wearing gloves, and perform good hand hygiene with soap and water afterward. Condoms are recommended during sex while a patient is receiving systemic therapy. Clothing or linens that may have body fluids on them should be washed twice, once alone with hot water, and then they can be washed the second time with regular laundry.

A patient handout on safe handling of body fluids is available from BC Cancer via:

http://www.bccancer.bc.ca/drug-database-site/documents/handling%20cancer%20drugs%20and%20body%20fluids.pdf

Hazardous Drug Exposures

If an accidental **clothing/skin exposure** occurs immediately remove contaminated clothing and wash the affected area with soap and water. Continue to rinse for 15 minutes or use a decontamination shower if available.

If an accidental **eye exposure** occurs flush eyes at an eye wash station if available, or flush eyes with sterile 0.9% NS (contact lenses should be removed before using an eyewash if possible).

If a **needle stick injury** occurs allow the wound to bleed freely, then gently and thoroughly wash the area with soap under running water.

After ANY hazardous drug exposure, the RN should contact their occupational health department and seek immediate medical attention. Completing the required organizational documentation as soon as possible is also important.

Management of Hazardous Drug Spills

Refer to policy HR-OH(o)-090 MANAGEMENT OF EXPOSURE TO HAZARDOUS MEDICATIONS.

Spill kits should be readily available to manage hazardous drug spills in the systemic therapy treatment area. The items required for the spill kit can be seen in the policy listed above. The personnel handling the hazardous medication are responsible for spill clean-up. Hazardous drug spills must be cleaned up immediately and never left unsupervised.

Procedure for Spill Clean-Up

If a hazardous drug spill occurs, immediately contain the area by removing unnecessary personnel, then obtain a spill kit. Don personal protective equipment (e.g., double gloves, gown, head cover, shoe coverings, respirator, and face shield/goggles). Place a warning sign in the immediate area, then initiate clean-up.

Place an absorbent material over the spill, starting at the perimeter and working towards the center. Dispose of the contaminated absorbent material in a red cytotoxic bag and use the dustpan to clean up any broken glass. Use Accel wipes to clean all contaminated surfaces 3 times, starting at the perimeter and working towards the center. Dispose of all contaminated materials and personal protective

equipment in a red cytotoxic bag, and then arrange to replace the spill kit and/or supplies as needed.

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Appendix A:
Case Studies

Eight case discussions are provided to supplement your learning. Numbered case studies correspond with each numbered section of the continuing education resource.

1. Janice is a 63-year-old female diagnosed with metastatic breast cancer. Their metastases are small, and the prognosis is good. Their oncologist offered them "palliative chemotherapy." When you see Janice for their first treatment in the systemic therapy unit, they start to cry, stating "I need to get my affairs in order, the doctor told me I'm palliative so that means I am going to die soon." How would you respond to Janice?

   Janice is likely feeling overwhelmed with the amount of information received diagnosis. They may have misunderstood their prognosis and the meaning of "palliative intent" treatment. It is important to discuss with Janice that palliative treatment does not mean end of life. The RN should educate Janice that palliative treatment is used for cancers that cannot be cured but can be treated. The goals of palliative treatment include extending a patient's life, providing symptom control, and improving quality of life.

2. George is a 58-year-old male diagnosed with colon cancer and receiving treatment with capecitabine and oxaliplatin. You saw them in the outpatient clinic last week, where they complained of some mild tenderness in their palms. When George arrives for oxaliplatin, they report soreness and tenderness of their palms, and you notice mild redness and swelling on both hands. What may be causing these issues? What should you do?

   George may be experiencing palmar-plantar erythrodysesthesia (PPE), or "hand-foot syndrome," a side-effect of capecitabine. It is important to have the physician assess George's skin and determine the severity of this side effect. A dosage adjustment or discontinuation of capecitabine may be warranted depending on the severity. The RN should counsel the patient to use a lanolin-based moisturizing cream or a prescription cream if indicated by the physician. Ensure that the patient has follow-up arrangements for monitoring of PPE and contact information for their healthcare providers should their symptoms worsen.

3. You are the RN assigned to orientate a new RN who has transferred from another area to your systemic therapy unit. They observe you programming your BD™ Alaris Pump to administer systemic therapy, using the Guardrails™ function. The RN asks why you use Guardrails, as they are unfamiliar with it. How would you best describe this function?

   The BD Alaris Guardrails can be explicitly programmed for specialized practice areas, such as the systemic therapy unit. A custom drug library provides users with administration information and safety alerts on dosage limits. Using this feature is expected in your practice area to help increase patient safety, decrease the risk of medication errors, and provide guidance to the clinician.

4. Glenda is a 55-year-old female with ovarian cancer who presents to the systemic therapy unit for intraperitoneal chemotherapy treatment. During instillation, what complications should the RN assess for?

   The RN must monitor for any potential dislodgement of the needle access device and the patient's tolerance to their treatment. The RN should assess the abdomen for any unusual swelling, and assess the access site for any swelling, pain, discoloration, or fluid leakage. It is also important to monitor the IP fluid flow to ensure that the treatment is instilling appropriately.

5. Tony is receiving systemic therapy for metastatic cancer and is taking morphine regularly for bone pain. You assess Tony pre-treatment in the systemic therapy unit. Tony reports that they are experiencing worsening constipation and asks how to manage constipation at home best. What would the RN suggest?
   Both systemic therapy and narcotic analgesia could be contributing to Tony's constipation. The RN could counsel Tony on increasing oral fluid intake and making dietary changes (e.g., increasing intake of fiber, and "natural laxatives" such as prunes, dates, figs, raisins, and bran). The RN could suggest that Tony engages in light physical activity as well. Tony may require laxatives especially since they are taking narcotic analgesia. The RN should suggest laxatives such as sennokot or PEG, and counsel on their use. The RN could also review the patient's home medications to see if they are taking medications that may also contribute to constipation (e.g., ondansetron) and discuss potential alternatives with the pharmacist.

6. Lisa is in the systemic therapy unit receiving their first dose of R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone) for their lymphoma. What adverse reactions may occur with the first dose of rituximab? What interventions are used to decrease the risk of these adverse reactions?

   Patients receiving rituximab for the first time are at risk of experiencing a hypersensitivity reaction and tumor lysis syndrome (TLS). The RN should monitor the patient closely for signs of an adverse reaction. For patients with a high disease burden, the physician may choose to pre-medicate with steroids or omit rituximab for the first treatment to decrease the risk of TLS. To decrease the risk of a hypersensitivity reaction, pre-medications (e.g., acetaminophen, and diphenhydramine) are administered before treatment, and Q4H if the infusion exceeds 4 hours. The RN should also follow the slow, graduated infusion rate for the first dose of rituximab and monitor for tolerance to the treatment. Hypotension is also common during rituximab administration. Close monitoring of vital signs is warranted throughout the infusion.

7. You are administering vincristine through a peripheral IV to your patient Joan. Joan is complaining of burning and pain at their IV site. On assessment, you find Joan's arm is reddened and there is no blood return from the IV site. You suspect extravasation has occurred. How should you proceed? What antidote is required? What patient education is required at discharge after an extravasation?

   Stop the infusion immediately, disconnect the tubing, and aspirate the residual drug from the peripheral IV using a 3ml syringe. Notify the physician immediately and obtain the extravasation tray. Leave the IV in place until the physician assesses the patient, and they determine whether antidote administration is required. SQ aspiration of the drug may also be required. For vinca alkaloid extravasation, hyaluronidase SQ is used to increase systemic absorption of the agent. [Hyaluronidase 1500 units in 1ml NS/sterile water]. Following a vinca alkaloid extravasation, the RN should encourage the patient to apply a warm compress for 15 minutes 4-5 times daily for 48 hours. The patient should be encouraged to follow up with their physician or proceed to the emergency department if their symptoms worsen.

8. You are working in the systemic therapy unit when your patient Betty accidentally dislodges the needle access device from their implanted port while ambulating to the bathroom. While Betty was not exposed, there was a significant chemotherapy spill on the floor. Discuss how you would initiate a hazardous spill cleanup.

   If a hazardous drug spill occurs, immediately contain the area by removing unnecessary personnel, then obtain a spill kit. Don personal protective equipment (e.g., double gloves, gown, head cover, shoe coverings, respirator, and face shield/goggles). Place a warning sign in the immediate area, then initiate clean-up. Place an absorbent material over the spill, starting at the perimeter and working towards the center. Dispose of the contaminated absorbent material in a red cytotoxic bag. Use Accel wipes to clean all contaminated surfaces 3 times, starting at the perimeter and working towards the center. Dispose of all contaminated materials in a red cytotoxic bag then arrange for the replacement of the spill kit and/or supplies as needed.

Appendix B:
Post-Test Questions

This post-test contains 15 questions that will test your knowledge of the systemic therapy topics covered in this course. A score of 80% is considered a passing grade (12/15 questions answered correctly).

1. Carol was recently diagnosed with breast cancer. They will receive a course of systemic therapy **before** having breast surgery. Which term describes this treatment approach?

   A. Adjuvant

   B. Neoadjuvant

   C. Consolidation

   D. Maintenance

2. Which cancer stage refers to metastatic cancer that has spread to other areas of the body via the blood or lymphatic systems?

   A. 1

   B. 2

   C. 3

   D. 4

3. Which of the following is an important pre-treatment consideration for patients planning to start systemic therapy with cisplatin?

   A. Baseline eye exam

   B. Baseline hearing exam

   C. Baseline pulmonary function test

   D. Baseline echocardiogram

4. Your patient Brenda arrives for her second cycle of systemic therapy which includes the agent doxorubicin. They report that after their first treatment, they were voiding pink/red urine for two days then it resolved. They are concerned about having "bleeding" again after this cycle. What intervention is required?

   A. Contact the oncologist immediately. This may be a life-threatening complication.

   B. Collect a 24-hour urine to assess for hematuria.

   C. Educate Brenda on the side effects of her treatment. This is an expected side-effect of doxorubicin.

   D. Encourage the patient to follow up with their GP for a urology referral.

5. Bob arrives for their first cycle of systemic therapy that includes docetaxel. You ask Bob whether they have taken their pre-treatment steroids (dexamethasone). Bob states that they forgot to fill their outpatient prescription and haven't taken any steroids. How should you proceed?

   A. Start the docetaxel. Steroids are optional for this protocol.

   B. Give Bob one dose of oral steroids then start the docetaxel.

   C. Tell Bob he will not be able to have his treatment today and ask the care facilitator to rebook the patient.

   D. Contact the oncologist and/or pharmacist. Bob may need IV steroids before starting docetaxel.

6. What is the correct way to administer vincristine through a peripheral IV site?

   A. Administer via gravity.

   B. IV push.

   C. Using an IV infusion pump

   D. Any of the above are acceptable.

7. Doris is receiving pembrolizumab as part of their treatment for lung cancer. They report a new onset of severe diarrhea 8-10 times per day for the last week. What is the most appropriate intervention?

   A. Encourage Doris to increase oral fluids and proceed with treatment.

   B. Encourage Doris to take loperamide regularly and proceed with treatment.

   C. Educate Doris that diarrhea is an expected side-effect of pembrolizumab and is not concerning.

   D. Notify the physician immediately. This could be a serious side-effect of immunotherapy and warrants further intervention.

8. How many mls of heparin solution (100 units/ml) should you use to lock a tunneled central venous access device (Hickman or Permacath)?

   A. 2.5 mls

   B. 5 mls

   C. 7.5 mls

   D. 10 mls

9. Timothy is receiving systemic therapy that includes fluorouracil. They are complaining of ongoing mouth soreness. Upon assessment, you identify they are experiencing stomatitis. Which of the following would you NOT recommend for management of stomatitis?

   A. Saline rinse

   B. Baking soda rinse

   C. Mouthwash containing alcohol (e.g., Listerine)

   D. Increasing oral fluids

10. Myelosuppression is common in patients receiving systemic therapy. Which blood cells are the most susceptible to the effects of systemic therapy agents?

   A. Red blood cells

   B. Neutrophils

   C. Basophils

   D. Platelets

11. Bethany presents to the systemic therapy unit for their treatment for **ovarian cancer.** While reviewing lab values, you note that their ANC is 0.7. Bethany reports having symptoms of a urinary tract infection. Their temperature is 38.4C. What is the most appropriate action?

   A. Proceed with treatment. There is no reason why Bethany cannot receive systemic therapy while they have a UTI.

   B. Proceed with treatment but notify the oncologist so they can order oral antibiotics for Bethany.

   C. Notify the oncologist immediately. Bethany is showing signs of febrile neutropenia that require further intervention.

   D. Hold treatment – ANC is below 1.5. Send Bethany home and encourage them to rest and drink fluids.

12. Arthur presents to the systemic therapy unit for their treatment for **leukemia**. While reviewing lab values, you note that their ANC is 0.7. Arthur denies any signs of infection. Their temperature is 36.8C. What is the most appropriate action?

A. Hold treatment – ANC is below 1.5.

B. Proceed with treatment if Arthur is feeling well.

C. Notify the hematologist immediately. Arthur is showing signs of febrile neutropenia that require further intervention.

D. Contact the hematologist for further guidance. Some leukemia treatments have lower ANC thresholds.

13. Which systemic therapy agents require urine protein monitoring?

A. Bevacizumab

B. Rituximab

C. Trastuzumab

D. Nivolumab

14. Which medication is **not** indicated in the management of hypersensitivity reaction protocol?

A. Famotidine

B. Dimenhydrinate

C. Diphenhydramine

D. Hydrocortisone

15. How long after systemic therapy administration should patients, families, and caregivers take precautions when handling body fluids in the home?

A. 24 hours

B. 48 hours

C. 72 hours

D. 1 week