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## **Evidence-Based Practice Education for Nurses Caring for Oncology Patients with Chemotherapy-Induced Peripheral Neuropathy: A Quality improvement Project.**

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Evidence-Based Practice Education for Nurses Caring for Oncology Patients with  
Chemotherapy-Induced Peripheral Neuropathy: A Quality improvement Project.

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### **Abstract**

Nurses are one of the primary sources of information for patients during their healthcare journey. The importance of adequate education can mean the difference between a positive or negative patient outcome. Oncology patients undergoing chemotherapy are an especially vulnerable population in which significant time should be spent educating and preparing them for potential side-effects related to chemotherapy. There are several ways to control chemotherapy-induced side effects (CISE). The purpose of this project was centered around the importance of nursing education for patients during their chemotherapy journey with a specific focus on the use of self-administered cryotherapy as a treatment option for chemotherapy-induced peripheral neuropathy (CIPN). This debilitating side effect is difficult to manage, but the support of nursing staff encouraging patients to take an active role in their care could help decrease the risk of CIPN and improve their quality of life.

*Keywords: Nursing knowledge, Nursing education, Chemotherapy, Cryotherapy, Chemotherapy-induced Peripheral Neuropathy.*

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**Background and Clinical Significance**

The decision to receive cancer treatment should be made with careful thought. There are a number of side effects that occur with any cancer treatment modality. Some of the most commonly experienced chemotherapy-induced side effects (CISE) are nausea, vomiting, hair loss, and peripheral neuropathy (National Cancer Institute (NCI), 2018). Usually, CISE are manageable and often correctable. However, side effects like peripheral neuropathy (PN) can be debilitating and hinder one's ability to function well each day.

PN presents differently for each patient. Sensory nerves are most frequently affected, in which changes to sensations like pain, heat and cold exposure, as well as pressure can occur (NCI, 2018). The cumulative effect of chemotherapy creates what is known as "stocking-glove distribution" (Wickham, 2007, p.371). Patients may begin experiencing numbness and tingling in their hands and feet. At first, it may only affect a finger or toe. Over time, however, it can begin to affect one's gait and damage both motor and autonomic nerves.

Hanai et al. (2017) reported, 67-80% of patients describe symptoms of chemotherapy-induced peripheral neuropathy (CIPN) for one year past completion of chemotherapy. Additionally, in a study published in 2016, over 45% of the 462 participating women experienced PN nearly six years after the completion of treatment (Winters-Stone et al., 2016). Another consideration is patient comorbidities. Existing PN from connective tissue, endocrine, and nutritional diseases all play a role in the severity and tolerance of the side effect during chemotherapy (Wickham, 2007).

The subjectivity of PN increases the need for adequate patient understanding. Despite the number of grading scales offered to evaluate CIPN, most have limitations and are not evidence based. The most objective way to measure CIPN is through their level of functional impairment while performing activities of daily living (Wickham, 2007). It is the responsibility of healthcare providers to thoroughly educate patients about CIPN. The inability to safely remove a hot dish from the oven, button a shirt, live without muscle cramping, or struggle with altered digestion is not a reality most want to consider.

CIPN is a dose dependent side effect, and although dose adjustments can be made, it is not optimal during the treatment plan. The onset of PN varies among patients, but as treatment continues the cumulative effects of chemotherapy increases the risk. This dose related issue could potentially be treated with neuroprotective therapy, by reducing blood flow to peripheral nerves thus limiting the nerve damage. (Bandla et al., 2016).

There is a wide variation in CISE. Each patient will respond to chemotherapy differently based on pre-existing diseases, medication tolerance, lifestyle choices, education and comprehension level, and drug regimen. Nausea and vomiting resolves after treatment completion, but CIPN does not always disappear. Controlling PN as soon as symptoms appear gives patients the best chance of continued mobility and decreased pain, while minimizing delays in the treatment process.

To properly educate patients about symptom management and available interventions, nurses must first be well educated on the topic themselves. The information offered to patients needs to be concise, easily accessible, and reasonable to translate into self-paced interventions. The time spent in an outpatient infusion facility is limited compared to the time spent at home.

Therefore, it is important for patients to feel prepared to manage their care in both the infusion clinic as well as in their home environment.

### **Problem Statement**

Garcia (2014) explains patient anxiety levels decrease when nurses can adequately describe methods to help with side-effect management. Additionally, the relationship between patient and nurse is strengthened when patients feel secure in the knowledge being offered by their provider (Garcia, 2014). The amount of information provided to patients particularly during the beginning stages of their treatment journey is often overwhelming. The nurse can play a pivotal role with a patient's overall understanding of how best to address symptom management needs. It is not enough to explain the risks associated with chemotherapy. It is equally important to ensure patients have tools to mitigate the symptoms associated with treatment.

Cryotherapy in chemotherapy patients is the use of ice or extreme cold to the extremities of those receiving treatment as a way of controlling the severity of CIPN. Hypothermia is used in hopes of reducing peripheral nerve flow, thus decreasing CIPN. However, this intervention is specific to those receiving taxane and platinum-based drugs as well as vinca alkaloids (Bandla et al., 2016). There are other chemotherapy drugs known for causing PN, but they also cause an extreme sensitivity to cold which prevents those patients from utilizing cryotherapy.

According to Bandla et al. (2016) nearly 20% of patients receiving weekly taxane-based drugs experience CIPN. There is little intervention currently used to prevent CIPN (Wickham, 2007). Instead, it is managed after patients experience symptoms. For this reason, the focus of this DNP Project was to improve patient education concerning the neurological effects of chemotherapy and effective ways to manage the symptoms. That process began by evaluating

infusion nurse knowledge through substantial education about CIPN and self-administered cryotherapy (SAC) as an appropriate intervention for qualifying patients.

The problem was managed through nursing education and provider support. With this collaborative approach, the goal was to excite and encourage nurses to embrace the learning opportunity and find ways to incorporate it into their patient education process. The DNP project leader educated staff nurses about PN and CIPN. Additionally, there was substantial time spent on non-pharmacological CIPN interventions with primary focus on SAC. The project was not meant to add work or stress to the RN, but rather broaden the knowledge base of all infusion nurses in the clinic.

At the completion of dissemination of findings, the goal was for nurses to feel confident enough in their knowledge of CIPN and SAC to then educate eligible patients as they begin their chemotherapy journey. Ultimately, the hope was to create and implement a standardized educational tool for all future qualifying patients in the Chemotherapy Infusion Center (CIC).

### **Needs Assessment**

According to Bandla et al. (2016) chemotherapy disrupts normal cell function by stimulating abnormal formation of microtubules. Because of this formation, up to 40% of patients experience PN during chemotherapy treatment (Kajih & Moore, 2015). It is important to become innovative with symptom management and allow patients to choose what is best for them. Combining these facts with the importance of staff education, nurses serve as the primary contact for many patients with CIPN. This makes it necessary to ensure nurses are properly educated in how to effectively evaluate CIPN-related deficits (Smith et al., 2014).

At the time of project implementation, there was one physician implementing SAC with qualifying patients in the CIC at The University of Tennessee Medical Center. The support of a



physician helped promote staff interest. Additionally, the design of the CIC also promoted patient curiosity and involvement. Patients face one another during treatment. While this physician's patients received chemotherapy and utilized SAC, it naturally prompted an educational opportunity between staff nurses and other patients.

### **PICO Question**

In an outpatient cancer center, how does the implementation of an evidence-based practice (EBP) education program concerning the use of cryotherapy to treat chemotherapy-induced peripheral neuropathy increase nurse knowledge concerning the effects of chemotherapy with a specified treatment option of cryotherapy?

### **Project Objectives and Aims**

The overall goal of the DNP Project was to educate and ensure staff nurses receive adequate information on the importance of CIPN symptom management through SAC. The efficacy of the intervention is growing, but without proper knowledge of how debilitating the side effect is, it would be difficult to expect RNs to spend significant time educating on ways to manage it.

Encouraging non-medication-based symptom management options was also a way to promote self-efficacy. Patients need to feel in control of their decisions and supported in the process. What works for one person may not work for another. Educating nurses on these points helped broaden their thought process while caring for patients.

CIPN is too debilitating to ignore. Patients deserve the ability to function at their best despite being an oncology patient undergoing chemotherapy. This QI project was the first step into important organizational change. The educational experience gained from implementing

this project, both as a patient and provider helped expand the CIC's perspective on symptom management.

### **Evidence Determination**

This QI project was centered around nursing education and the importance of understanding evidence-based literature as healthcare providers prior to educating patients. For this reason, the literature review was done in two parts. Part one was focused on CIPN, cryotherapy, and the need for CIPN intervention options. Part two was meant to identify the importance of educating nurses and the direct link their knowledge has to positive patient outcomes.

#### *Search Strategy Part I*

A literature search was conducted with the help from a health science librarian, using PubMed, CINAHL, Scopus, and Web of Science databases. Using the building block method, keywords and Boolean connectors were, cryotherapy OR cold OR ice AND therapy\* OR expos\* AND adult\* AND oncology\* OR cancer\* OR neoplasm\* OR malignant\* AND “peripheral neuropathy” OR “neuropath”. Mesh terms were, “Cryotherapy”, “Hypothermia, Induced”, “Adult”, “Neoplasms”, and “Peripheral Nervous System Diseases”.

The initial keyword search in PubMed was cryotherapy OR cold OR ice AND therapy\* OR expos\*, resulting in 62,598 hits. The second search was, oncology\* OR cancer\* OR neoplasm\* OR malignant\*, totaling 3,702,434 hits. The third search was, adult\*, which provided 5,598,503 hits. Finally, “peripheral neuropathy” OR “neuropath” was searched individually, resulting in 168,398 hits. After combining all search terms including MeSH terms and applying filters of English language only and human species, a total of 86 articles met search criteria. Five articles were found to be relevant to the topic

The CINAHL database was used with the same search strategy. First cryotherapy OR cold OR ice AND therapy\* OR expos\*, was used and resulted in 10,463 hits. Next, oncology\* OR cancer\* OR neoplasm\* OR malignant\* offered 559,349 hits. Third, adult\* provided 1,189,505 hits. Lastly, “peripheral neuropathy” OR “neuropath” was used and totaled, 26,359 hits. After combining all search terms including MeSH terms and applying human species and English language, 13 articles were provided. Two were relevant, but duplicated from the results in the PubMed search.

The Scopus database was used next to conduct keyword searches. First, a search using cryotherapy OR cold OR ice AND therapy\* OR expos\* was done, resulting in 84,813 hits. Next, oncology\* OR cancer\* OR neoplasm\* OR malignant\* was used, offering 4,060,933 hits. The third search using adult\*, provided 7,731,905 hits. Finally, “peripheral neuropathy” OR “neuropath” was searched totaling, 267,836 hits. After combining the keywords including all MeSH terms, 133 articles presented. Three of those were relevant to the topic selection, but also duplicates from the two previous searches.

Web of Science database was searched next. In the same order, an initial search using cryotherapy OR cold OR ice AND therapy\* OR expos\* was done. This result offered 48,561 hits. The second search using, oncology\* OR cancer\* OR neoplasm\* OR malignant\* showed 2,747,936 hits. The third search using adult\*, provided 1,494,425 hits. Lastly, keywords “peripheral neuropathy” OR “neuropath” offered 156,509 hits. Upon combining all search terms including provided MeSH terms a result of 7 hits was provided. None of these articles were specific enough to the topic selection.

An independent search was conducted using Google Scholar offering four more relevant articles. Overall, multiple articles were excluded based on malignancy type. Specifically,

gastrointestinal cancers, in which cryotherapy is not an option for CIPN due to cold sensitivity issues during treatment. Other articles were excluded because cryotherapy was implemented to prevent nail toxicity or mucositis instead of PN. Articles discussing medication based interventions were also excluded. The inclusion articles focus on the use of cryotherapy as the primary intervention for CIPN. An additional systematic review with recommendations for PN was also used as an additional reference.

### *Search Strategy Part II*

Part two of the literature search was conducted using CINAHL, PubMed, Web of Science, and Scopus databases. Again, the building block method was used using the following keywords and Boolean connectors, nurs\* AND “chemotherapy-induced peripheral neuropathy” OR “chemo induced peripheral neuropathy” OR “CIPN” OR (“peripheral neuropathy AND chemo”) OR (chemo\* AND induced AND neuropath\*) AND educat\* OR teach\* OR learn\* OR instruct\* OR train\* OR knowledge\* OR guid\* AND patient\* OR outpatient\* AND “side effect” OR aftereffect\* OR “secondary effect\*” or react\*. MeSH terms were Nurses, Nursing, Peripheral Nervous System Diseases/chemically induced, Peripheral Nervous System Diseases/drug therapy, Education, Nursing, Continuing, Patient Education as Topic, Drug-Related Side Effects and Adverse Reactions. Additionally, literature no more than 10 years old and in the English language were the two filters applied.

Using the order listed above and including all appropriate MeSH terms, CINAHL first produced 8,332, then 3,229, next 1,315, and then 30 results. After combining all terms, the search yielded 10 articles. Of those, four were deemed relevant to the project.

PubMed produced 1,009,035, second search was 25,946, third search yielded, 4,386,869 hits, then 7,966,078, and 2,933,287. The combined search offered only five results, but none were pertinent to the project.

The Web of Science search was done in the same order. The first five individual searches were as follows, 2,182,122 next, 1,544,376 then 7,794,659 hits, fourth search produced 307,539 documents, and finally, 49,364 results. Combining all search and MeSH terms Web of Science offered nine document results. None of these articles were specific to nursing education or peripheral cryotherapy.

The Scopus search began with 2,007,051. The next search produced 1,503,386 hits. The third search provided 7,433,915 hits. The fourth search offered 320,807 results. The fifth individual search yielded 76,452 documents. The combined search with use of appropriate MeSH terms offered 11 results, but again none were relevant to this project.

Literature was appraised using the Johns Hopkins Nursing Evidence-Based Practice Appraisal Tool (2017). Each study was evaluated through the prompts provided in the tool and then ranked appropriately. *Figure 1* is the PRISMA Flow Diagram which depicts the number of applicable studies found to support the project. The evidence found and appraised was separated into two tables to mimic the search strategy process. *Table I* summarizes the evidence surrounding the use of cryotherapy and *Table II* summarizes the importance of education and the effects it has on the patient experience during their medical journey.

Figure 1

*Adapted PRISMA Flow Diagram*

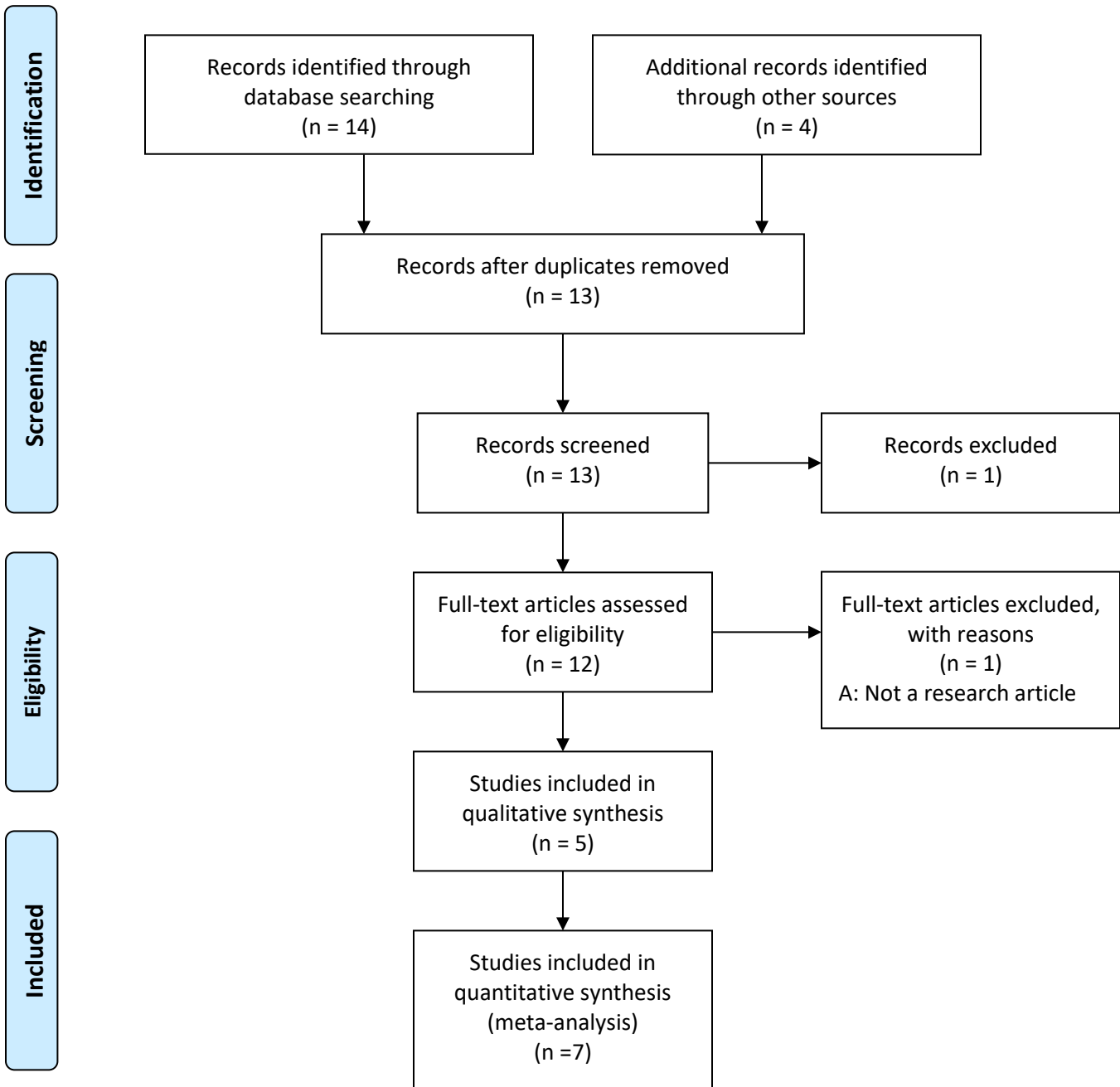


Table 1

*Literature Synthesis Table I*

Outcome	Bandla (2016)	Griffith (2018)	Hanai (2017)	Hou (2014)	Sato (2016)	Sundar (2017)
Methods	Pilot Study: Continuous cool flow limb infusion to dominant hand-arm & foot-leg	Randomized controlled trial of glove/sock to either dominant of non-dominant hand/foot	Self-controlled CT: Frozen gloves and socks to dominant side of patient body. Control was opposing side	Systematic Review of approved CIPN therapies	Regional cooling to hands and feet with cool insulators. Control groups was from MR of past patients	Pilot Trial using continuous-flow limb hypothermia
Cytotoxic Agent	NA	Paclitaxel	Weekly Paclitaxel 80mg/m <sup>2</sup>	NA	Q3 week Paclitaxel 150-175mg/m <sup>2</sup>	Weekly Paclitaxel 80mg/m <sup>2</sup>
Sample Size	15 Healthy Subjects	29 Patients	40 Patients	26 treatment options identified in 35 studies	Regional Cooling group: 42; Control group 142	20 Patients
Results	All 15 subjects completed of 3-hour mock Paclitaxel infusion	No significant findings. Dropout rate high d/t intolerability	Signs of CIPN:27.8% intervention side; 80.6% control side. P<0.01 for both hand and foot of intervention side	Limited evidence of pharmacological support for CIPN. Cryotherapy was not addressed	Incidence of $\geq 2$ grade PN was p<0.05 with 4 <sup>th</sup> cycle and p<0.01 with 5 <sup>th</sup> cycle	Grade 1 PN: 60% Grade 2 PN: 10% Grade 3 PN: 10% P<0.0005 at 6 months for motor nerve amplitude preservation
Screening Tool Used	NA	NPSI & BPI	Thermosensory deficits & PNQ	NA	CTCAE	Clinical exam & NCS
Level of Evidence	I	I	II	III	III	I
Quality of Evidence	B	B	A	A	B	A

Table 2  
*Literature Synthesis Table II*

Outcome	Garcia (2014)	Greenlee (2017)	Smith (2014)	Toftagen (2010)
Design	Integrative Review	Systematic Review	Descriptive, Cross-Sectional	Descriptive, In-depth Interviews
Study Focus	Reduction in anxiety levels and other psychosocial benefits from chemotherapy education	The use of integrative therapies of symptom management during chemotherapy	To explore practice patterns and level of knowledge RNs have surround CIPN and symptom management	To describe the effect of CIPN, ADLs, and associated pain. To improve knowledge and provide implications for nursing practice
Sample Size	NA	NA	408 Oncology RNs	14
Results	Patient education is linked to positive self-care behaviors and positive emotional response towards side-effect management	Best practice suggests the importance of education and training for providers of integrative therapies	RNs are not adequately educated about neurotoxic agents and appropriate ways to educate patients on CIPN management	Assessing patients for pre-existing PN and offer “anticipatory guidance” from RNs to those receiving high risk CIPN drugs
Level of Evidence	III	III	II	III
Quality of Evidence	B	B	A	A



### **Supporting Evidence**

The use of cryotherapy has been supported in several pieces of literature. Hanai et al. (2017) conducted a self-controlled clinical trial in which a patient's dominant hand and foot was used during the intervention and the non-dominant side was used as the control. A flexible frozen glove and sock was applied 15 minutes before the chemotherapy infusion started and remained on 15 minutes after drug completion. Interestingly, authors evaluated patient progress with subjective and objective outcome measures. For example, CIPN was objectively measured using thermosensory disturbance. With eyes closed, patients were asked to assess their sensation to hot and cold stimuli (Hanai et al., 2017). In addition, a PN questionnaire was completed by participants assessing subjectively their ability to perform activities of daily living (ADLs).

The results from Hanai et al. (2017) provide both clinically and statistically significant results in the control of PN while using cryotherapy. Participants received paclitaxel, a drug well known for causing CIPN. Patients able to reach a cumulative dose of paclitaxel at 960mg/m<sup>2</sup> or higher were evaluated during and after the intervention (Hanai et al., 2017). There was 27.8% hand sensitivity measured on the intervention side, compared to 80.6% on the control side. Additionally, there was 25%-foot sensitivity on the intervention side and 63.9% on the control side (Hanai et al., 2017).

While clinical trials to reduce CIPN are ongoing, the symptom itself does not wait for a cure. The role of the nurse must be to thoroughly educate and support the patient while on their chemotherapy journey. Quality and safety in nursing is centered around education and the positive affect it has when delivering high-quality care to patients with complex healthcare needs (Balakas & Smith, 2016).

Comparatively, Sundar et al. (2017) conducted a pilot study with breast cancer patients also receiving paclitaxel, but alternatively used continuous-flow limb hypothermia as the intervention. Instead of using an already frozen glove or sock, this intervention required an entire system called a thermoregulator device. This machine circulated cold water through to the limb, while multiple sensors monitored for ideal temperatures, which were then recorded wirelessly for analysis. Findings by Sundar et al. (2017) proved significant for patient comfort and tolerability when using continuous-flow hypothermia, as well as preservation of nerve motor amplitudes three months after beginning chemotherapy.

A major difference between these two studies is the process in which patient outcomes were measured. Hanai et al. (2017) thoroughly evaluated patient progress through five different evaluation methods, while Sundar et al. (2017) used two. Another difference is the implementation process. Hanai et al. (2017) use of gloves and socks allowed for better patient mobility. While Sundar et al. (2017) and the use of a thermoregulator made it far more difficult for patients to ambulate to the restroom without losing significant intervention time.

In another study conducted by Sato et al. (2016) researchers use pre-cooled insulated mitts and socks for patients receiving paclitaxel at doses of 150-175mg/m<sup>2</sup>. All participants were being treated for some type of gynecological malignancy. The interventional limb was randomly chosen and the opposing limb was used as the control. Authors Sato et al. (2016) argue the grade of PN is greatly affected by two factors. One, the length of the infusion and two, the cumulative dose reached. For example, those receiving paclitaxel 200mg/m<sup>2</sup> every three weeks experienced >3 grade PN, than those receiving 67mg/m<sup>2</sup> each week (Sato et al., 2016). The weekly dose is standardly administered for one hour, while all three-week doses are infused over three hours.

The results showed limbs that underwent “regional cooling” had a decreased incidence rate of >2grade PN (Sato et al., 2016). Although the results were promising, researchers still argue the need for randomized comparison. Another consideration to these results compared to the other studies is the drug types administered during the intervention. In addition to paclitaxel, cisplatin, epirubicin, and paraplatin were also given. Although researchers were looking specifically at the effects of paclitaxel, some of the other medications cause CIPN too. They recognize this potentially contributed to the amount of PN experienced by patients (Sato et al., 2016).

The final study found supporting the use of cryotherapy was conducted on 15 breast cancer participants receiving limb cooling via a thermoregulator device (Bandla et al., 2016). This intervention is similar to Sundar et al. (2017) study, except the limb receiving the intervention was randomly selected. The focus of this study was more on the tolerability of cryotherapy rather than the effects on CIPN. Results showed positive patient tolerability, with all participants completing the study process. One suggestion made by authors is the importance of minimalizing interruptions during the intervention process. The fear of “rebound flow” would cause counter-productivity to the delivery of cryotherapy (Bandla et al., 2016).

Patients were able to safely and comfortably endure limb hypothermia for a three hour paclitaxel infusion. Researchers also suggest, 22° C is the optimal temperature to maintain efficacy during the intervention (Banda et al., 2016). Fluctuations in the temperature may lead to sub-optimal results. The thermodynamics of unidirectional heat exchange is what makes limb hypothermia efficacious. Authors also argue continuous flow compared to ice packs can also decrease pain associated with the temperature variation (Bandla et al., 2016).

One gap in the literature presented is the inconsistency in evaluation tools for CIPN. Each study used appropriate tools, but no two studies used the same tool. With eight different outcome measurement options, it is difficult to determine universal efficacy without standardized tools. According to Hou, Huh, Kim, Kim, & Salahadin (2014), it is not uncommon for studies to only report neuropathy as it relates to the effects on ADLs compared to pain caused by the CIPN. They also suggest, only patients experiencing a 4/10 with the numeric rating pain scale should be considered candidates for studies in which pain is an outcome measure (Hou et al., 2014).

In all four studies, authors excluded those with pre-existing PN secondary to comorbidities like diabetes. Although patients with pre-existing diseases deserve the chance to minimize additional PN, for the purposes of these studies, it is only advantageous to first determine the validity of cryotherapy first. Despite variations in each applicable study, the concept of cryotherapy has been successful. Although there are multiple interventions available to combat CIPN, none have been proven to be universally helpful to patients.

Patients count on healthcare providers to help them manage debilitating side effects like PN. With an intervention like cryotherapy, it allows for care from a healthcare provider, but also the participation of the patient. That partnership cannot be understated. Obviously, more high quality research needs to be done, but this is certainly a start. Every effort should be made to find a solution to one of the most difficult side effects experienced during chemotherapy.

Complementary and alternative therapies such as SAC are often considered separate from conventional medical care (Greenlee et al., 2017). The use of these therapies is done through a coordinated team approach with well-trained providers. The education of those providers is what helps identify them as being those offering the highest standard of care in their specialty (Greenlee et al., 2017). The anxiety and fear patients experience, particularly at the beginning of

their chemotherapy journey is well documented (Garcia, 2014). To reduce anxiety and promote available tools and interventions proper patient education must occur first (Garcia, 2014).

The American Society of Clinical Oncology describes a clinical practice guideline which stresses the importance of learning materials appropriate for a new patient starting their chemotherapy process. Of those materials the most important are side effect management and self-monitoring symptoms (Tofthagen, 2010). Nurses need to engage in continued education opportunities about oncology medications and evidence-based strategies to help manage patient side effects and remain effective educators (Tofthagen, 2010). Additionally, there is a direct link between effective patient education and self-management strategies as well as decreased hospitalizations and emergency department visits.

One of the gaps noted in the knowledge nurses have of CIPN and effective symptom management is identified at the forefront of evaluating the patient. Many nurses are unaware of which chemotherapy drugs cause neurotoxic symptoms (Smith et al, 2014). The education process needs to begin with the chemotherapy agents likely to cause the symptom at all, or if the patient has existing neuropathy for another reason. Nurses cannot properly assess symptoms if they are unaware of those requiring the assessment.

Educating oncology nurses should generally be broad enough for nurses to be familiar with multiple chemotherapy drugs and different disease types. Evidence-based education programs should be offered frequently to nurses regarding alternative therapies for CIPN (Smith et al., 2014). Additionally, proficiency in using CIPN measurement tools should be confirmed regularly to ensure nurses are using the accurate tool efficiently. Including these elements into regular opportunities of education will increase nurses' confidence in identifying qualifying patients and using appropriate assessment tools and intervention options.

Although standardized approaches are often best, as mentioned above there is not a singular standardized assessment tool for CIPN. Instead, nurses will have the option to choose a tool to evaluate patient symptoms. While educating staff, time was spent reviewing several of the popular tools available. Additionally, nurses were taught on painful and non-painful symptoms of CIPN as well as environmental hazards that could impact activities of daily living (Tofthagen, 2010).

### **Theoretical Framework**

The Theory of Symptom Self-Management (TSSM) is a blend of two existing theories known as, the Theory of Unpleasant Symptoms (TOUS) and the Self-Efficacy Theory (SET). The TSSM is a middle range nursing theory, and has been empirically tested with proven benefit to patients managing chronic disease. By combining TOUS and SET healthcare providers are able to utilize a theory specific to oncology patients, and help them with both side effect management and the self-efficacy it takes to succeed during treatment.

Bandura and Adams (1977) offer a thorough description of the meaning and importance of self-efficacy. They explain the relationship between performing tasks at a mastery level to achieve a goal, and growth one has from that success. Additionally, Bandura empirically tested his theory in which self-efficacy proved to be a predictor of behavioral improvement (Bandura & Adams, 1977). SET is meant to offer patients a personalized plan to symptom management. Through perceived self-efficacy (PSE) nurses are able to help patients address feelings, motivation, and performance ability (Hoffman, 2013).

The purpose of the TOUS is to describe and explain the importance of symptom management and the connection one symptom has to another. The TOUS is a middle range nursing theory developed specifically for nurses and clinical researchers (Peterson & Bredow,

2013). Although other theories exist concerning symptom management, the TOUS allows for the portrayal of multiple symptoms, which helps identify the contributing factors symptoms have to each other. An additional component to the TOUS are physiological, psychological, and situational antecedent factors. These are specific to each patient, and linked to their overall symptom experience.

The major concepts of the TSSM include patient characteristics, symptoms, and perceived self-efficacy for symptom self-management. Symptoms are considered threats to a person's health and their PSE is evaluated to establish their willingness and ability to set goals and implement change for themselves (Hoffman, 2013). The metaparadigms addressed in the TSSM are centered around human beings and their health experiences as well as how nursing actions play a role in patient outcomes. It is important to note, although the TSSM offers tools implemented by nurses on a patient's behalf, success would be impossible without a patient's understanding and willingness to participate in their own care.

### **Theoretical Application**

Specific to oncology, a patient's understanding in how symptoms interact and exacerbate one another is crucial. The most appropriate way to encourage PSE and symptom self-management starts with a patient's ability to recognize and articulate their perceived symptoms. Creating a foundation of understanding between the nurse and the patient will allow for a more targeted interventional plan, with hopes of optimal success and patient empowerment.

The TSSM theory was chosen based on the dual component of self-efficacy and the management of debilitating and frustrating symptoms experienced with anti-cancer medication. When educating oncology patients, it is important to offer in depth explanations regarding all risks associated with chemotherapy. If the goal is for patients to actively participate in their care,

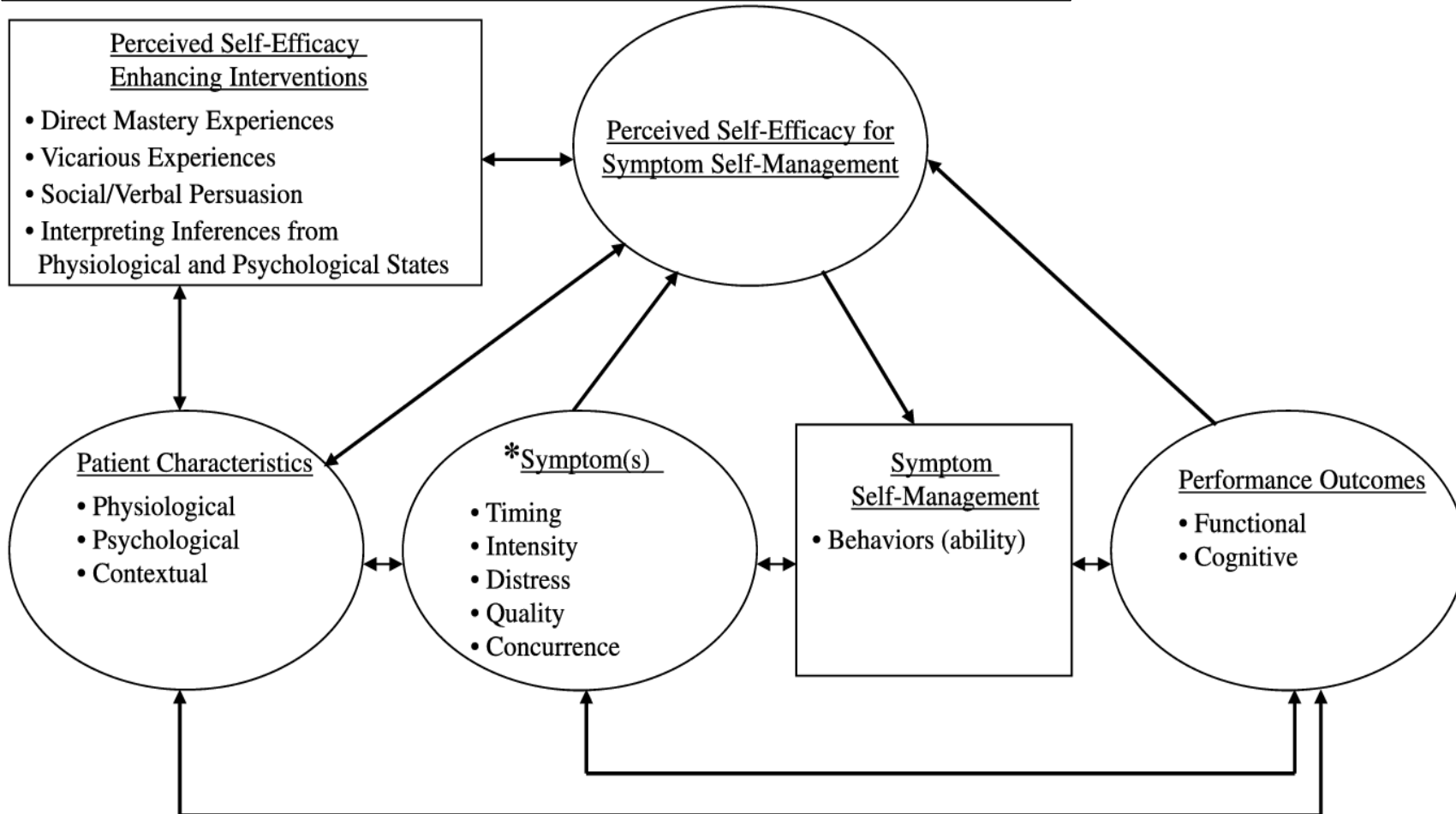
nurses must ensure enough time is spent explaining potential side effects as well as ways to control them. For example, the successful use of SAC is based on consistency and a patient's state of mind. Since CIPN is dose-dependent, physicians can make changes to a patient's drug dosage. However, despite dose adjustments, symptoms like CIPN are often unavoidable. The need for self-efficacy starts with one's ability to identify and verbalize their experiences as it could mean the difference between a positive outcome or more debilitating symptoms.

Cryotherapy is an optional intervention. If nurses do not feel confident in their knowledge of an intervention, it is likely to be excluded from their patient education routine. In the event a patient has already spent significant time learning about their disease and treatment options on their own, it is even more important for the infusion nurse to be familiar with new and different intervention options. The goal is to educate patients, while creating an environment in which nurses and patients learn from one another while on their cancer journey. Additionally, education is the first step in helping patient redirect their anxiety from an emotional to functional response to encourage involvement in their own care (Garcia, 2014). Ultimately, using TSSM when implementing cryotherapy or any intervention is for patients to actively participate in their care and feel empowered in the process.

*Figure 2* offers a visual description of the links the TOUS and the SET make to form the TSSM. Each shape interconnects with one another explaining the all-inclusive process the TSSM is meant to provide. Utilizing this model is not only specific to those battling a malignancy, but also supports the patient as a whole. Whether it is cryotherapy or another side effect management intervention, the TSSM can help nurses and patients navigate through the journey together.

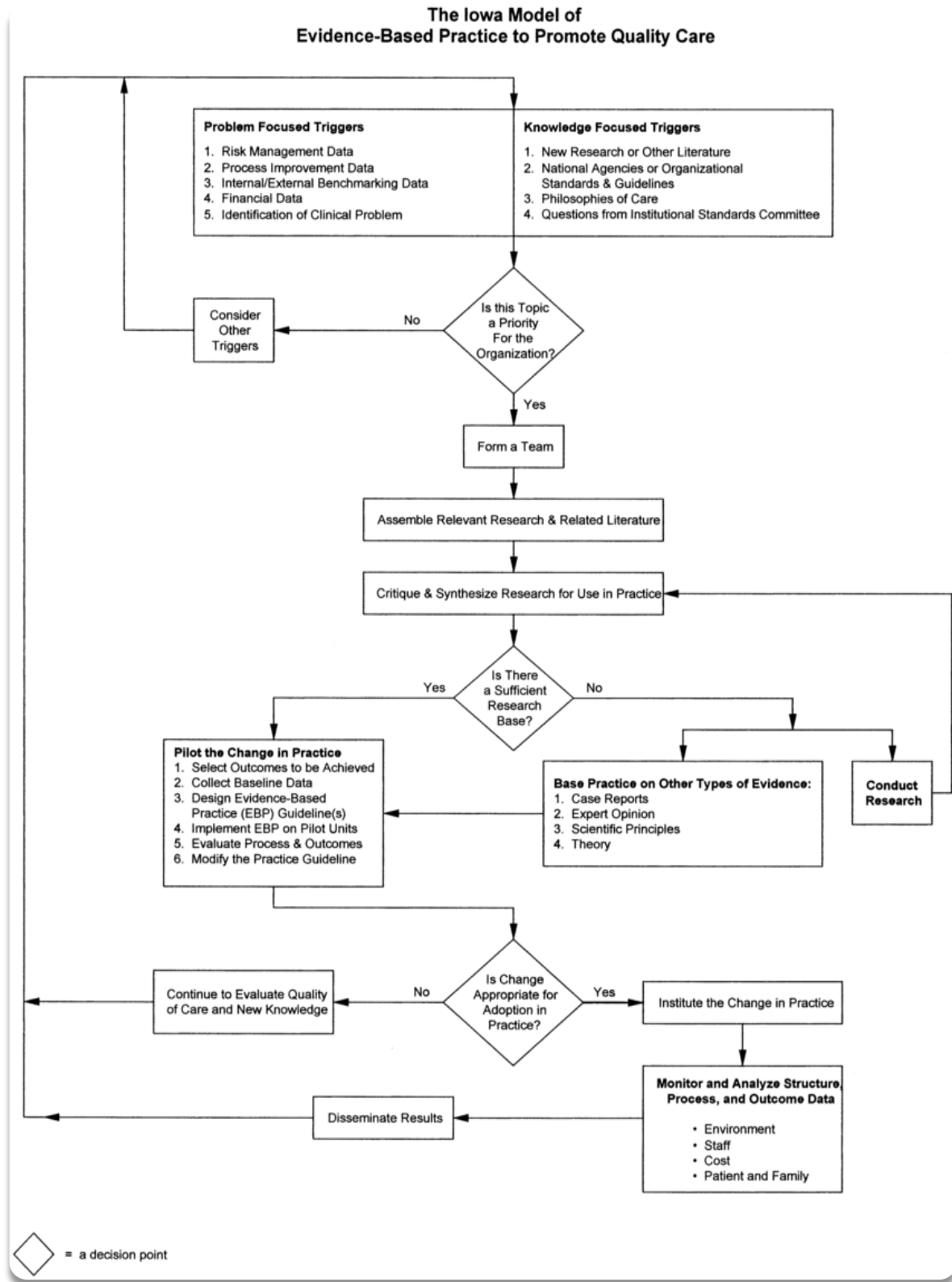


Figure 2. The TSSM Model. Squares indicate action & ovals indicate a trait or state



... ..

Figure 3. *The Iowa Model of Evidence-Based Practice to Promote Quality Care*



### **Methodology**

*Figure 3* depicts the Iowa Model of Evidence-Based Practice to Promote Quality Care. This model was used to support the need for improvement in the institution. By following the process provided in the model it was determined there was a need for improved education surrounding CIPN. The Institute for Healthcare Improvement (2019) created a useful tool known as PDSA (Plan-Do-Study-Act) cycles to help institutions implement change in small pieces. The purpose behind this tool is to ensure proper planning, support, and ample opportunity to modify plans for change prior to large scale implementation. The importance of developing plans for change and improvement helps protect patients, but allows room for error as adjustments are made to the implementation process.

The project implementation was executed with PDSA cycles. The first step in the implementation process was to offer a pre-education survey to staff nurses regarding their knowledge of CIPN and cryotherapy. This allowed the DNP Project Leader to evaluate gaps in their current knowledge prior to presenting educational material. The second step was educating fellow nursing staff about the risk and prevalence of CIPN with taxane-based chemotherapy treatment as well as SAC as an intervention option. The aim was to educate staff over a three-month period using a PowerPoint presentation and intervention demonstration. This allowed for adequate time to reach all staff members, provided opportunities for questions and feedback.

The process was meant to be informative and conversational. Whether a novice or more seasoned nurse the goal for all providers was to offer evidence-based care to promote positive patient outcomes. The Community Member working with the DNP Project Leader also served as an additional source of knowledge as he was most likely to treat malignancies requiring taxane-based chemotherapy drugs.

The next step was evaluating the amount of knowledge retained through a post-education test at the end of the three-month period. The timeframe of three months was chosen so staff nurses do not feel pressured to immediately incorporate SAC into their education process, but to also allow time to feel comfortable and confident in the new knowledge received.

## **Implementation**

### **Project Setting & Population**

The Cancer Institute (CI) is located at the University of Tennessee Medical Center. As one of many institutes operating within the medical center the focus is patient centered care. The population specific to the project were the staff RNs of the CIC. However, it is important to also describe the setting in which these nurses work in. This intervention would not have been successful if nurses didn't have an area optimal for patient education. The QI educational presentation for staff nurses was performed in the education room of the infusion area. The room offered a small conference table and a TV to display the PowerPoint presentation.

The population served within the CI is both acute and chronically ill adult oncology patients. Patients as young as 18 years old are treated for malignancies, as well as those much further along in adulthood. This outpatient facility was created to offer patients a place to receive standard of care treatment for their disease, but also avoid lengthy and expensive inpatient hospital stays.

The design of the CI was advantageous for providers and patients alike. Each patient receives treatment in a recliner stationed within a room called a chemotherapy cove. Each room houses six chairs and a space for a family member or friend to sit with the patient during treatment. Two chemotherapy certified RNs serve as providers for each cove. Additionally, a float nurse travels from cove to cove and offers support to fellow staff members and education to

patients throughout the day. This design allows for patients to have a semi-private space to perform self-paced interventions as they see fit.

Nurse responsibilities rotate daily in the CIC. Meaning, each staff nurse was likely to serve as the educator to patients on a regular basis. The importance of offering multiple educational opportunities with this project was to ensure each nurse received the same information and became comfortable enough with the knowledge gained to include it in their patient education process. The layout of the CIC is described above to better explain the opportunities nurses have while working with their patients to promote an approach of collaboration.

### **Implementation Process**

Staff education was presented on multiple occasions to ensure each nurse had ample opportunity to participate. Using PowerPoint and examples of self-administered cryotherapy tools, a presentation was offered along with time to ask questions and troubleshoot potential barriers to the success of promoting the intervention. Additionally, copies of all presentation materials were available to nursing staff.

During the education process the flexibility and convenience of the intervention was described to staff nurses. It is important for nurses to understand this is not meant to be additional responsibility for them during the workday, but rather a way to educate current and future patients on the importance of being an active participant in their own care. A hypothetical scenario was illustrated to better explain how the routine might go for these patients during their treatment infusion. For example, during an infusion while using SAC, patients would be able to pause during the intervention to consume a meal and utilize bathroom breaks. Another important role in this process was caretaker involvement. The intervention is simple enough family and

friends can assist during SAC. This is especially helpful for patient success. Staff RNs could perform the initial demonstration of SAC, but encourage the patient and support system to work together on the intervention during their infusion process.

### **Risks, Benefits, and Economical Considerations**

The only risk associated with the project was if nurses did not value the information provided and chose not to include it while educating patients. There is no risk of harm to anyone involved, only the hope nurses continue to spread their new knowledge with patients and one another to encourage patients to take an active role in their own care.

One benefit to cryotherapy, as mentioned before, is the simplicity of the intervention. Family and friends can easily participate in the care of their loved one. Additionally, when applicable, patients themselves can initiate their own ice therapy, but will always have the support of staff members during their treatment when needed. Part of this benefit is how easily the intervention can be incorporated into the routine of patients receiving chemotherapy. These details will be explained during the education intervention.

The importance of small-scale change is for reasons like this. It allows for brainstorming and opportunities for thoughtful decisions. The feedback expected during PDSA cycles offered time to discuss how best to move future participants in and out of the CIC without delaying treatment for other patients and providing a seamless intervention process. The hope is for the development of a cryotherapy protocol to help promote self-efficacy and symptom management. Patients have an opportunity to be proactive about their care, take charge of an intervention, and rely on themselves for success.

### **Data Analysis**

The optimal number of collected surveys was 25 from the 40-45 Registered Nurses working for the Cancer Institute in the chemotherapy infusion department. Unfortunately, due to COVID-19 infection rates and staffing issues, only 15 nurses were successfully surveyed.

*Table 3* and *Table 4* offer descriptive statistics for the pre-test and post test results of the project.

A Likert Scale of one to five was used to measure responses, with one being strongly disagree, three being neutral, and five being strongly agree.

The data were analyzed with the help of a statistician from the College of Nursing using SPSS version 28. The pre-test survey results showed most RNs do not regularly discuss CIPN in depth with patients with a mean of 3.13 and a standard deviation of 1.125. The post test results showed an improvement in RN knowledge and confidence with a mean of 4.47 and a standard deviation of .640.

An interesting note made was the range of nursing experience amongst those surveyed. Even those having been in nursing for years still expressed an improvement in their knowledge base surrounding CIPN and SAC. This was a relatively unexpected finding considering their years of experience in oncology. This finding was important to note as it proves the importance to continued education regardless of years spent in practice.

Table 3

*Pre-Test Descriptive Statistics*

Pre-Test Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
How many years have you been an RN?	15	5	36	17.27	8.146
How many years have you worked in Oncology?	15	1	36	11.40	8.983
I feel as if I can identify neurotoxic chemotherapy agents.	15	2	5	3.47	.915
I feel prepared to educate chemotherapy patients about Chemotherapy-Induced Peripheral Neuropathy (CIPN)	15	1	5	3.47	.990
I discuss CIPN in depth with at risk patients	15	1	5	3.13	1.125
Valid N (listwise)	15				



Table 4

*Post Test Descriptive Statistics*

Post Test Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
I gained valuable knowledge during the education presentation.	15	4	5	4.60	.507
I will use the knowledge I've gained to educate future chemotherapy patients.	15	3	5	4.40	.737
I feel more confident about the meaning of neurotoxic chemotherapy, CIPN, and self-paced interventions.	15	3	5	4.53	.640
I intend to use this knowledge in my day-to-day routine while caring for patients	15	3	5	4.40	.632
I feel confident adding the knowledge I've learned into my new patient education routine	15	3	5	4.47	.640
Valid N	15				

### **Outcome Evaluation**

The goal of a Doctorate of Nursing Practice (DNP) project is the ability to translate understanding of *The Essentials of Doctoral Education for Advanced Nursing Practice* (DNP Essentials) through the implementation and dissemination process (American Association of Colleges of Nursing, 2016). The foundation the DNP Essentials provide is the cornerstone for nursing practice at the doctorate level. Using the Enhanced Actualized DNP Model, the DNP project can be evaluated for positive patient outcomes using evidence-based knowledge and patient driven care (Moran, Burson, & Conrad, 2020).

The evaluation plan for this DNP project required feedback from the surveyed staff. Part of the post-test approach was to evaluate their experience during project participation. The goal was not just a successfully executed DNP project, but rather a positive experience and effective intervention to create practice change. Participating staff should feel as if their efforts matter and like their feedback will spark necessary change for future projects.

Phase one of project implementation was a PDSA cycle for staff education. As such, the final phase of the project was their input in how well the intervention protocol was designed and executed. Additionally, they should have felt as if the intervention would be something feasible for them to incorporate in their practice. This was best evaluated through a follow-up meeting with all participating staff. If there is to be any change in practice, nurses should feel prepared to carry on what they have learned into their regular practice long after the completion of the DNP project.

Nurses were asked to complete a pre and post education survey at the end of PSDA cycle one. The questions were meant to ensure there were no gaps in the education provided. Once

survey responses were complete, time was spent clarifying questions or concerns. Replies to questions were posted within the unit to ensure all staff had access to necessary answers. This also served as a quick reference site on the unit floor. Staff compliance was the cornerstone of the project. Therefore, offering as much information as possible helped the success of the project and future outcomes for patients.

The follow-up meeting served as a brainstorming session as well. The goal beyond the limits of this QI project was to develop an approved medical center learning/intervention tool for patients to utilize during treatment. The meeting served as an informal opportunity to present project findings. The interest and motivation of nurses was based on how well the intervention worked. As stakeholders, nurses deserve to see the fruits of their labor. For that reason, disseminating information to them is key.

Outcome measures were evaluated using a post-education test. The results of the post test were compared to the pre-education test offered prior to the presentation. The post test included questions with a focus on not only the retention of knowledge the RNs maintain, but also if the information learned would be included in their patient education routine. It is important nurses understand what they are educating patients about, but if the information does not also make it to the patient, then the knowledge is wasted.

According to the descriptive statistics reported, nearly all participants expressed some level of knowledge improvement about CIPN. Additionally, most RNs expressed incorporating the added knowledge into their patient education process. One of the major limitations of this project was the questions asked during the pre and posttest. When comparing results, it was determined the questions should have been identical between both tests. Instead, questions varied, which prohibited the collection of a *p* value.

Although a statistical significance could not be determined, a clinical significance was confirmed. If one were to replicate this project, the goal should be identical pre and posttest evaluation while keeping the same Likert Scale. During the debriefing portion of the project, it was determined another physician had also began using frozen gloves as a preventative technique for CIPN. This proved helpful for the patient when their treatment began as the RNs were already familiar with the intervention process and able to adequately educate them.

### **Data Maintenance and Security**

Protecting personal health information (PHI) is of utmost importance. However, for the purposes of this QI project, the educational intervention did not require knowing the names of any participants. The pre and post test tools were anonymous as to only focus on the quality of information and value the nurse places on the education provided.

After post-test collection is completed, the goal was to identify the implications to practice. With the help of the project Committee Chair and Champion Physician discussions have begun on how best to incorporate the information into the standard patient education process.

### **Dissemination**

From an institutional standpoint, starting with disseminating results of the project in the CI would be most helpful. The CI staff are the most important providers to disclose findings to, since they are responsible for treating patients eligible for ice therapy. In addition, they are likely going to be those most interested in the results, as they will have participated in the progress and success of the project. During the evaluation phase and final PDSA cycle, time will be spent sharing project results and encouraging staff feedback.

Another important avenue of dissemination is through Magnet Committees within the medical center. Any advance in knowledge and quality improvement could help strengthen the center's position to maintain Magnet status. Formally presenting at an institution wide conference or meeting is another way to spread the results. Lastly, and most importantly, the ultimate goal is to publish project findings in a peer-reviewed nursing journal.

Finally, to spread the knowledge of cryotherapy to other patients, the goal would be to develop an approved education tool within the Cancer Institute. For every new and qualifying patient, additional education material would be offered to encourage ice therapy participation. In time, it could become a frequent and normal practice for patients. One of the greatest aspects of the nursing field is the opportunity to share knowledge and improve quality. No matter how small the intervention may seem, if it is cost-effective and offers quality to patients, it is worth it, and cryotherapy can be both.

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