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The Subcutaneous Administration of Bortezomib Practice Guideline Capstone Project

Jasmine Martin
Regis University

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Rueckert-Hartman College for Health Professions
Loretto Heights School of Nursing
Doctor of Nursing Practice Capstone Project

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Jasmine Martin

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Executive Summary

Executive Summary: The subcutaneous Administration of Bortezomib Practice Guideline Project

Problem

Multiple myeloma is the second leading cause of hematological malignancies in the United States. Bortezomib is a chemotherapy agent effective in the treatment of all stages of multiple myeloma. Bortezomib administered by the subcutaneous (SC) route is as efficacious as the intravenous route. However, the literature does not describe how the drug was to be administered SC. A review of literature was inconclusive on how to administer SC injections and supported the need to describe how nurses are administering SC injections in order to develop practice guidelines.

The question guiding this evidence based project was: For oncology nurses in a network of community clinics will the development of a standardized guideline for the administration of SC bortezomib compared to absence of a standard guideline result in the implementation of a standard guideline.

Purpose

The purpose of this evidence based practice improvement project was to develop a practice guideline for administering SC bortezomib in a network of community oncology clinics.

Goal

The goal was to present the evidence based practice guideline for implementation at a network of oncology clinics.

Objectives

The objectives for this project included 1) development and administration of the Subcutaneous Administration of Bortezomib Survey (SABS), 2) development the Subcutaneous Administration of Bortezomib Practice Guideline, and 3) implementation of the practice guideline at the network of community oncology clinics.

Plan

Developing and implementing an evidence based practice guideline required understanding how nurses administer SC bortezomib. A descriptive web based survey was administered to 43 registered oncology nurses. The questions were based on an extensive review of the literature on administering SC injections. The information from the survey and literature were the basis for developing the guideline. The survey results and guidelines were reviewed with executives from the network for approval and implementation.

Outcomes and Results

The survey results confirmed different techniques were being used when administering SC bortezomib. Nurses predominantly used and preferred the abdomen for injections, particularly in clinics with private administration facilities. Purging versus the use of an air bubble was essentially divided (49% vs. 51%) within the group. There was no relationship between needle length and angle of insertion ($p=0.34$). Most nurses injected over three to five seconds. Nurses agreed a guideline would be important for improved patient outcomes, and indicated a willingness to adopt a guideline.

A SC bortezomib injection practice guideline was developed based on the survey results and evidence from the literature. The final guideline was presented for implementation.

Keywords: DNP capstone project; subcutaneous bortezomib; administration subcutaneous chemotherapy; subcutaneous injection techniques; oncology nursing.

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Capstone Project

The Subcutaneous Administration of Bortezomib Practice Guideline Capstone Project was conducted in partial fulfillment of the Regis University, Loretto Heights School of Nursing, Doctor of Nursing Practice (DNP) program. Capstone projects investigate practice issues and develop outcomes solutions to improve clinical practice for the benefit of a population (Zaccagnini & White, 2011). The identified practice issue was the lack of a standardized practice guideline for administering chemotherapy by the subcutaneous (SC) route. This practice improvement project was the development of a practice guideline for oncology nurses in a network of community cancer clinics. The project intended to benefit the patients with multiple myeloma (MM) who are receiving the chemotherapy, bortezomib, by the SC route.

Problem Recognition and Definition

Purpose

The purpose of this evidence-based practice improvement project was to develop a practice guideline on the SC administration of the anti-cancer chemotherapy, bortezomib. The intention of the guideline was to improve oncology nurses' clinical practice in order to provide patient with the most relevant evidence based care for optimal outcomes. Oncology nurses who administered subcutaneous bortezomib (SCB) to patients at the Cancer Clinics of Excellence (CCE) network of community oncology clinics were asked to complete the Subcutaneous Administration of Bortezomib Survey (SABS) describing their SCB injection practice. Survey data and evidence from the clinical literature provided the basis for the practice guideline.

Problem Statement and Change

Multiple myeloma is the second leading cause of hematologic malignancies in the United States (US) with an incidence rate of 22,300 and prevalence rate of 77,617 in 2010 (National Cancer Institute [NCI] 2013). Bortezomib was approved for the treatment of MM by the intravenous (IV) route in 2003. Numerous studies demonstrate that bortezomib, as a single agent or in combination with other agents, is highly effective in producing responses and improving overall survival in patients at all states of MM (Driscoll, Burris & Annunziata, 2012). The United States (US) Food and Drug Administration (FDA) approved the SC route of administration in January 2012. However, there is no published information based on clinical studies on how to administer SCB. There is also a lack of oncology research literature describing how to administer SC chemotherapy in general. The lack of evidence poses a challenge for oncology nursing practice. Nurses may be using different techniques for SCB injections. The clinical practice problem is that inconsistent injection techniques can result in patients experiencing injection site reactions and pain, whereas good techniques can reduce these adverse events (Girouard & Theoret, 2008; McEwan et al., 2010). Injection site reactions and pain can be troublesome for patients and may result in patients choosing to stop effective treatment (Kurtin, Knop & Millireon, 2012; McEwan et al. 2010).

Nursing sensitive patient outcomes (NSPO) are those patient outcomes that can be directly impacted by nursing interventions. The anticipated practice change associated with implementation of the evidence-based guideline will be consistent techniques used by all nurses in the CCE network when administering SCB. This practice change supports the oncology nursing sensitive outcomes of providing quality nursing care to minimize adverse events and maximize effective therapy (Given & Sherwood, 2005).

Population, Intervention, Comparison, Outcome Practice Question

A practice question addresses the population or problem (P), the proposed intervention (I), the comparison intervention (C) and the expected outcome of the intervention (O). Houser (2008) summarizes these elements as the PICO question. The clinical practice problem led to the following PICO question: (**P**) For oncology nurses in the Cancer Clinics of Excellence network of community clinics, (**I**) will the development of an standardized guideline for the administration of subcutaneous bortezomib (**C**) compared to the absence of a guideline (**O**) result in the implementation of the guideline?

Project Significance, Scope, and Rationale

The FDA approved the SC administration of bortezomib based on Phase II and Phase III randomized controlled trials (RCT) demonstrating equal efficacy when compared to IV administration. Data demonstrated the SC route reduced the incidence of peripheral neuropathy (PN) experienced by patient compared to the IV route (38% vs. 53%). Dose reductions due to adverse events were also lower in patients receiving SCB compared to IV (31% vs. 43%) (Moreau et al., 2011, VELCADE 2012). The implications of dose reductions and stopping therapy due to adverse events such as PN can include treatment failure or being changed to less effective therapy (McEwen et al, 2010).

Peripheral neuropathy is the most troubling adverse event associated with IV bortezomib and can significantly impact patient well-being. Assessing and managing PN is difficult. Results from an exploratory cross sectional survey of oncology nurses indicated a lack of knowledge, confidence, training, and proficiency in evaluating patients for chemotherapy induced PN (Binner, Ross & Browner, 2011). Therefore, reducing or mitigating PN by using the SC route can improve nursing practice and patient outcomes.

The scope of the project was to develop a practice guideline for the administration of SCB and present it to CCE for implementation. In order to develop a practice guideline, the literature recommends surveying nurses to describe how nurses actually administer SC injections particularly in oncology and palliative care settings (Annerson & Willman, 2005; Kurtin, Knop & Milliron, 2012; Walker, Lane & McKenzie, 2010). Therefore, the SABS was administered to elicit how network oncology nurses were administering SCB. Educating the network nurses on the guideline to ensure adoption and adherence was not within the scope of the project due to time constraints and limiting the focus of the project.

Theoretical Foundation

The Theory of Planned Behavior. The Theory of Planned Behavior (TPB) (Ajzen, 2012) asserts that three types of beliefs guide behavior (Figure 1):

- Behavioral beliefs, or attitudes about current behavior
- Subjective beliefs, or expectations of others about behavior
- Control beliefs, or perceived competence of and control over the behavior

The combination of attitude about the behavior, expectations of others and competence can lead to behavior intentions. The TPB conceptual model provided the basis for developing SABS questions to assess nurses' current practice and perceptions.

The SABS was a 44-item instrument. Twenty-two competence questions (control) identified how nurses are currently preparing and administering SCB injections. Six demographic questions plus ten opinion questions (behavior) explored what nurses think about various aspects of SC treatments. Six perception (subjective) questions ascertained how others might influence SC treatment beliefs. This combination of information about nurses' competence, perceptions and opinions about practice provided insights into intention to adopt a

practice guideline (Cote, Cagnon, Houme, Abdeljelil, & Cagnon, 2012; Nirenberg, Reame, Cato, & Larson, 2010; O'Boyle, Henley, & Larson, 2001; Phansalker, Weir, Morris, & Warner, 2008; Zhou, Stoltzfus, Houldin, Marks, & Swan, 2010).

Figure 1 The Theory of Planned Behavior

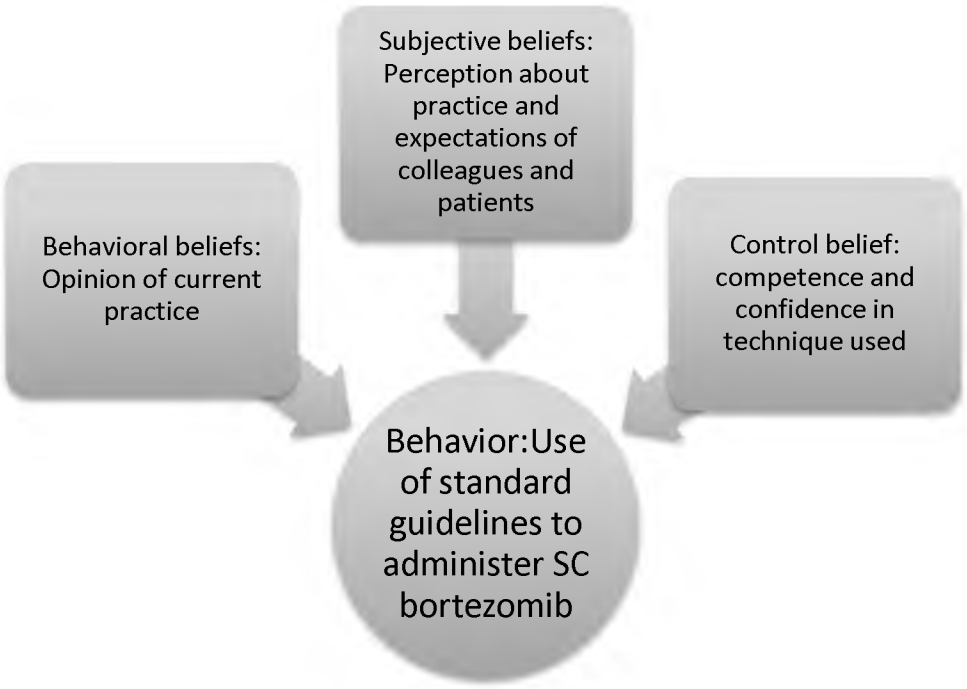

Figure 1. Theory of Planned Behavior conceptual model applied to Capstone Project.

Control, behavior and subjective beliefs influence the intention to implement a practice guideline. Adapted from "TBP Diagram" by I. Ajzan, 2006. Retrieved from http://people.umass.edu/aizen/tpb.diag.html. Copyright 2006 by Icek Ajzen. Used and adapted with permission.

Nursing theoretical framework. Joann Duffy's Quality Caring Model contends professional nursing practice is evaluated on an ongoing basis, and competency can be assessed through self-evaluations. The purposes of the model are to "(1) guide professional practice and (2) provide a foundation for nursing research" (Duffy, 2010, p. 405). Nurses are responsible for using evidence in practice and applying attitudes and behaviors of caring. Improvements in

health outcomes are possible when caring relationships are integrated into nursing practice. Nurses engage in collaborative relationships with health care teams and independent relationships with patients and families. Patients may feel cared for when nursing practice is based on relationship-centered professional encounters and practice is grounded in evidence. Clinicians can influence patient perceptions about cancer treatment through communication of data in ways patients can understand and apply to their own situation (Weeks et al., 2012).

The Quality Caring Model is aligned with tenants of the advanced practice Doctor of Nursing role to improve health care outcomes including:

- The scientific and theoretical underpinnings for practice
- Systems and organizations
- Evidence based practice
- Interprofessional collaboration
- Research collaboration

Evidence based practice decision-making includes evidence from the literature, environmental and organizational context, practitioner experience, and patient preferences (Brown, Fielding, & Maylahn, 2009). Nurses may be relying on past experiences or other nurses rather than evidence for SC injection techniques (Squires, Moralejo, & LeFort, 2007). Addressing only the techniques of nursing skills was inadequate to design a practice guideline; knowledge and caring attitudes need to be integrated (Bjork & Kirkevold, 2000). The survey instrument evaluated practice techniques and experience through self-evaluation. The SABS considered interprofessional collaboration, patient preference and organizational context by exploring behavioral and subjective beliefs. The SABS questions were supported by the clinical

literature. The project was in collaboration with individuals involved in research and may generate hypothesis for future clinical trials.

The results from the SABS and best evidence guided the development of a standard administration practice guideline. The expected outcome of the guideline is practice improvement. Multiple myeloma patients receiving SCB may experience decreased site injection discomfort and feel more confident in nurses' expertise when the same techniques are being utilized.

Literature Selection

The primary topics for the literature search included studies on subcutaneous chemotherapy, SC administration techniques for any drugs and biologics, adherence to practice guidelines and the TPB. Literature was preferentially selected for articles from systematic reviews of relevant randomized controlled trials (RCTs) (Level 1 evidence), RCTs (Level II evidence) and well designed non-randomized controlled trials (Level III evidence). Melnyk's Hierarchy of Evidence (2005) was selected because it is utilized by the Oncology Nursing Society (ONS).

Scope of Evidence

References related to the efficacy and safety of SC chemotherapy were primarily based on RCTs. Evidence for the application of the TPB was supported by case controlled and cohort studies (Level IV). Specific techniques were selected if there were controlled trials and case controlled or cohort studies. This selection resulted in focusing on site selection, needle size, whether to change needles before injections (dry needle), whether to purge air from the syringe or pull air into the syringe (air bubble or air sandwich), needle size, angle of insertion, and administration time. Recommendations from a review article and expert panel on administering

SCB (Level VII) were included because there were no studies on SCB administration techniques. The ensuing guideline was supported with current literature which was primarily relevant to the administration of SC heparin, insulin, beta-interferon and azacitadine. These data were applicable to this project in so far as there was a dearth of studies on techniques for administering SC chemotherapy.

Review of Evidence

Background and the Problem

There was a lack of evidence on how to administer SC chemotherapy. Systematic reviews of the literature on SC administration of insulin and heparin suggested inconsistency in the literature to help guide nurses to utilize best evidence for injections. Literature on teaching patients how to self inject differed and often referenced text books rather than studies. The techniques supported by studies tended to have consistent findings, except for changing needles before injections. A common recommendation from systematic reviews, practice reviews, and clinical studies was the need to determine how nurses actually administer SC injections. These recommendations supported the need to survey the nurses for this project. The inconsistency in injection recommendations validated the problem of inconsistent injection techniques.

Systematic Review of the Literature

An extensive database review was completed to identify relevant literature in the field of nursing, medicine, statistics, and behavior to support the project (Appendix A). Databases selected for review included Medline, CINAHL and Cochrane Library. Key search terms used included “subcutaneous bortezomib”, “subcutaneous chemotherapy”, “subcutaneous injection techniques”, AND “versus intravenous”, “nurs* utilization”, “procedure”, “guidelines,” “adherence”, “compliance”, “clinical practice skills”, “clinical decisions”, “theory of planned

behavior", "survey instrument statistics" and "oncology". Inclusion criteria included "randomized trial", study", "systematic review", "review article", "guideline", and "practice article". Exclusion criteria included "pediatric", "vaccine", "editorial", "case report". In addition, a hand search of references in pertinent oncology journals was completed.

Fifty articles from clinical literature were included for this project proposal. The search resulted in the selection of 30 articles about SC injection techniques (Appendix A). Predominantly, articles on subcutaneous injection techniques were not oncology specific, and included two systematic reviews of literature. Additionally, five articles met the most pertinent criteria of "subcutaneous injection bortezomib". There were limited articles on subcutaneous chemotherapy. Articles were included to support the Theory of Planned Behavior and statistical methods.

Subcutaneous bortezomib. Bortezomib is a proteasome inhibitor indicated for the treatment of all stages of multiple myeloma (Driscoll et al., 2012). The most frequent adverse events associated with intravenous bortezomib include peripheral neuropathy (PN). A Phase III randomized controlled trial (RCT) demonstrated the efficacy of SCB was non-inferior to intravenous bortezomib. The SC route resulted in fewer grade 3 adverse events and significantly less PN (38% vs. 53%, p=0.044). Fewer patients stopped treatment due to adverse events on the subcutaneous arm. At one-year follow up, the data for all end points of efficacy and safety remained similar across both arms (Arnulf et al., 2012; Moreau et al., 2011; Moreau et al. 2012). Pharmacokinetic and pharmacodynamics data from the Phase III RCT and a Phase I RCT confirmed systematic exposure was equivalent for SC versus IV administration. In both the Phase I and Phase III studies, SC administration sites were in the abdomen and thighs. There were no differences in pharmacological parameters between these sites (Moreau et al., 2012). A

different retrospective analysis of 15 Japanese patients experiencing injection site reactions following SCB reported more incidences of reactions in the thigh than the abdomen (Kaminura et al., 2012). These data validate safe, effective administration in the abdomen and thigh. The literature on the Phase I and Phase III studies, and the report from Japan, do not include how the drug was administered subcutaneously.

Kurtin et al., (2012) described nursing strategies for administering SCB, and indicated the need to develop SC administration guidelines. The nursing management recommendations addressed site selection, use of an "air sandwich" technique (p. 408), use of a 4 – 6 mm needle, pinching to ensure adipose tissue and angle of needle insertion. The summary recommendations were based on five articles from clinical literature on subcutaneous administration of medications including one systematic review of literature by Annersten and Willman (2005). S. Kurtin is an author on two of the five references that describe the use of an air sandwich technique (Kurtin & Demakos, 2010; Murray et al., 2012). The source of the air sandwich technique was not referenced in the two articles. Use of the air sandwich technique were also recommended by the International Myeloma Foundation nurse leadership board at a board meeting (International Myeloma Foundation [IMF], 2012) The recommendations for SC administration appeared reasonable, however, appeared based on limited literature review and an expert panel.

Subcutaneous chemotherapy. The Oncology Nursing Society (ONS) and American Society of Clinical Oncology (ASC0) published standards for administering chemotherapy did not include guidelines on how to administer SC injections (Jacobson et al., 2011). Anti cancer agents and oncology supportive care agents that have been administered SC include azacitadine, trastuzumab, pegfilgastrim, alemtuzumab, dexamethasone, and methotrexate. Randomized clinical trials that compared standard IV administration to SC reported non-inferior efficacy and

similar or decreased adverse events between the two routes. The literature reporting chemotherapy SC clinical trials, review articles, and clinical experiences, did not describe how the injections were administered (Arthur, Jubb, & Homer, 2002; Du et al., 2005; Ismael et al., 2012; Stigenbauer et al., 2009; Walker, Lane, & McKenzie, 2010; Waters, Corrigan, Gatesman & Smith 2012; Wierda et al. 2011). A systematic review of Medline and CINAHL by Annerston & Willman (2005) found clinical trial literature on SC medications provided pharmacological, safety and efficacy data but no information on injections techniques or nursing recommendations. These findings supported this DNP student search results. The lack of information on how to administer SC anti-cancer agents necessitated incorporating techniques from other disciplines. The majority of literatures on SC injection techniques were related to heparin, insulin and instructing patients on self-injection.

Subcutaneous injection techniques. In a systematic review of literature on the scientific basis for nurses SC administration techniques, Annerston & Willman (2005) found inconsistent information to formulate clear recommendations based on research, and "no convincing evidence that a certain technique is better than another just because it has been practiced a long time" (pg. 127). The authors stated this inconsistency prevents nurses from using best evidence for SC injection techniques and that additional research was needed describing how nurses are administering SC injections. The subcutaneous administration of bortezomib survey component of this project described oncology nurses practice in community outpatient clinics.

Needle size and length. Consistent data from several studies indicated appropriate needle gauge and length are important in SC administration. Small gauge, short needles, appropriate for the medication formulation, reduces the incidence of pain and injection site reactions. Skin thickness does not vary significantly in adults, whereas subcutaneous adipose tissue does vary in

different anatomical sites, between genders, with increased body mass index (BMI), and waist circumference. In spite of adipose tissue differences, small gauge shorter needles (less than 6 mm) have been shown to effectively deliver SC medications even in obese subjects (Akkus, Oguz, Uzunlulu, & Kizlgul, 2012; Arendt-Neilsen, Egekvist, & Bjerring, 2006; Birkebaek, Solvig, Jorgensen, Smedegaard, & Christiansen, 2008; Frid et al., 2010; Gibney, Arce, Byron & Hirsch, 2010;Gill & Prausnitz, 2007). However, several articles providing instructions and graphics on how to administer SC injections for nurses and patients recommend 25 gauge or 27 gauge 3/8 to 5/8-inch needles (9.7 to 15mm) (Hunter, 2008; McConnell, 1990; NIH, 2012; Pope, 2002; Rushing, 2004). Small, short needles are not appropriate for delivery of large volumes or for drug formulations with large particles (Gill & Prausnitz, 2007). Overall, the data suggested small gauge needles less than 5 mm are appropriate for even obese subjects. Short needles reduce the need for pinching skin at injection sites and can be injected at 90-degree angles without the risk of an IM injection. The use of 3/8 or 5/8-inch needles may be based on historical practices.

Dry needle and air bubble technique. Bortezomib is considered an irritant; therefore it is reasonable to recommend changing the needle after drawing up the medication and prior to injection to reduce tracking drug during the injection (Kurtin 2012). Changing the needle after drawing up medication has been recommended to remove particles from the vial and medication that may adhere to the needle, as well as reduce the risk of dulling the needle from insertion into a vial (Agac & Gunes, 2011; Giroud & Theoret 2008). One study of two injection techniques found changing the needle after drawing up the medication, use of an air bubble, and a dry sponge to prepare the site resulted in smaller areas of bruising (Woodridge & Jackson 1988). However, one randomized study and one quantitative study did not find a difference in bruising

when needles were changed before administering the injections (Kingman, 2000; Lamblet et al., 2011).

Frid et al., (2010) published injection recommendations for diabetic patients based on a systematic review of literature. The recommendations include priming, or purging, needles to clear dead space. Two articles providing instructions on how to administer SC injections also recommend purging the needle prior to injection (Hunter, 2008; NIH, 2012). In contrast to purging needles, Woodridge and Jackson (1988) described the use of an air bubble technique as one of four variables that decreased bruising with SC heparin injections, compared to purging the needle. A two group cross over study of 43 multiple sclerosis patients (11 control, 33 experimental) compared standard SC beta interferon injections using a dry needle to the same technique using a 0.1 ml air bubble technique. The air bubble modification resulted in a significant ($p = 0.001$) decrease in site redness between the groups, as well as in the crossover group ($p=0.002$). Patients reported being more satisfied with the air bubble technique and continued to use it for self-injection six months after the study, suggesting a statistical and clinical advantage for the technique (Moore et al., 2007).

Site selection, preparation and site rotation. Appropriate sites for SC injections include the outer aspect of the upper arm, abdomen below the costal margins, above the iliac crest, and at least 5 cm away from the umbilicus, and the anterior thigh. Site rotation was recommended to prevent indurations and lypoatrophy (Frid et al. 2010; Girouard & Theoret, 2008; Hunter, 2008; Kurtin et al. 2012; NIH, 2012; Rushing, 2004). In clinical studies, bortezomib was only administered in the abdomen and thigh, and sites were rotated with each injection (Moreau, 2011). Millennium Pharmaceuticals has provided a site tracker for nurses to document site rotations between the abdomen and thigh (velcade.com, 2013). Three articles on how to

administer SC injections instruct on cleaning the site with alcohol prior to injections (NIH, 2012; McConnell1990; Rushing, 2004). However, the repeated use of alcohol may cause skin to harden and is not needed to cleanse the site. The World Health Organization recommends only the use of soap and water to prepare subcutaneous injection sites, and not alcohol (World Health Organization [WHO], 2010). A brief review of literature suggested use of alcohol is not necessary was inconclusive and conflicting (Hunter, 2008; Cocman & Murray, 2010).

Angle of insertion. There was consistency in describing the angle of insertion to ensure entering subcutaneous tissue rather than risking intramuscular (IM) injections based on needle size. A study of 388 adult diabetics demonstrated small needles, 4mm – 6 mm in length, inserted at a 90 degree angle without raising a skin fold will be in the SC tissue more than 98% of the time. Needles 6 mm to 8 mm inserted at 90 degrees will result in IM injections 5% and 15% of the time. A 12.7mm (1/2 inch) needle will result in IM injections 45% of the time when inserted at 90 degree angle and 21% of the time when inserted at 45 degree angle (Gibney, Arce, Bryon, & Hirsch, 2010). A study of 499 subjects, including 297 healthy controls, suggested the use of longer needles (> 6mm) without pinching the skin or inserting at a 90-degree angle might result in an IM injection (Akkus et al., 2012).

Injection duration. Two quasi-experimental studies on SC injection duration demonstrated 30-second SC injections resulted in statistically significantly less pain and bruising than 10-second injections (Akpinar & Celbioglu, 2007; Zybak & Khorshid, 2007). The recommended dose of bortezomib is 1.3 mg/m2. To limit injection volume, the final concentration for SC bortezomib is 2.5mg/ml compared to 1 mg/ml for IV administration. The average volume for a SC injection will be just under 1 ml. (VELCADE, 2012). The

recommended infusion time for IV bortezomib is three to five seconds. There are no recommendations for SC injection duration (VELCADE, 2012).

Adoption of guidelines and statistics. The American Society of Clinical Oncology and Oncology Nursing Society (ASCO/ONS) chemotherapy handling and administration guidelines do not address SC administration techniques (Jacobson et al., 2011). Three descriptive survey studies of oncology nurses knowledge and implementation of oncology practice guidelines suggested approximate 80% of respondents were familiar with various clinical guidelines, however adoption ranged from 40% to 85% (Martin & Larsen, 2003; Nirenberg et al., 2010;Weingart et al, 2011). Several cohort, descriptive and qualitative studies in the literature review supported nurses' knowledge, competence and perceptions of clinical practice guidelines based on the Theory of Planned Behavior (Cote, Cagnon, Houme, Abdeljelil, & Cagnon, 2012; Nirenberg, Reame, Cato, & Larson, 2010; O'Boyle, Henley, & Larson, 2001; Phansalker, Weir, Morris, & Warner, 2008; Zhou, Stoltzfus, Houldin, Marks, & Swan, 2010).

Two articles provided guidance for content analysis of qualitative survey responses (Bradley, Curry, & Devers, 2007; Hsieh & Shannon, 2005). Two articles provided clarification on the use of Likert scales for survey instruments (Allen & Seamona, 2007; Norman, 2010). The authors reinforced the use of non-parametric descriptive statistics for data analysis and reporting Likert responses. Based on recommendations by Allen & Seamona (2007) the survey developed for this project forced responses and did not offer a neutral option.

Scope of Evidence

The review of literature supported the need to describe what nurses are doing in order to develop a guideline on administering SC bortezomib. Variables in injection technique that decrease injection reactions and were supported by evidence from clinical studies were explored

and described in the survey and incorporated into the guideline (Agac & Gunes, 2011; Akkus et al., 2012; Akpinar & Celbioglu, 2007; Frid et al. 2010; Gibney, Arce, Bryon, & Hirsch, 2010; Girouard & Theoret, 2008; Hunter, 2008; Kurtin et al. 2012; Moore et al., 2007; NIH, 2012; Rushing, 2004; Woodridge & Jackson 1988; Zybak & Khorshid, 2007). The techniques included:

- Injection site selection
- Needle size and length
- Use of air bubble
- Insertion angle
- Injection duration

Project Plan and Evaluation

Market and Risk Analysis

An overview of the market provides evidence for the value proposition of the project within the clinical setting and health care industry. The oncology health care market is competitive. Physician owned practices, such as those associated with CCE, compete with University and Hospital based cancer centers for patients. Competitive advantages, such as commitment to evidence based care, location convenience, and potentially more personalized care, are important differentiations (Desch & Blayney, 2006). Championing evidence-based nursing guidelines demonstrates the networks' recognition of the importance of nursing for optimal patient outcomes.

Treatment options for patients with MM have changed. Prior to 2013, bortezomib was the only proteosome inhibitor on the market and has become the standard of care. A new proteosome inhibitor is indicated for patients who have relapsed or are refractory to bortezomib and is being

marketed as having the advantage of less PN (Kortuem & Stewart, 2013). Clinical data demonstrates SCB results in reduced PN and bortezomib has proven five year survival advantage not demonstrated by other therapies (Velcade, 2012). Therefore, it is in the interest of patients to receive SCB as long as there is clinical benefit.

Project Strengths, Weaknesses, Opportunities and Threats (SWOT)

A SWOT analysis provides an overview of elements that may promote or derail a strategy. The analysis is generally done at the project's strategic planning stage. The strengths and weaknesses are internal factors that are readily available and may be strategically addressed. Opportunities and threats represent external factors that need to be recognized but may not be controllable. A SWOT analysis was completed during the project planning and is described in Table 1.

Table 1. SWOT Analysis

STRENGTHS	WEAKNESS
• Congruent with DNP Capstone purpose • Investigated nursing practice issue important to oncology nursing • Aligned with CCE network mission to provide evidence based care • Aligned with Millennium mission to provide safe, effective treatment for patient with MM • Internal stakeholder collaboration across functions • CCE headquarters located in CO	• Limited time to implement and complete survey • Location of clinics across the country • Investigator developed survey • Competing priorities for time and resources • Number of nurses meeting eligibility criteria unknown • Resources to purchase software for survey • Medical Director at Millennium lack of support for nursing projects
THREATS	**OPPORTUNITIES**
• IRB approval timelines • Limited nurse participation • Nurses competing time and priorities • Nurses reluctant to recognize need or	• Future collaboration with CCE on outcomes research project • Guideline may be considered more broadly and adapted by Millennium

change practice • IMF publication and congress sessions may influence nurse behavior	• Potential publications • Future collaboration with IMF nurse leadership council to study SCB

Driving and Restraining Forces

The practice guideline project was designed to help oncology nurses provide evidence based care in the community setting. The project also helped demonstrate the value of nursing research projects to Millennium (the company) will be to ensure safe, effective use of drugs in actual practice settings. It was important to the mission of both organizations to provide safe, effective treatment and to maximize patient outcomes.

However, there were constraints associated with the project. Complying with legal, compliance, and regulatory guidelines associated with a product developed and marketed by the company resulted in numerous consults with the legal department to ensure no conflict of interests or revelation of proprietary information. Additionally, the project investigator was in an advanced practice role not associated with a clinical practice site. It was therefore necessary to identify community oncology clinics willing to participate in the project. One network with clinics in a metropolitan area in the Mountain region originally agreed to participate, and then declined in March, 2013. The Cancer Clinics of Excellence network (CCE) was then asked to and agreed to participate. The CCE headquarters in Colorado, provided convenience and access for the project investigator to collaborate with the Vice President of Clinical Operations and Manager of Research. However, the clinics associated with the CCE network are located across the country, limiting personal contact by the project investigator with the nurses.

Feasibility, Risks, and Unintended Consequences

It was feasible to complete the project within the academic year time frame to ensure completion by August, 2013 (Appendix C), in spite of CCE not being contacted until March

2013. Because the clinics are located across the United States (US), CCE was willing to adapt the survey instrument from a paper and pencil to web based format and to engage the clinic coordinators to promote the project.

Risks associated with the project included the potential lack of involvement of nurses to complete the survey instrument. However, in anticipation of this risk, and because the total number of nurses meeting the inclusion criteria were unknown, a power analysis was not done. The project investigator was willing to accept the number of responses received after three weeks. A significant risk to the company would have been the report by a nurse on the survey of a serious patient adverse event and the inability to identify where the event occurred. Company employees must report serious adverse events within 24 hours of being made aware of the occurrence. A risk to CCE was the potential to reveal poor practices among the nurses. However, the survey was reported in the aggregate, individual nurses and clinic locations could not be identified.

Project Team

The project team was lead by the DNP student project investigator, and stakeholders at Millennium and CCE. Team members at the company included the Associate Director of Health Economics and Outcomes Research (HEOR), one global medical affairs (GMA) Associate Medical Director, and the Senior Director of Scientific Alliances and Research who is a doctorally prepared Registered Nurse (RN) with expertise in qualitative research. Two statisticians agreed to run the data from the survey and the Associate Director of GMA Publications joined the team after the survey data were known. The CCE team members were the Vice President of Clinical Operations and the Manager of Research.

Cost / Benefit Analysis

The direct and indirect costs related to the project were estimated at $23,000 (Appendix D). Benefits realized from a SC administration guideline include improved nurse patient relationships due to consistency of techniques used and nurses influence on patient perceptions about treatment expectations (Schwappach et al., 2010; Weeks et al. 2012). When the SCB evidence based guideline is adopted by CCE, patient benefit may include decreased injection site reactions and pain resulting in a willingness to stay on effective treatment with fewer side effects. The benefit to the company is an understanding of nursing practice in a community setting that may inform future clinical trial designs. The benefits to clinical practice and patient outcomes outweigh the cost associated with the project.

Project Objectives

Mission / Vision

The mission and vision of this practice improvement project linked nursing intervention and patient outcomes and was aligned with the Oncology Nursing Society focus on improving nurse sensitive patient outcomes (Given & Sherwood, 2005). The mission was to ensure safe, effective treatment for patients with multiple myeloma who are receiving bortezomib treatment through development of an administration guideline based on best evidence, clinician experience and patient preference. The vision was to demonstrate that CCE oncology nurses effectively deliver high-quality care that impacts nurse sensitive patient outcomes.

Goals / Outcomes

The goal of the project was to describe how oncology nurses at CCE actually administer SCB and use the best available evidence from the clinical literature to support developing the guideline. The expected project outcomes included implementation of the guideline at clinics in

the CCE network. Implementation of the guideline can specifically influence nurse sensitive outcomes of patients with MM. Outcomes aligned with advanced practice nursing reflect clinical practice effectiveness (Gawlinski & McCloy, 2009). Oncology nursing patient outcomes aligned with good SC injection techniques includes:

Table 2 Oncology Nursing Sensitive Patient Outcomes and Measures

OUTCOME	MEASURE
Symptom control and management	• Lower incidence of peripheral neuropathy • Reduced injection site reactions and pain
Functional Status	• Completion of effective treatment length of therapy
Economics	• Reduced clinic time • Reduced cost • Cost effective treatment compared to other treatment options

Evaluation Plan

Logic Model

Logic models provide a systematic overview of a project in order to demonstrate the relationship between resources, activities and outcomes expected in the short and long term (Zaccagnini & White, 2011) Appendix B describes the logic model for this project.

Population

The target population was registered nurses in the CCE network who administered SCB. All nurses who had ever administered SCB were eligible to participate. There are over 200

nurses associated with the network, however the numbers who have administered SCB was not known. Physician assistants who were not nurses, non-registered nurses, and those who administered IV but not SC bortezomib were excluded from participation. The target population for the guideline review and implementation was the Vice President of Clinical Operation who will present the guideline to the network clinics.

Setting

Cancer Clinics of Excellence is a network of physician owned community oncology clinics in cities through the US. The network's goal is to "Develop, influence, measure and support evidence-based best practice cancer care to patients in their own community" (Cancer Centers of Excellence [CCE], para. 1). The nurses completed the electronic survey on the network intra-net during clinic hours.

Design and Measurement

This practice improvement project incorporated a project investigator developed descriptive survey and literature review as evidence for developing the practice guideline. The Vice President of Clinical Operations and the Manager of Research at CCE were presented with the project proposal in March, 2013 and agreed to participate. The CCE electronic data base confirmed SCB was being administered at CCE clinics.

The Manager of Research contacted the local clinic coordinators, who have administrative positions and were not in supervisory roles to inform them of the project during conference calls. The project purpose, confidentiality, and investigator contact information were clarified with the coordinators. The clinic coordinators invited the nurses to participate in the survey and provided the link to the web survey. The survey was opened on May 20, 2013 and

remained open for 3 weeks. The project investigator conducted weekly phone calls to remind the Manager of Research of the project.

The survey was administered once during a three week time period. The project investigator accessed the aggregated survey results at the end of the open period and analyzed all responses. The Excel spreadsheet with aggregated results was sent to statisticians at the company. The qualitative survey responses were logged by the project investigator onto a separate spreadsheet for analysis. Forty three (43) nurses completed the survey, all survey questions were answered, and there were no missing data.

The survey results were categorized for the target administration techniques and compared to the information from the literature. The subjective responses were analyzed for themes using content analysis to identify potential rationale for responses. The domains of beliefs from the TPB were cross referenced to evaluate behavior intentions. Where there was less than 50% agreement on any administration technique, or where there was more than 60% agreement contrary to the best evidence, questions were flagged as potential techniques that would require summarizing the evidence to justify changing behavior.

The survey results and a draft guideline were discussed with the Vice President of Clinical Operations at CCE to ensure commitment to continuing the project. It was determined that the results were appropriate, and the draft guideline was within the scope of CCE nursing practice. The final guideline will be presented by the Vice President of Clinical Operations to the CCE network for implementation at the national meeting of clinicians in September, 2013.

Protection of Human Rights

Institutional Board Approval (IRB) for the project was obtained from New England IRB and Regis University IRB. The project investigator completed the Collaborative Institutional

Training Initiative (CITI) certification prior to beginning the project (Appendix F). The CCE manager of research explained the survey purpose and process to office coordinators at the clinics where SCB had been administered. The coordinators, in addition to the Manager of Research, invited oncology nurses to consider participation and explained the purpose and expected outcome of the survey.

The electronic survey included an introduction explaining the survey and how to contact the project investigator and academic supervisor (Appendix E). Participation was voluntary as described on the survey introduction. The introduction emphasized that participation or non-participation would not reflect performance expectations at the clinic. Completion of the survey constituted the nurses consent to participate.

The web-based survey was confidential and anonymous and the results could not be assigned to an individual or clinic. The project investigator was given the secure link to the survey. The aggregated data and spreadsheets are to be maintained in a locked office drawer for three years by the project investigator in hard copy form.

Instrument Reliability / Validity and Intended Statistics

The project investigator-developed survey, the Subcutaneous Administration of Bortezomib Survey (SABS) was adapted with permission (A. Niremberg, personal communication, December 11, 2012, Appendix H), from the Neutropenia Oncology Nurses Survey ™ (NONS). The NONS instrument was researcher developed to measure the constructs of the TPB and demonstrated an overall internal consistency, Cronbach alpha = 0.84. (Nirenberg et al., 2010, p. 767). The Subcutaneous Administration of Bortezomib Survey (SABS) (Appendix E) content validity was established by five oncology nurses (2 Doctor of Philosophy (PhD), 1 Nursing Doctorate (ND), 2 Masters of Science in Nursing Advanced Practice

Registered Nurses (MSN, APRN), one medical oncologist, legal counsel, and three health economic outcomes research experts. No reliability has been established for the SABS. The SABS was a 44 item questionnaire, consisting of six demographic questions, 20 questions addressing practice to identify areas of knowledge and competence; 10 questions addressing opinions about SC bortezomib to identify behavioral beliefs and eight questions to identify perceptions of colleague's beliefs. The survey attributes included four point Likert scales, yes and no and multiple-choice questions. The Likert scales forced a response in ranking. Many questions asked for brief explanations for the chosen response.

There were threats to the reliability and validity of the instrument including an author developed, single use survey instrument. In addition, responses may have been influence by nurses potentially being more aware of their techniques because of the survey and responded with what they believed the right answer should be rather than what they actually did in practice.

Non-parametric descriptive statistics, including frequency and percentages were used to describe the survey results. The project investigator was interested in evaluating the relationship between question responses such as needle length and angle of insertion, facility privacy, injection site preference, and consistency of techniques for nurses who believed that practice guideline were already in place. In these instances Fishers exact test was applied to identify relationships between these questions. Traditional content analysis was used to summarize the themes of short answer responses.

The survey described the most prevalent injection techniques used by the nurses for selecting injection sites, changing needles prior to injecting, selecting needle size, purging or including air in the syringe, and length of time administering an injection. The common themes obtained from the content analysis suggested the nurses rational for some administration

practices (Bradley et al., 2007). This information and the clinical literature were used to develop a standardized guideline.

Project Findings and Results

The objectives of the project were to 1) develop and administer a survey of oncology nurses who had administered SCB in the CCE network, 2) develop a practice guideline on the administration of SCB, and 3) implement the guideline at CCE.

Objective One: The Subcutaneous Administration of Bortezomib Survey Results

Demographics. All respondents were female, approximately half held Bachelor of Science in Nursing (BSN) as their highest nursing degree, 35% held Associates Degree in Nursing (ADN) and 12% Diplomas in Nursing. Half were certified by the Oncology Nursing Society (ONS) as Oncology Certified Nurses (OCN), 30% had been in oncology nursing between 11-20 years. Table 3 summarizes the demographics. Table 4 validates the inclusion criteria, representing the number of patients per month to whom respondents administered SCB.

Table 3 Demographics of Oncology Nurses

Highest Nursing Degree	Percent	Number
ADN	35%	15
BSN	51%	22
MSN	2%	1
Other (Diploma)	12%	5
Specialty Certification	**Percent***	**Number**
Not certified	40%	17
OCN	51%	22
Other Certification	12%	5

*May not add to 100% due to rounding and multiple certifications

Table 4 To how many patients do you administer SCB in a month?

Number of patients	Percent	Number
1 – 5	46%	20
6-10	33%	14
More than 10	21%	9

Physicians were primarily responsible for ordering bortezomib by the SC route; however, 53% of respondents indicated Nurse Practitioners (NPs) ordered the SC route in their setting. The majority of nurses (61%) believed they were able to provide some input into decisions regarding the route of administration.

Administration Techniques – Control Beliefs

Control beliefs reflect the nurse's confidence and competence in performing the procedure.

Anatomical site selection. Appropriate site for SC injections include the arm, abdomen and thigh (National Institutes of Health [NIH], n.d.). In Phase III clinical trials, SCB was only administered in the abdomen and thigh (Moreau et al., 2011). Nurses reported administering SCB in the abdomen, arm, and thigh (Table 5). However, 88% indicated their preference is to administer in the abdomen (Table 6). The reasons for preferring the abdomen included more adipose tissue, less irritation, easy access, patient preference, and information from the package insert and literature. Figure 2 compares sites used for administration to those preferred. All respondents documented the site of injections, although only 23% reported having an anatomical map in the patient chart to guide site rotations for each injection.

Table 5 What anatomical site(s) do you use to administer SCB?

Anatomical Site	Yes	No
Abdomen	98%	2%
Thigh	19%	81%
Arm	54%	46%

Table 6 What anatomical site(s) do you prefer to use for SCB?

Anatomical Site	Yes
Abdomen	88%
Thigh	0%
Arm	12%

Figure 2 Comparison of site administration versus site preferences

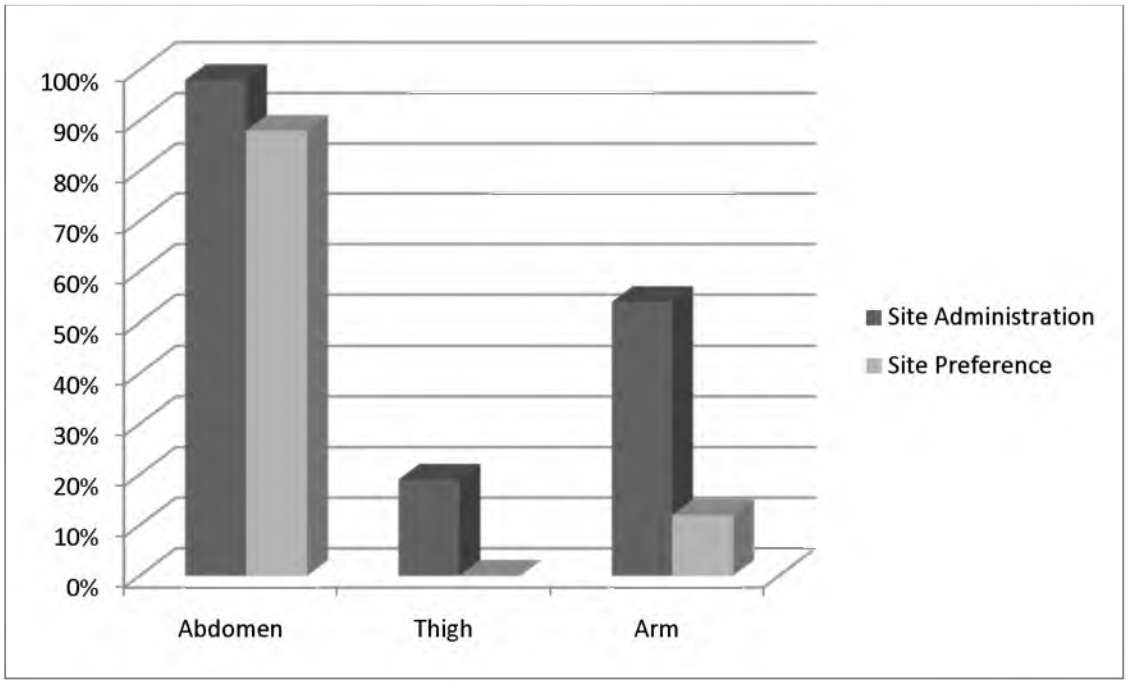

Figure 2. Comparison of nurse's actual site selections and site preferences for administering SCB injections. The abdomen and arm are used most often and preferred.

Facility lay out for chemotherapy administration in community clinics can vary from private to semi-private. There was an association between administration site preference and facility layout. Nurses in facilities with more private surroundings preferred the abdominal site for injections, while those with semi or non-private layouts preferred the arm ($p=0.02$).

Needle size and angle of inserting needle. Small gauge, short needles cause less bruising and injection reactions (Arendt-Neilsen et al., 2006; Birkebaek et al., 2008; Frid et al., 2010; Gibney et al., 2010). Approximately 40% of the respondents indicated using 25 gauge 5/8-inch (15.8 mm) needles, and 56% indicated use of smaller 27 – 30 gauge shorter than 1/ 2-inch needle (12.7 mm). Of the nurses using the larger 25 gauge 5/8-inch needles, 61% used 45-degree angle for insertion and 39% used 90-degree angles. For the nurses using the smaller, shorter needles, 42% used 45-degree angle insertions, while 58% used 90-degree angle insertions (Figure 3). There was no association between needle size and angle of insertion (p= 0.35). The literature suggests use of 45-degree angle for needles longer than 6 mm to avoid intramuscular injections, and 90 degree for shorter needles (Akkus et al., 2012).

Figure 3 Association between needle length and angle of needle insertion for injections

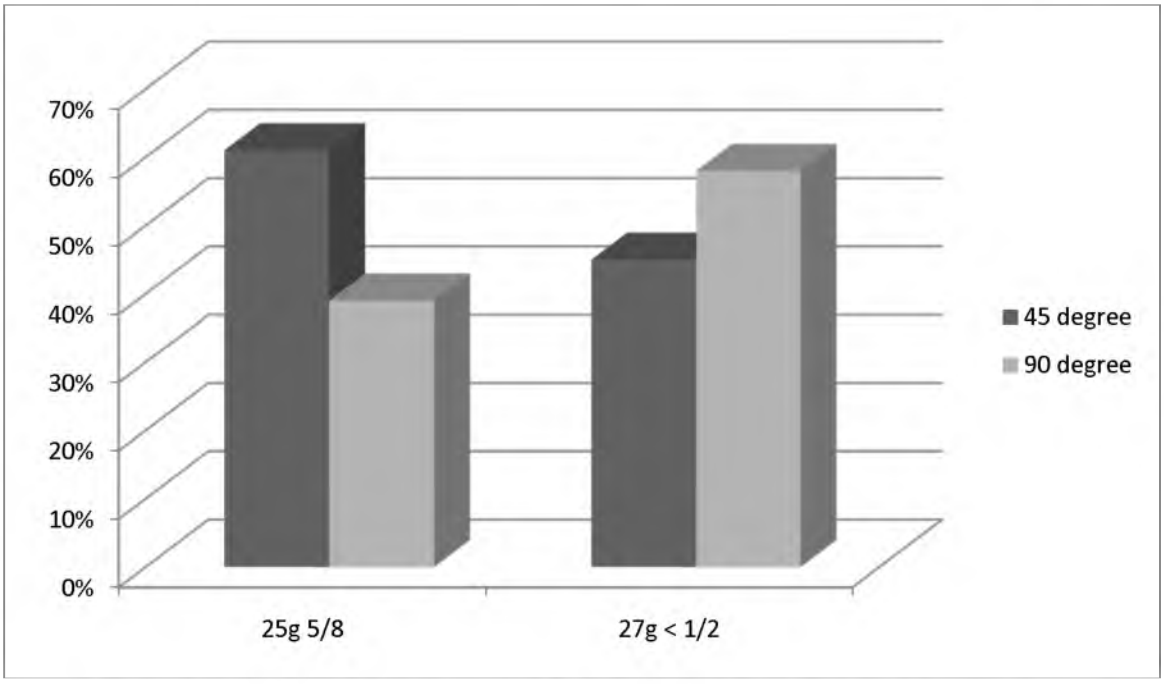

Figure 3. Association between needle size and angle of insertion indicates more than 30% of nurses used 90 degree angles with longer needles. This may result in IM injections.

Changing needles and purging or adding air. There is rationale for changing needles prior to injections, also known as using a dry needle, with drugs that are irritants, such as bortezomib. Studies have demonstrated no reduction in bruising using a dry needle, while other studies have revealed reduction in bruising injections (Agac & Gunes, 2011; Kingman, 2000; Lamblet et al. 2011). Use of a dry needle was most prevalent, with 93% indicating they do change needles prior to administering SCB.

The literature frequently recommends purging air from the needle prior to injections. However, clinical studies have demonstrated the use of an air bubble, or air sandwich, significantly reduced bruising, injection pain, and increased patient acceptance (Moore et al., 2007; Wooldridge & Jackson, 1988). The survey indicated practices were essentially split, with 49% purging air and 51% pulling air into the syringe. Qualitative responses providing rationale for the techniques suggested the primary reason for purging air was having been taught to do so, or habit. The main reasons for using the air bubble was having had attended an in-service or lecture at a meeting where the technique was explained.

Administration time. Studies have demonstrated that injection times of 30 seconds result in less bruising than 10 second injections. Recommendations for the time to administer a SC injection are approximately 10 seconds per milliliter (ml) of drug (Akpinar & Celebioglu, 2008; Chan, 2001;IMF 2012; Kurtin, Knop & Milliron 2012; Moore et al. 2007; Wooldridge & Jackson, 1988; Zabak & Khorshid 2007). Intravenous bortezomib is administered as a three to five second push (Velcade 2012). There is no information on how long to administer SCB injections. Approximately half of the nurses (49%) indicated administering each ml of SCB over three to five seconds.

Source of practice standards. Half of the respondents believed the network had a standard guideline already in place for administering SCB. However, for those who indicated a guideline was in place, there was no consistency in injection time (p=0.19), use of air bubble (p=0.31), or needle length and injection angle (p=0.56). Because the literature and textbooks do not provide clear guidance on SC administration and there is no information in the literature on administering SCB, the participants were asked to identify the source of their knowledge on SCB administration (Table 7). Half of respondents indicated their techniques were based on in-services. Five respondents specifically indicated the manufacturer's sales representatives or nurse educator provided the in-service information, and one referenced the drug package insert as the source for information.

Table 7 The technique you use to inject SCB is based on:

Source	Yes	No
My clinical experience	93%	7%
Clinical practice guidelines	72%	28%
Demonstration from colleagues	61%	39%
Inservice or education seminar	54%	46%
Other	16%	84%

Summary of administration techniques, control beliefs. There were differences and similarities in injection techniques used for SCB among nurses. The techniques with the greatest consistency (> 60%) of practice included:

- Documenting site of injection (100%)
- Rotating injection site within the same anatomical area (67%)
- Not having an anatomical map in the chart for site rotation (77%)
- Using alcohol preparation at site (93%)
- Changing the needle on the syringe (93%)

- Pinching a skin fold (81%)
- Administering in the abdomen (88%)
- Not administering in the thigh (81%)
- Injecting in under 10 seconds (84%)
- Not applying pressure to injection site (63%)

In general, for the techniques that varied, the technique differences were about half and half.

- Size of needle 25 gauge 5/8 inch vs. 27-30 gauge ½ inch or smaller (42% vs. 56%)
- Angle of injection 45 degree vs. 90 degree (51% vs. 49%)
- Purge needle vs. air bubble (49% vs. 51%)

Considering nurses behavior intentions, there were three evidence based techniques in the practice guideline that may be problematic for nurses to adopt due to their current practice. First, the time for an injection should be longer than 10 seconds, and ideally injected over 30 seconds. Second, needles longer than 1/ 4 inch (6 mm) should be inserted at 45-degree angle to reduce the risk of an IM injection, even with pinching the skin. Third, the use of an air bubble prevents the irritating drug from tracking on the needle when inserting or withdrawing the injection, and has been shown in two studies to cause less bruising and increase patient compliance.

Nurses and patients strongly disliked the thigh as an injection site. Including an anatomical map in the charts to document abdominal injection sites used may decrease the risk of abdominal lypohypertophy due to inconsistent site rotation (Australian Diabetic Educators Association [ADEA], 2011). An anatomical map was incorporated into the practice guideline (Appendix H).

Opinions about Bortezomib – Behavior Beliefs

Convenience and patient preference. Overall, nurses believed SCB was more convenient (Table 8) and took less time than IV bortezomib (Table 9). Reasons for believing SCB to be more convenient were primarily because it was quicker to administer. Comments reflected on patient preference and ease for the nurses and patients. Relative to responses about the time to administer, nurses primarily commented on the difference in time to start an IV, running pre medications, and hydration and gathering the supplies for an IV. Some indicated the actual injection time is the same as the IV push, which is congruent with the information that many nurses are administering the SC injection over three to five seconds. Time conveniences for the patient included not having to wait for a treatment chair or IV fluids. One respondent believed patients to be more compliant with the SC route.

Nurses were divided as to whether privacy concerns influenced site selection. However, the results suggest an association between site selection and facility privacy. Several commented that many patients, especially women, were less willing to expose their abdomen and more privacy was needed and provided for abdominal injections.

The majority of nurses (86%) believed patients prefer SCB to IVB. The primary reason for patient preference stated was that it took less time and they did not have to get an IV stick. Five nurses commented that some patients have experienced injection site reactions described as "skin irritation, sensitivity reaction at site of administration, red welts, skin sites get quite sore and site reactions". Five also commented patient preference is due to decreased neuropathy with SCB.

Most nurses (72%) believed patients preferred the abdomen, while 28% believed patients preferred the arm for SC injections. The primary reason for patient preference was less pain and

redness with abdominal injections. Other reasons for preferring the abdomen were ease of access, modesty, and not having to redress.

Table 8 Overall; is the SC route more or less convenient for nurses to administer than the IV route?

Convenience	Percent
Subcutaneous much more convenient	84%
Subcutaneous somewhat more convenient	14%
Subcutaneous somewhat less convenient	0%
Subcutaneous much less convenient	2%

Table 9 Overall; is there a difference in the time it takes to administer SCB versus IVB?

Time	Percent
Much less time for SC	67%
Somewhat less time for SC	28%
Somewhat more time for SC	5%
Much more time for SC	0%

Summary of opinions and behavior beliefs

Nurses believed the SC route to be more convenient and that patients prefer SCB to IV. These beliefs will support Duffy's Quality Caring Model when presenting a guideline based on their own practice and clinical evidence. Nurses are responsible for using evidence in practice and applying attitudes and behaviors of caring. Improvements in health outcomes are possible when caring relationships are integrated into nursing practice. The Theory of Planned Behavior (Azjen, 2007) suggests behavior beliefs will predict willingness to act. Rationale for the practice guideline will include evidence from the literature about the convenience and cost effectiveness of SC chemotherapy (Du et al.2005) as well as information from the SABS on nurses and patients beliefs about the convenience of SCB.

Perceptions of Others, Subjective Beliefs

There was general agreement that all nurses used similar techniques for administering SCB (Table 10). The belief in consistency was due to incorporating information from attendance at in-services or standardized teaching in the clinic. However, several commented that there were different techniques being used and being observed, patients had commented on differences and indicated having favorite nurses for injections, and nurses had different training or different experiences. Respondents agreed that consistency was important to patients for continuity of care, safety and to reassure the patients.

Table 10 All nurses in this clinic use the same technique to administer SCB

Same technique	Percent
Completely agree	39%
Somewhat agree	56%
Somewhat disagree	5%
Disagree completely	0%

Adherence to practice guidelines

Participating nurses agreed that practice guidelines are important for consistency and quality care, and if the techniques being used differed from a practice guideline, they would be willing to change. Half of the respondents indicated there was a standard guideline in their clinic for administering SCB, 20% indicated there was not a guideline and approximately 30% were unsure. For those who believed there was a standard guideline, there was no consistency in the time to administer an injection ($p=0.19$), use of the air bubble ($p=0.31$) or angle of insertion ($p=0.56$).These findings are supported by clinical literature that indicates although guidelines may be in place, clinician (nurses and physicians) adherence and knowledge of the guidelines is inconsistent even when the clinicians agree about the importance of following guidelines (Binner et al., 2011; Cote et al., 2012; Martin & Larsen, 2003; Nirenberg et al., 2010; O'Boyle et al., 2001; Squires et al., 2007).

Objective Two: Results for Evidence Based Practice – Development of the Subcutaneous Administration of Bortezomib Practice Guideline

A comprehensive clinical literature review supported the lack of standard SC administration techniques, the need to describe how nurses are administering subcutaneous injections and to develop evidence based practice guidelines in order to improve patient outcomes by potentially reducing injection site reactions and injection site pain. Reducing the adverse events associated with inconsistent injection techniques may result in patients complying with treatment and completing effective therapy.

The Capstone Project process identified the different techniques oncology nurses in a network of cancer clinics used to administer SC bortezomib and lack of standard practice guidelines for the administration of subcutaneous chemotherapy. The practice guideline developed was based on evidence from the actual practice of 43 oncology nurses who administered SC bortezomib to patients in a network of community oncology clinics and supported with evidence from the clinical literature. The Subcutaneous Administration of Bortezomib Practice Guideline included descriptions of potential patient benefit, levels of evidence and graphics for specific techniques (Appendix H) Permission was granted for use of the graphics (Appendix G).

The specific techniques in the guideline recommendations included:

- Anatomical site rotation and use of an anatomical map
- Appropriate method of skin pinch to ensure access into adipose tissue
- Use of 45 degree angle with needles that are longer than 6 mm (1/ 4 inch) to avoid risk of intramuscular injections
- Use of dry needle

- Use of air bubble
- Injection duration of 10 to 30 seconds

Objective Three: Implementation of the Practice Guideline

The Subcutaneous Administration of Bortezomib Practice Guideline was presented to the Vice President of Clinical Operations for review and approval. The Vice President of Clinical Operations will present the guideline for implementation at the September 2013 CCE national meeting. The project investigator will follow up with the Vice President in October, 2013.

According to the constructs of the Theory of Planned Behavior (Azjen, 2012), incorporating information on what the nurses were actually doing, what they believed about SC bortezomib and their perceptions of what patients and colleagues believed about SC bortezomib, implementation of the guideline is likely to occur. Adoption of the practice guideline at CCE is possible with appropriate staff education.

Joan Duffy's Quality Caring Model can be the framework for educating CCE nurses about the Subcutaneous Administration of Bortezomib Practice Guideline. The model contends that through self-evaluation of practice, collaborative relationships, and adoption of evidence-based practice, nurses can improve patient caring and outcomes.

Limitations, Recommendations and Implications for Practice

Limitations

There are several limitations to this project. First, the project investigator developed the SABS survey instrument based on adaptation of the Neutropenia Oncology Nurse Survey™. Although the SABS was reviewed for content validity, there is no established and validity for this instrument. In addition there is no instrument reliability. Second, the survey results only reflect one community oncology network. Third, the number of respondents was small. Finally,

the survey was administered after some of the surveyed nurses had attended education sessions on SCB injections which may have influences their responses. The findings cannot be generalized to other community oncology networks, independent community practices, or academic cancer centers.

Recommendations

The purpose of this project was to develop and implement a practice guideline on the administration of SCB for a community oncology network. The project was in alignment with the clinical literature assertions that nurses use different techniques for SC injections. Different techniques are recommended in the literature and textbooks. Project surveyed nurses agreed guidelines result in consistency of care that is important to patients. It would be reasonable to recommend oncology nurses assess how nurses are administering SC injections in order to better understand current practice.

The results of this project suggested potential opportunities for future nursing research. There is no evidence that adopting a practice guideline will result in fewer injections site reactions. The incidence of SCB injection site reactions in actual practice is unknown. A clinical study comparing the incidence of injection site reactions and patient reported outcomes when following the guideline injection technique is needed.

A weakness associated with new SC drugs is the lack of information drug manufacturers provide on how to administer the SC injections (Annerson & Williams, 2005). Drug manufacturers could improve data reports by including evidence based SC administration techniques in the drug study designs. Including information from clinical trials on how to safely administer SC injections, along with the safety and efficacy data, may mitigate the risk of injection site adverse events when drugs are more widely used after approval. This project

exposed members of the Millennium project team to the importance of considering nursing interventions in study design to improve patient outcomes.

The manufacturer of bortezomib, Millennium, the Takeda Oncology Company, was willing to sponsor this project in the interest of identifying what nurses are actually doing when administering SC bortezomib injections. Millennium may not be able to recommend the guideline that was developed for this project. Cancer Clinics of Excellence reviewed the guideline and agreed to its implementation. A comprehensive training plan that engages Advanced Practice Nurse Practitioners (APRNs) as champions throughout the network may improve the likelihood of widespread adoption. Nurse Practitioners currently have responsibility for ordering SCB in some of the network clinics. Championing and promoting evidence based guidelines can provide APRNs continuity in advanced practice roles within the CCE organization. The APRNs can influence the outcomes that are most meaningful to patients by modeling the importance of consistent caring practice to patients and supporting professional collaboration with evidence based practice (Gawlinski & McCloy, 2009). Adopting the guideline will contribute to nursing practice by demonstrating evidence based care impacts nurse sensitive patient outcomes.

Summary

Essential to the Doctor of Nursing Practice (DNP) role is improving patient outcomes and the overall quality of healthcare organizations (Zaccagnini & White, 2011). The Subcutaneous Administration of Bortezomib Guideline Capstone Project endeavored to advance oncology-nursing practice in a network of community oncology clinics in order to improve patient outcomes. Additionally, the project introduced the value proposition of nursing outcomes projects in a global oncology pharmaceutical company medical affairs organization. The project

addressed the first three essentials of a DNP education (American Association of Colleges of Nursing [AACN], 2006).

First, the scientific underpinnings of practice were met by utilizing evidence from the clinical literature and actual practice. Second, the project investigator demonstrated organizational and system leadership for quality improvement and system thinking within in a network of oncology clinics committed to evidence based practice and a global pharmaceutical company committed to developing effective oncology therapeutics. Third, clinical scholarship and analytical methods for evidence based practice were achieved by critically collecting and analyzing data to develop a guideline consistent with the principles of evidence based practice. The Subcutaneous Administration of Bortezomib Capstone Project met the criteria of investigating a practice issues and developing outcomes solutions to improve clinical practice for the benefit of a population.

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Appendix A

Systematic Review of Clinical Literature

	1	2	3
Article Title	Chemotherapy handling practices of outpatient and office based oncology nurses	Variation in modes of chemotherapy administration for breast carcinoma and association with hospitalization for chemotherapy related toxicity.	Subcutaneous or intravenous administration of (neo)adjuvant trastuzumab in patients with HER2-positive clinical stage I-III breast cancer (HennaH Study): a phase 3, open label, multicenter, randomized trail.
Author, year, Journal	Martin,S, Larson, E, (2003) *Oncology Nursing Forum* 30(4)575-581	Du, X.L., Chan, W., Giordano, S., Geraci, J.M., Delcios, S.L., Barau, K., & Fang, S. (2005) CANCER Sept. 1 104(5) 913-924 doi:10.1002/cncr.21271	Ismael, G, Hegg, R., Meulhlbarer, S., Menizmann, D., Lum, B., Kim, S-B, Pienkowski, T., Lichinster, M., Semiglazov, V., Melicher, B., Jackisch, C. (2012 September) *The Lancet Oncology* 869-878 retrieved from http://dx.doi.org/10.1016/S1470-2045(12)70329-7
Data Base & Key Words	ONS.org chemotherapy, administration, oncology nurses, practice, knowledge, perception	MEDLine chemotherapy, mode administration, toxicity	EBSCo Host, subcutaneous versus intravenous chemotherapy, efficacy, administration chemotherapy
Research Design	Descriptive, correlation	matched case report, retrospective, epidemiological	Open label Ph III randomized controlled trial
Level of Evidence	VI (Melnyk 2005)	IV (Melnyk)	II
Study Aim/Purpose	Determine nurses adherence to OSHA guidelines for chemotherapy handing	Describe how chemo for breast cancer is administered and determine if administration modes are associated with greater	" comparability of the 600 mg sub- cutaneous trastuzumab fixed dose and the registered intravenous formulation

		toxicity	with respect to pharmaco- kinetics, efficacy, and safety" (p 870).
Methods/ Study Appraisal	ONS members self identified practice in clinic, office, private practice role chemo administration. Random selection from ONS membership list 500 surveys, 263 respondents/ difference in practice patterns of >20% significance <0.05 power 0.80	Identified population by ICD codes, procedure code 9925 (chemo administration) V codes, CPT, J codes for anthracyclines (doxirubicin or mitoxantrone, 5FU, and taxanes) and revenue center codes. 5 administration methods based on first course of therapy 1. SC, IM or intralesion, 2. IV Push, 3. Infusion les than 1 hour, 4. infusion 1 - 8 hours, 5.Infusion > 8 hrs. Comorbidity index defined using the NCI SAS macro rule-out programs, Toxicity defined by IC-9 codes that occurred within 7 months of diagnoses in 1 month window after chemo administration. Chi square statististics to test significance for trends, multivariable logistics regression to assess risk (odds ratio) confounding variables likely to affect chemotherapy:(p. 917) of being hospitalized adjusted for patient age, rage, tumor stage, comorbidity, years of diagnosis, geographic area	18yearsorolder,hadHER2 - positive(definedasimmun ohistochemistry3+orin-situ hybridisationpositive),ne wlydiagnosed,non-metastatic, primary, invasive adenocarcinoma of the breast (clinical stageItoIIIC)withprimary tumours1cmorlargerby ultrasound or 2 cm or larger by palpation, a baseline Eastern Cooperative Oncology Group performance status of 0 to 1 and baseline left ventricular ejection fraction (LVEF) of 55% or more (by echocardiography or multiple gated acquisition). (p870) 299 IV, 279 SC arms. Non-inferiority pharmakokinetics two sided 90% CI; 130 patients each arm to reach 80% power was reached;
Primary Outcomes/ Measures/R esults	20 item Chemotherapy Handling Questionnaire, mailed w stamped return envelope, validated by expert	for 5FU SC / IM or IVP significantly lower risk of hospitalization than IV infusions. Substantial geographic variations "important public health implications because if the	Met primary outcome non-inferiority of SC vs IV, efficacy, PK/PD, and similar toxicity profile.

	panel, stability Cohens kappa 0.8. Synthesis: compared demographics to ONS membership for experience, degree, certification, geographic response rate, FT/PT, practice setting, # pts/day	modes of administration are associated with subsequent outcomes it may be possible to take steps to prevent negative outcomes by controlling for the preferred mode/route of chemotherapy administration" (p 922).	
Author Conclusions / Implications of Key Findings	Availability of protective equip 100%; use of gloves 99%, gowns 53%, goggles rare; preparation 49% RPh, 40% nurses, Education & Training 87%; Policies and procedures 85%	Prevalence of administration: 72% IV <1 hour or 1 - 8 hrs; 15% IV> 8 hours; 12% IVP; 1% SC/IM. Patients significantly less likely to be hospitalized with SC and infusion > 8 hrs	SC non-inferior to IV = valid administration option that "Could provide substantial time saving for patients, physicians and nursing staff"(p877)
Strengths/limitations	High response rate from experienced nurses. Not generalizable due to he expertise of the respondents may not reflect general practice	SEER data highly reliable and valid to monitor cancer control & prevention. Medicate covers IV chemotherapy inpatient and outpatient. Limitations: cannot be generalized beyond women >65 y/o with breast cancer who are not covered by HMOs or fully covered by Medicare A&B. Codes could be misclassified, dose of chemotherapy not known that may have impact on adverse events	RCT with PK/PD evidence. Limitations, applicable only in neo-adjuvant setting. SC dose mixed with 10,000U RHuPH enzyme to improve SC absorption. 4
Funding Source	Not indicated	NCI	Roche Pharmaceutical
Comments	Applicable to PICO due to design of questionnaire and evidence that oncology nurses	Risk of adverse events lowest with SC vs IV administration. Only 1% of admin is SC, possible lack of knowledge due to less	Ph III non-inferiority of SC MOAB. Administration technique not clearly described. 5 min SC administration

	prepare own chemotherapy, 87% education on chemo admin, 85% policies in place. Suggests capstone population may be preparing chemo, may not have been educated and not have, or not realize SOP for SC admin	frequent mode. Substantial geographic variations "important public health implications because if the modes of administration are associated with subsequent outcomes it may be possible to take steps to prevent negative outcomes by controlling for the preferred mode/route of chemotherapy administration" (p 922). Application to PICO - may support lack of SOP for SC administration and opportunity for teaching and change in practice.	would be difficult to administer and would require extensive nursing teaching. Butterfly used for SC administration and sites were moved due to volume (Personal communication T. Caver October 5, 2012). Application to PICO supports literature does not describe how to administer SC anti cancer agents

	4	5	6`
Article Title	Explaining the role of organizational policies and procedures in promoting research utilization in registered nurses.	Patients' expectations about effects of chemotherapy for advanced cancer	Oncology nurses' use of national comprehensive cancer network clinical practice guidelines for chemotherapy-induced and febrile neutropenia
Author, year, Journal	Squires, J.E., Moralejo, D., LeFort, S.M. (2007 June 5) *Implementation Science* 2(17) doi:10.1186/1748-5908-2-17	Weeks, J.C., Catalano, P.J., Finkelman, M.D., Mack, J.W., Keating, N.L., Schrag, D. (2012 October 25) *New England Journal of Medicine.* 367(17) 1616-1625 doi: 10.1056/NEJMoa.1204-410 Retrieved from nejm.org	Nirenberg, A., Reame, N.K., Cato, K.D., Larson, E.L. (2010 November) *Oncology Nursing Forum*. 37(6) 765-772 doi: 10.1188/10.ONF.765-773
Data Base & Key	BioMed Central,	NEJM.org	ONS.org/publicatio

Words	Open Access. Perceptions nurses utilization procedures	Patient perceptions chemotherapy	ns Evidence practice, adherence, procedures, guidelines, perceived competence
Research Design	Cross sectional survey	Descriptive survey interview	Cross-sectional survey
Level of Evidence	VI	VI	VI
Study Aim/Purpose	Identify factors influencing registered nurses to use and follow organizational policies and procedures	Characterize the expectations of patients with advanced colorectal and lung cancer about the effectiveness of chemotherapy and expectations for cure and to identify the clinical, socioedemographic and health system factors associated with expectations of cure (p 1617)	Describe oncology nurses use of guidelines in practice
Methods/ Study Appraisal	Staff and agency RNS in one eastern Canadian Provence, Newfoundland and Labrador. Medical, surgical and critical nurses. 464 surveys mailed, 58% response rate N= 248 . Staff Nurse Questionnaire (SNQ) 96 items revised from Nurses Practice questionnaire (NPQ), tested for reliability on 12 nurses. Descriptive statistics	Patients (or surrogate if pt too ill) from patients in national Cancer Care Outcomes Reearch And Surveillance (CanCORS) study with advanced colorectal or lung cancer. Interviewed 4 – 7 months after diagnosis by telephone interview software. Questions adapted from Los Angeles Women's Health Study to elicit "how likely did you think.."	Neutropenia Oncology Nurses' Survey Web based random sample of US RNs members of ONS. Survey available online for two weeks through ONSEdge. Survey measured constructs of Theory of planned behavior: subjective norms, attitudes, perceived behavioral control, perceived barriers to use of NCCN guidelines. Psychometric properties for

	summarized data. Cross tabulations and chi square for dichotomous data, stepwise multivariate analysis for factors predicting use of P&P	likert like responses of very, somewhat, a little, not at all likely or don't know. Questions on patient / physician communication, QoL, patient role in decision making . Four level responses analyzed with non-parametric test for trends.	instrument internal consistency, Cronbach alpha = 0.84. Descriptive statistics compared to ONS membership. Bivariate analysis of identified variables,
Primary Outcomes/Measures /Results	Table 2 Frequency of use of resources for practice. In the frequently/always use category: 81.9% P&P, 81.1% personal experience; 58.5% fellow nurses; 32.6% Always done that way	1193 of 1274 patients (93%) opted for chemotherapy. 69% with lung cancer and 81% with colorectal believed chemo was very likely to cure their cancer. Variables associated with expectations were colorectal cancer and nonwhite race. Patients from integrated health care networks were less likely to provide inaccurate responses.	Guidelines were more likely to be used when expected by physicians and nurse colleagues. Oncology certified nurses perceived fewer barriers to use of guidelines
Author Conclusions/ Implications of Key Findings	Multivariate regression analysis identified three significant predictors of being a user versus non-user of RBP overall: awareness, awareness by regular use, and persuasion. Six significant	Rate of inaccurate responses higher than from previous small studies. "paradoxically, patients who reported higher scores for physician communication were also at higher risk for inaccurate expectations"	Although 80% reported using guidelines for CIN and FN, only 56% reported it was their own decision. On line survey of ONS members feasible. Provided insights into future member surveys. Need to develop

	predictors of being a consistent versus less consistent user of RBP overall were also identified: perception of P&P existence, unit, nursing experience, personal experience as a source of practice knowledge, number of existing research-based P&Ps, and lack of time as a barrier to consulting P&P manuals.	(p1620) Patients ability to make informed decisions will be impaired if they don't understand treatment is not curative. This suggests a significant obstacle to end of life planning. "Physicians have some ability to influence patients' understanding.	standard nursing protocols. Most respondents from community settings where oncology care is shifting.
Strengths/limitations	Multicentered survey with >200 respondents.248 respondents may not have been enough to identify differences in variables. Nurses alerted to existence of P&P being important. Questionnaire not validated. Not generalizable outside of Canadian provences or community practice	Very large sample size, population based and scope of sociodemographic data collected. Limitations: due to timing of interview after diagnosis, unable to comment on beliefs of those who died shortly after receiving chemotherapy. Single survey does not identify if beliefs changed over time. Interviewers may not have been skilled enough to delve more deeply into responses	309 oncology nurses providing direct patient care, self selected from ONS membership. Limitations: Only 9% response rate. Web based format open only to computer users. Survey conducted one month before ONS Congress may have respondents with more professional interest. Self report may result in overestimation
Source of Funding	Not indicated	NCI	Not indicated
Comments	Factors influencing use of P&P include perceptions of whether or not procedure exists,	Support of PICO – clinicians can influence patient perceptions about treatment. Suggests	Based on Theory of Planned Behavior supported basis for survey development and assessing

	personal experience and peer experience. This information may support hypothesis that whether or not SC procedure in place, nurses may rely on past experience or other nurses for SC chemo administration.	nurses can influence preferences about SC. Supports importance of clinician communication of actual data in ways patient can understand and apply to own situation.	outcomes. Provides framework for project survey: • Attitudes • Subjective norms: perceptions about colleagues • Perceived self competence • Perceived barriers • Reported use

	7	8	9
Article Title	Updated survival analysis of a randomized phase III study of subcutaneous versus intravenous bortezomib in patients with relapsed multiple myeloma	US cancer center implementation of ASCO/Oncology Nursing Society chemotherapy administration safety standards	From simplicity to complexity: developing a model of practical skill performance in nursing
Author, year, Journal	Arnulf, B., Pylpenko, H., Groscki, S., Karamanesht, L., Lelu, X., Van de Velde, H.,...Moreau, P. (2012, June 11).	Weingart, S,N, Li, J.W., Zhu, J., Morway, L., Stuver, S.O., Shulman, L.N., & Hassett M.J. (2011 Dec 6) *Journal of Oncology Practice*. Retrieved from joppubs.org as doi:10.1200/JOP.2011.000379	Bjork, I.T., Kirkevold, M., (2000) *Journal of Clinical Nursing*. 9. 620-631
Data Base & Key Words	MedLine Subcutaneous bortezomib	ASCO Publications Adherence guidelines, chemotherapy administration	CINHAL Clinical nursing skill, practice skill, skill performance

Research Design		Written survey	observational
Level of Evidence	II	VI	VI
Study Aim/Purpose	Update data from Phase III non-inferiority study	Determine the implementation of chemotherapy administration standards in NCI designated cancer centers	New model of nursing practical skill performance
Methods/ Study Appraisal	Phase III RCT Non-inferiority design Updated time to event endpoints Response rates and adverse events Comparing IV and SC administration 2:1 randomization	Written survey using exact, or near exact phrasing of standards. Degree of implementation responses on 4 scale likert or binary yes/no scale. Defined standard as fully implemented if more than 90% of responses were mostly positive, partially implemented if 50-90% mostly positive and not implemented if <50% positive. Internal consistency within domains Cronbachs alpha >0.7 for six of 8 domains. 44 of 55 eligible centers responded.	Videotaping 4 new nurses 3 times over 3-5 months during skills of wound dressing change and post=-op ambulation. Nurses and patients were interviewed. Nurses on intentions and appraisals before and after and patients on expectations and experiences. Models of skills were created with coding scheme for action and set of performance categories developed: substance and sequence, accuracy, fluency, integration and caring conduct. Empirical data were compared with the components to check model validity
Primary Outcomes/Measures /Results	Best response after 10 cycles bortezomib + dexamethasone IV vs. SC 52% each arm	6 standards were fully implemented in at least 80% of the centers. The standards with lowest	Practical skills are highly complex and what seems like simple skills are integrated and comprehensive.

	23% / 22% CR 9.7 mo /9.6mo TTP 9.3 mo/8.6 mo PFS 76% /78% 1 yr OS PN 53% / 38% subsequent therapy 57% / 53%	implementation were providing chemo education materials before administering chemo, providing oral chemo-specific materials, written guidance about regime specific lab testing intervals and chart documentation during chemo planning. Only 4 centers had fully implemented all 31 standards	
Author Conclusions/ Implications of Key Findings	Confirms SC as effective as IV with improved safety profile	Slow adoption may be due to complexity of standards and the infrastructure required to support. Even if electronic systems were to become available through HER, it would require significant work flow changes and staffing. Lack of detailed written patient education and support may "account for the problems with safe handling, adherence and reporting noted" in recent literature. Variability in NCI center practice suggests even more variability in other settings.	Relying on procedure knowledge is inadequate because technical skills are complex actions. Cannot just address motor component of skills, must integrate knowledge and caring considerations

		There is variability in adherence to the safety standards, with opportunities for improvement.	
Strengths/limitations	Observational study may altered natural practice. Observer bias.	"Social desirability bias may have led respondents to report more favorable adherence "(p 5). Centers are complex and multiple specialties are involved in chemotherapy process, though one person facilitated the survey, usually the clinical pharmacist. Nonresponse bias from the 11 centers that did not respond may differ.	Small study, theoretical nature designed to develop a model.
Source of Funding	Packaging concepts Assoc. LLC	Authors Weingart, S.N & Shulman, L.N	Not indicated
Comments	Nurses adherence to practice guidelines may not be congruent with perceptions of practice. Support PICO hypothesis of perceptions versus practice of SC administration	Supports project hypothesis of variable adherence to standard procedures even when standards exist.	Cannot assume because a procedure is in place nurses are able to perform what may seem to be simple nursing skills. Nursing education focus on theory and professionalism has resulted in less time on clinical skills.

	10	11	12
Article Title	Revisions to the 2009 ASCO/ONS standards for safe chemotherapy administration: expanding the scope to include inpatient settings	Pharmakokinetics, pharmacodynamics and covariate analysis of subcutaneous versus intravenous administration of bortezomib in patients with relapsed multiple myeloma.	Chemotherapy-induced peripheral neuropathy: assessment of oncology nurses' knowledge and practice.
Author, year, Journal	Jacobson, J.O., Polovich, M., Gilmore, T.R., Schulmeister, L., Esper, P., LeFebvre, f.B., & Neuss, M.N. (2011) *Journal of Oncology Practice* . Retrieved from http://jop.ascopubs.org/content/8/1/2.full?sid=9c7e1e88-b12a-4cc1-8641-e78ba3e5b3e2	Moreau, P., Karamanesht, I.I., Dominkova, N., Kyselyova, M., Vilchevska, K.V., Doronin, V.A., Schmidt, A., …Facon, T. (2012 Sept 25) Published online *Clin Pharmacokine*t. DOI 10.1007/s40262-012-0010-0	Binner, M., Ross, D., Browner, I. (2011 July) *Oncology Nursing Forum* 38(4)448-454 doi:10.1188/11.ONF.448-454
Data Base & Key Words	ASCO publications Chemotherapy standards	Medline subcutaneous bortezomib, pharmacokinetics	ONS.org oncology nurs* knowledge, practice, perception
Research Design	Practice guideline	Phase III open label RCT AND Randomized Ph 1	cross sectional, descriptive
Level of Evidence	VII	II	VI
Study Aim/Purpose	Revision of standards for safe chemotherapy administration	present a comprehensive analysis of the pharmacokinetics and pharmacodynamics of subcutaneous versus intravenous bortezomib, and to evaluate the impact of the subcutaneous administration site,	explore oncology nurses knowledge and practice behavior of assessing for chemotherapy induced PN

		subcutaneous injection concentration and demographic characteristics on bortezo- mib pharmacokinetics and pharmacodynamics.	
Methods/ Study Appraisal	40 stakeholders, including medical oncologists, oncology nurses, oncology pharmacists, social workers, practice administrators, and patient advocates, as well as representatives from American Cancer Society, Association of Community Cancer Centers, National Quality Forum, National Coalition for Cancer Survivorship, The Joint Commission, and Institute for Safe Medication Practices met for a single day and, using a structured process, drafted 64 chemotherapy administration safety standards. The draft standards were subsequently presented to the full group of participants for comment and discussion, and	age >18 <65 relapsed or refractory MM 1 - 3 prior therapies. In Ph III 32 of 222 patients had PK/PD (18 SC & 14 IV)from Ph I 10 patients each group. Power ratio and 90% CI point estimates AUC mean. Equivalence defined as 90% CI falling between 85-125%. Regression covariates demographics PK /PD collected day 11 of cycle 1 immediately or 30 minutes pre-dose and 2, 5, 15 and 30 minutes post dose, and 1, 2, 4, 6, 10, 24, 36 and 72 hours post dose comparing SC vs IV PK/PD. Pharmacokinetic parameters included the area under the plasma concentration–time curve (AUC) from time zero to the last quantifiable time-	convenience sample 39 oncology nurses in two hospital based outpatient chemotherapy infusion clinics Author developed questionnaire "The Chemotherapy Induced Peripheral Neuropathy: Assessment of Oncology Nurses Knowledge and Practice Questionnaire" 16 knowledge and 16 practice items, 9 demographic items. Content validity 0.95 and reliability Cornbach alpha 0.85. Descrriptive statistics

	assessed for redundancy and gaps. Participants voted on the draft standards within 1 week of the workshop, and the SG used the voting results to clarify and edit the standards, reducing their number to 35.(p	point (AUClast), maximum (peak) plasma drug concentration (Cmax), and time to Cmax (tmax). Pharmacodynamic parameters were calculated by analysis of data on the percentage inhibition of the 20S proteasome in blood over time, which was determined based on the change in pro- teasome activity from baseline (pre-dose) to subsequent time points. Pharmacodynamic parameters included area under the effect–time curve from time zero to 72 h (AUEC72), maximum percentage 20S proteasome inhibi- tion [maximum effect (Emax)] and time to Emax.	
Primary Outcomes/Measures /Results	Primary change was to include inpatient setting	Table 1. systemic exposure was equivalent to subcutaneous versus intravenous administration, mean AUClast was 155 versus 151 ng□h/mL, subcuta- neous injection concentration had	75% rated assessment skills as poor or fair, only 15% had prior PN assessment teaching, barriers included lack of knowledge, time and inadequate tools, 33% routinely screened for PN

		no appreciable effect on pharmacokinetic parameters, blood 20S proteasome inhibition were also similar with subcutaneous versus intravenous bortezomib. the site at which the subcutaneous injection was administered and the concentration of the injected solution (2.5 or 1 mg/mL) did not appear to affect the pharmacokinetic and pharmacodynamics parameters of bortezomib following subcutaneous injection, demonstrat- ing the feasibility of using a higher subcutaneous injection concentration (2.5 mg/mL) in order to minimize the vol- ume injected per dose of bortezomib. In both studies, subcutaneous injection sites were the thighs and the abdomen (but not the arms); the absence of any apparent differences in pharmacological	

		parameters between these sites indicates that both represent equally feasible sites for the subcutaneous administration of bortezomib. Addition- ally, demographic covariates did not appear to have an impact on the systemic exposure with subcutaneous bort- ezomib, when dosed on the basis of BSA, suggesting the feasibility of this route of administration regardless of a patient's age or bodyweight.	
Author Conclusions/ Implications of Key Findings	Standards, 12, 13, 14 Drug prep. 12. A second person (a practitioner or other personnel approved by the practice/institution to prepare or administer chemotherapy) independently verifies each order for chemotherapy before preparation, including confirming: A. Two patient identifiers B. Drug names	SC administration non inferior to IV. Efficacy related to systemic exposure, not Cmax. SC resulted in less grade 3 adverse events, most importantly, significantly less Peripheral Neuropathy	Lack of confidence, knowledge and assessment skills prevent routine assessment. Need for clinical guidelines on PN assessment and more assessment education

	C. Drug dose D. Drug volume E. Rate of administration F. Route of administration G. The calculation for dosing (including the variables used in this calculation) H. Treatment cycle and day of cycle 13. Chemotherapy drugs are labeled immediately upon preparation, including, at minimum: A. Patient's full name and a second patient identifier (e.g., medical record number, DOB) B. Full generic drug name C. Drug administration route D. Total dose to be given E. Total volume		

	required to administer this dosage F. Date of administration G. Date and time of preparation H. Date and time of expiration when not for immediate use* *Immediate use must be defined by institutional policy, state, and federal regulations (e.g. use within 2 hours). Practices/institutions are not expected to be in full compliance with this standard if they currently have electronic systems that are unable to meet these labeling requirements. Appropriate changes should be implemented as soon as possible to ensure that electronic labels integrate all of these elements. 14. Practices/institutions that administer intrathecal		

	medication maintain policies specifying that intrathecal medication will: A. Not be prepared during preparation of any other agents. B. Be stored, once prepared, in an isolated container or location with a uniquely identifiable intrathecal medication label. C. Be delivered to the patient only with other medication intended for administration into the CNS. Standard 18-20 Administration 18. Before chemotherapy administration: Confirm with the patient his/her planned treatment prior to each cycle;		

	At least two practitioners or personnel approved by the practice/institution to prepare or administer chemotherapy, verify the accuracy of: A. Drug name B. Drug dose C. Drug volume D. Rate of administration E. Route of administration F. Expiration dates/times; if applicable: [expiration date/time is not required if for immediate use*] G. Appearance and physical integrity of the drugs H. Document to indicate verification was done and; I. At least two individuals, in the presence of patient, verify the		

	patient identification using at least two identifiers (e.g., medical record number, DOB) * Immediate use must be defined by institutional policy, state, and federal regulations (e.g. use within 2 hours). 19. Extravasation management procedures are defined and align with current literature and guidelines; antidote order sets and antidotes are accessible. 20. A licensed independent practitioner is on site and immediately available during all chemotherapy administration. ***In organizations or home care settings where chemotherapy may be administered 24/7, patients/caregivers should be explicitly		

	educated in procedures for unplanned events and circumstances.		
Strengths/limitations		PK/PD data from two randomized studies confirms non inferiority of SC vs IV administration. Small number of patients with grade 3 adverse events included in PK/PD evaluation	small study. Nurses may not be reflective of general practice since 54% had BS, and 44% oncology certified. Questionnaire may have reflected more perceived practice than actual and may have prompted more consideration of PN assessment
Source of Funding	ASCO/ONS	Jensen Pharma/Millennium Pharma	none
Comments	Provides standards for project	Published studies only used abdomen and thighs for SC bortezomib. No data on PK/PD in other sites (arm) demographics and BSA does not impact PK/PD SC vs IV. Support PICO hypothesis	SC bortezomib has less PN than IV. Benefit to nursing practice, applicability to contextual practice is important given study indicating need for more knowledge about assessment and PN not frequently assessed. Support PICO importance of SC for improved patient outcomes and nurse sensitive outcomes.

	13	14	15
Article Title	Subcutaneous versus intravenous administration of bortezomib in patients with relapsed multiple myeloma: a randomized, phase 3, non-inferiority study.	Comparison of pegfilgrastim prescribing practice to national guidelines at a university hospital outpatient oncology clinic	Subcutaneous alemtuzumab in fludarabine refractory chronic lymphocytic leukemia: clinical results and prognostic marker analysis from the CLL2H stud of the German chronic lymphoma leukemia study group
Author, year, Journal	Moreau, P., Pylpinko, H., Grosicki, S., Karamanesht, I., Lelu, X., Grishunina, M., Rekhtman, G., …Harousseau J-L (2011 April 19) *Lancet Oncology* 12, 431-440 DOI:10.1016/S1470 - 2045(11)70081-X	Waters, G.E., Corrigan, P., Gatesman, M., & Smith, T.J. (2012 Nov 6) Journal of Oncology Practice doi: 10.1200/JOP.2012. 000662 retrieved from http://jop.ascopubs. org/content/early/20 12/11/06/JOP.2012. 000662?papetoc	Stilgenbauer, S., Zenz, T., Winkler, D., Buhler A., Schlenk, R.F., Groner, S., Busch R., Hensel, M., …Dohner, H. (2009 August 20) *Journal of Clinical Oncology* 27(24). 3994-4001 Doi:10.1200/JCO/2 008.21.1128
Data Base & Key Words	MedLine subcutaneous bortezomib, Phase 3 randomized	none	Medline Subcutaneous chemotherapy =3,424 Subcutaneous versus intravenous = 107 Administration procedure = 47 Alemtuzumab = 4 Bortezomib = 3 Trastuzumab = 1
Research Design	Phase III, open label, randomized	Retrospective medical record review	Phase II safety and efficacy of SC alemtuzumab
Level of Evidence	II	VI	III
Study Aim/Purpose	compare efficacy	Determine if	Evaluate safety,

	and safety of SC administration to standard IV administration	pegfilgrastrim is overprescribed in order to maintain quality and reduce costs	efficacy and clinical biomarker impact on outcomes
Methods/ Study Appraisal	2:1 randomization of 222 relapsed MM patients in 53 centers in 10 countries in Europe, Asia and SoAmerica. SC = 148 IV = 74.	Record review of 292 patients, 124 evaluated and 88 included for study. Descriptive statistics	109 patients enrolled (intent to treat) 103 evaluable. After IV dose escalation, SC administered 3 x week for up to 12 weeks, response evaluated every 4 weeks during treatment. Progression Free Survival (PFS) defined from first drug administration to disease progression, Overall Survival (OS) time from first drug to death, data censored for patients alive at last follow up. Time to Treatment failure (TTTF) from first drug to disease progression, next treatment or death. Kaplan Meier estimation of response duration, CI based on cumulative hazard. Survival distribution by log rank, Cox hazard regression for variables. Biologic markers by FISH.
Primary Outcomes/Measures /Results	non-inferiority in overall response rate as defined by	37% had no risk factors, 22% had one risk factor,	OR 39% (CR 4%, PR 30%) Median PFS 7.7 mos,

	retaining 60% of IV treatment effect. OR of 35% in both arms or greater for a 80% power and one sided alpha of 0.025. Time to event with Kaplan Mier, adverse events in all patients receiving at least one dose	46% of doses were avoidable. Cost to health care system was $712, 264 in 1 year	Median OS 19.1 mos. Toxicity profile similar to IV administration w mild injection site reactions
Author Conclusions/ Implications of Key Findings	OR after 4 and 8 cycles were identical in SC and IV arms. Adverse events were similar in both arms EXCEPT peripheral neuropathy was lower in SC than IV arm (5% vs 15%). PK/PD reflect similar AUC and Cmax 10 times longer with SC.	Approximately 50% of pegfilgastrim use did not follow NCCN or ASCO guidelines for use. Changing practice will reduce cost without harming patients	SC as effective and save as IV data in pt population. "SC should be preferred delivery route because of efficacy, convenience, improved adverse effect profile, and cost savings" p. 394
Strengths/limitations	Large multi-centered international study. Limitations, no U.S. sites. No patient reported outcomes to support benefit of SC from patient perspective	Retrospective chart review in one institution. Prescribers background not identified. Prescribers knowledge of guidelines not addressed	Clinical trial does not describe how or where SC administered
Source of Funding	Johnson & Johnson & Millennium Pharma		
Comments	Pivotal data supporting use of SC bortezomib as being effective with	Support PICO hypothesis that guidelines may not be followed even	Support PICO hypothesis of lack of data on how to administer SC

	less PN. Provides guidance on dilution and administration of SC formulation at 2.5mg/ml vs. 1:1 concentration. Administration sites only in abdomen and thigh.	when published. Adherence to guidelines can reduce costs without patient harm.	chemotherapy.

	16	17	18
Article Title	Knowledge, attitudes and practice behavior of oncology advanced practice nurses regarding advanced care planning for patients with cancer.	Subcutaneous administration of bortezomib: strategies to reduce injection site reactions	Using the Theory of Planned Behavior to predict nurses' intention to integrate research evidence into clinical decision-making.
Author, year, Journal	Zhou, G., Stoltzfus, J.C., Houldin, A.D., Marks, S.M., Swan B.A. (2010 November) Oncology Nursing Forum 37(6) p E400-E410 doi:10.1188/10.ONF.E400-E410	Kurtin, S., Knop, C.S. & Milliron, T. (2012, Nov/Dec) Journal of Advanced Practice Oncology 3(6) 406-410). *Journal of Advanced.*	Cote, F., Gagnon, J., Houme, P.K., Abdeljelil, A.B, Cagnon, M-P. (2012) Journal of Advanced Nursing 68(10)2289-2doi: 10.1111/j.1365-2648.2011.05922.x 298
Data Base & Key Words	ONS.org oncology nurses knowledge, practice, theory of planned behavior, valid practice survey	CINHAL subcutaneous bortezomib, nurse, administration, injection	CINHAL,Wiley Online; Theory of Planned Behavior, clinical decisions, apply evidence
Research Design	descriptive, cross sectional pilot	Opinion of author	predictive correlational study

	survey		
Level of Evidence	VI	VII	VI
Study Aim/Purpose	establish reliability, validity of web based survey on nurses knowledge, attitudes and practice, gain understanding of nurses knowledge and perceived barriers to practice	Review of SC Phase III study. Provide recommendation for SC administration technique	identify factors that influence nurses intention to adopt research into practice
Methods/ Study Appraisal	One author developed questions based on Theory of Planned behavior, using questions from other surveys, own clinical expertise and input from pracrice experts. Initial survey evaluated by 6 APNs, then sent to 300 APNs. 89 included in final analysis. After 30-40 days re-test survey sent to 89 respondents. 53 completed. Information loaded onto excell and coded then put into SAS for stats. Descriptive stats for demographics, Factor analysis for questions for test and re-test with Cornbach alpha for 5 factors to validate questionnaire."Resu lts revealed a sta-	n/a	questionnaires sent to nurses in one hospital. 336 questionnaires analyzed. Sample size was deemed adequate due to being 10 times higher than number of varialbes in the regression model. Institution was University setting with wide variety of settings. test-retest to validate questionnaire. Added two elements to TPB 1. past behavior and moral norm based on research done by authors. Descriptive statistics for mean and SD of scores,Pearsons correlations between outcome variable = intention and independent variables, multiple

	tistically significant correlation between the two surveys (r = 0.74, p < 0.0001), thereby providing preliminary evidence of test-retest reliability." (p E405)		linear regression to identify variables that predict nurses intention to use research in practice and between beliefs and intentions ,
Primary Outcomes/Measures /Results	Knowledge of advanced care planning: average score was 67% (33-92%). In general participants scored positively in attitudes about advanced care planning, only marginally positive in practice of incorporating advanced care planning. Barriers included family not ready, physicians reluctant, staff discomfort and time.	Recommendations: Site seletion Air sandwich	Intention predicts behavior and is based on attitudes (behavior beliefs), subjective norms (normative beliefs) and perceived control (control beliefs). Study suggests moral norms, perceived behavioral control, normative beliefs and past behaviors predict intention.
Author Conclusions/ Implications of Key Findings	Established construct validity of survey items assessing nurses knowledge of advanced care planning. Nurses moderately knowledgeable, and with positive attitudes. Study outcomes similar to literature for APNs and MDs	Need to develop practice guideline for SC bortezomib admniistration	Interventions to change behaviors need to be relevant to specific nursing practice and within the context of the practice. Behavior beliefs are not associated with intentions, subjective norms are least associated with behavior, moral norm and past behavior are

			most associated with intention and behavior
Strengths/limitations	small sample. Need 5 - 10 respondents per item & other analytics to validate survey	Very limited references utilized. References for air sandwich based on authors articles, not reference	small sample at one French Canadian institution
Source of Funding	Not indicated	Non indicated	Canadian Institutes of Health Research
Comments	Theory of Planned Behavior (TPB) valid for capstone in identifying perceptions and practice.	Supports need to develop SC injection guidelines. Need for more literature review	Strong article to support TPB in considering how nurses intent to use SC procedure. Reinforce nurses have important role in pt outcomes

	19	20	21
Article Title	Understanding adherence to hand hygiene recommendations: the Theory of Planned Behavior.	Clinicians' perceptions about use of computerized protocols: a multicenter study	Subcutaneous injection technique
Author, year, Journal	O'Boyle, C.A. Henley, S.J., Larson, E. (2001) Am J Infection Control 29; 352-260	Phansalkar, S., Weir, C.R., Morris, A.H. & Warner, H.R. (2008) *International Journal of Medical Informatics* 77. 184-193	Hunter, J (2008 January) *Nursing Standard*. 22(21) 41-44
Data Base & Key Words	CINHAL, Theory of Planned Behavior, nurse, adherence, procedures	MedLine Clinician perceptions = 405 Clinical protocols Decisions = 4	CINHAL subcutaneous injection, technique, drug administration
Research Design	longitudinal, observational	Semi structured interviews	none
Level of Evidence	VI	VI	VII
Study Aim/Purpose	Estimate adherence to hand washing recommendations; describe relationship between motivational factors, adherence and intensity of nursing activity to handwashing; test a model for adherence based on TPB	Develop and validate instrument for assessing clinicians perceptions about computerized protocols	Describe principles and technique for SC injections to update nurses' knowledge and skills
Methods/ Study Appraisal	120 nurses in critical care and post critical care unit s in 4 Minneapolis	Two stage: 1. semi structured interviews to identify	N/A

	hospitals. Nurses completed Hand washing Assessment Inventory, 2 weeks - 4 months later were observed in practice for adherence to guideline. Descriptive statistics and correlation statistics	themes 2. 2. Item generation for instrument; administer instrument needed 5 participants per item for power = sample size 175; factor analysis using Varimax rotation and scree plots;, scale construction Cornbachs alpha 0.70 or higher; construct and predictive validity Pearsons correlation	
Primary Outcomes/Measures /Results	1246 indications for handwashing, adherence 70% (61-74%) vs self reported adherence of 82% (71-89%) p=0.0001. High correlation between motivational factors and intentions, but not w observed adherence	82% response rate 240 clinicians (53 physicians, 132 nurses, 55 resp. therapists) 29 of 35 items retained	N/A
Author Conclusions/ Implications of Key Findings	Predicting handwashing adherence only occurred in the	Results provide a theorectical framework for assessing clinical	Step by step approach with rationale for the steps .

	context of specific nursing activities, and not related to motivational variables from the TPB.	perceptions about computerized protocols Strongest predictor: Beliefs regarding self-Efficacy. Literature review of barriers to guideline adherence: Knowledge, attitudes and external barriers. Making clinicians understand why protocols are important for patient outcomes will improve intentions for use.	
Strengths/limitations	Important study. Small sample size, self selected participants, no control for institutional confounding variables		Based on Nursing and Midwifery Council (UK).
Source of Funding	Georgetown University School of Nursing, 3M Enrich Program, Association of Professionals in Infection Control Research Association	NIH/NHLBI ARDS	
Comments	Must focus on individual in specific context and situation, rather than on theoretical situation. Perceived control and past behavior can predict	Based on Theory of Planned Behavior. Factors influencing perceptions: Beliefs regarding self-efficacy, environmental support, role	Does NOT discuss changing needle before administration, important for chemotherapy administration. Does provide

	intention and behavior. Project should address SC in context of clinic setting and past experiences	relevance, work importance, beliefs regarding control, attitude towards information quality, social pressure, culture and behavioral intention	rationale for sites including the arm for SC

	22	23	24
Article Title	Management guidelines for the use of aletuzumab in chronic lymphocytic leukemia	Likert scales and data analysis	Likert scales, levels of measurement and the "laws" of statistics
Author, year, Journal	Ostergorg, A., Foa, R., Bezares, R.F., Dearden, C., Dyer, M.J.S., Geisler, C., Lin, T.S., Montillo, M., van Oers, M.H.J., Wendtner, C-M., (2009) *Leukemia* 23. 1980-1988 doi: 10.1038/leu.2009.146	Allen, I.E., Seamona, C.A. (2007) *American Society for Quality.* Retrieved from http://asq.org/quality-progress/2007/07/statistics/likert-scales	Norman, G. (2010) *Advances in Health Science Education* 15. 625-632. Doi: 10.1007/s10459-010-922-y
Data Base & Key Words	MedLine Subcutaneous chemotherapy, administration	Medline Survey instruments, design, Likert scales, ANOVA, ordinal statistics methods	MedLine Likert scales, data analysis,
Research Design	Consensus review	None	none
Level of Evidence	VII	N/A	n/a
Study Aim/Purpose	Update 2004 recommendations based on clinical data	Overview of use of likert scales for rating surveys.	Challenges argument that parametric methods cannot be used with ordinal data from Likert scales. Review of assumptions of various statistical

			methods and the problems when assumptions are violated (p 627)
Methods/ Study Appraisal	Consensus of experts	N/A	n/a
Primary Outcomes/Measures /Results	1. monotherapy can be used as front line 2. describes suitable subgroups of elderly, 3. Treatment should continue fo r12 weeks, 4. Mandate CMV monitoring by PCR, 5. SC IS SAFE, EASY AND EQUALLY EFFICACIOUS. 6. Combination and consolidation should only be used in clinical trials.	Likert scales should NOT involve parametric statistics but should rely on the ORDINAL nature of the data (p 3). Scales with even numbers force rank by eliminating the neutral option.	Sample Sizes: Small sample size may be an issue that is unrelated to choice of statistical test. Too small sample challenges validity of being representative EXCEPT in qualitative studies. Small size may cause concern about distributions. HOWEVER the demarcation is 5 per group. Normal distribution is based on the normality of the distribution of the means, not the data. Therefore, ANOVA can be used. The Central Limit Theory indicates for samples greater than 5 or 10 per group, the means are approximately normally distributed.
Author Conclusions/ Implications of Key Findings	See above	Mean and standard deviation are INVALID for descriptive stats from an ordinal scale. NON-PARAMETRIC	"Parametric statistics can be used with Likert data, with small sample sizes, with unequal variances and with non-

		procedures based on rank, median or range, or distribution free methods such as tabulations, frequencies, contingency tables and chi squared statistics are appropriate. Kruskall Wallis can be used for analysis of variance.	normal distributions"
Strengths/limitations	Based on data on over 20,000 patients in clinical literature and NCCN guidelines. Limitation, expert panel opinion	Brief summary of likert scales and appropriate statistics	
Source of Funding	Conflict of interest: all authors had received honoraria from Bayer Pharm		
Comments	Although SC is deemed safe, effective and easy to give, there is no direction on how to administer the drug.	Useful for designing survey statistics	Provided clarification for validation of instrument articles that indicated 5 respondents per question was needed. Provided confusion about what statistics to use for survey.

	25	26	27
Article Title	Oncology nurses' perceptions about involving patients in the prevention of chemotherapy administration errors	Nursing –sensitive patient outcomes – description and framework	Qualitative data analysis for health services research: developing taxonomy, themes and theory
Author, year, Journal	Schwappach, D.L.B., Hochreuetener, M-A, Wernli, M., (2010 March) *Oncology Nursing Forum* 37(2) E84-E91 doi: 10.1188/10.ONF.E84-E91	Given, B., Beck, S., Etland, C., Holmes Gobel, B., Lamkin, L., & Marsee, V.D. (2005) Retrived from http://www.ons.org/Research/NursingSensitive/ Description	Bradley, E.H, Curry, L.A., & Devers, K.J. (2007) *Health Services Research* 42, 1758-1772 doi:10.1111/j.1475-6773.2006.008684.x
Data Base & Key Words	CINHAL, Academic SearchPremier, Eric, MedLine Mixed methods design nurs* = 1,217 And oncology nurs = 45 Perception chemotherapy= 20	ONS.org Nurse sensitive outcomes defined	MedLine, Academic Search Premier, CINHAL, Eric Qualitative data analysis health care= 7,842 Developing themes = 187
Research Design	Descriptive qualitative	White paper	None -
Level of Evidence	VI	VII	
Study Aim/Purpose	Explore nurses' attitudes, and experiences toward patients participation in preventing chemo administration errors	Provide definition for nursing sensitive outcomes in support of ONS commitment to quality and defining, measuring, and educating about nursing sensitive outcomes.	Provide practical strategies for analyzing qualitative data
Methods/ Study Appraisal	Focus group discussion of 11 oncology nurses	Expert panel consensus	"describe an approach to qualitative data

	from a large Swedish community hospital. 6 nurses from outpatient oncology , 5 from inpatient setting. First focus group discussed experiences with patients, attitudes, and nurses' role in engaging patients in safety. Second session with same group 10 weeks later themes were observations and experiences, anticipated or perceived changes in relationships, responses and interventions. Sessions recorded and transcribed verbatim, inductive theme-identification content-analysis framework applied to transcripts, categories abstracted, iterative process to organize into themes. Results and interpretations discussed with focus group participants for member checking		analysis that applies the principles of inductive reasoning while also employing predetermined code types to guide data analysis and interpretation. These code types (conceptual, relationship, perspective, participant characteristics, and setting codes) define a structure that is appropriate for generation of taxonomy, themes, and theory. Conceptual codes and subcodes facilitate the development of taxonomies"
Primary Outcomes/Measures /Results	Four major themes emerged Involving patients; challenges, strains and barriers; Responsibility for	Outcomes must address short, intermediate and long-term interventions. Measurements must	Describe ways to develop and measure codes. Generating results through taxonomy, themes and theory

	safety; and learning and reflecting on patient involvement. (p E86) May participants changed behavior between focus groups	take place at expected time of outcome from intervention. Outcomes indicators are patient focused and provider focused. Provider focused outcomes relate to provider proficiency, knowledge, skill, self-confidence, turnover, priority satisfaction and caregiver demands. Provider practice activities affect patient outcomes, including complications and provider effectiveness	
Author Conclusions/ Implications of Key Findings	"Active involvement of patients in safety requires cultural and organizational change" for success. "Chemotherapy administration procedures should be standardized to allow patients to detect deviations from routine." (p E89) TPB self-efficacy, behavioral control beliefs and perceived effectiveness of actions supported in article.	Classification of Oncology NSO: Symptom experience Functional status Safety Psychological distress Economic	"Qualitative research methodologies can generate rich information about health care including, but not limited to, patient preferences, medical decision making, culturally determined values and health beliefs, consumer satisfaction, health-seeking behaviors, and health disparities"
Strengths/limitation	Single institution	Provides exemplars	

s	with subjects from two very different practice environments and experiences. Small number. Did not describe saturation	for NSOs. White paper from small group of experts	
Source of Funding	Grant from Oncosuisse	ONS	Patrick and Catherine Weldon Donaghue Medical Research Foundation and the Claude D. Pepper Older Americans 1768 HSR: Health Services Research 42:4 (August 2007) Independence Center at Yale University
Comments	Key article to consider for qualitative component of project. Supports patient role in administration and importance of nurses consistency in administration procedures to ensure patient safety and confidence in nursing procedures.	Oncology nurses skills, knowledge and competence can influence SC administration and adverse events.	Provides guidance for developing themes from project interviews in order to describe nurse perceptions and decisions about administering SC chemo

	28	29	30
Article Title	Three approaches to qualitative content analysis	Mixed methods research methodologies	Methodological reporting in qualitative, quantitative and mixed methods health services research articles
Author, year, Journal	Hsieh, H.F., & Shannon, S.E. (2005) *Qualitative Health Research.* 15, 1277-1288 doi: 10.1177/1049732305276687	Terrell, S.R (2012 Janurary) *The Qualitative Report* 17(1) 254-280 http://www.nova.edu/ssss/QR/QR17-1/terrell.pdf	Wisdom, J.P., Cavalerie, M.A., Onwuegbuzie, A.J., & Green, C.A. (2012 April) *Health Services Research.* 47(2) 721-745 DOI: 10.1111/j.1475-6773.2011.01344.x
Data Base & Key Words	Same as previous	Eric Mixed methods, qualitative research, methodology	MedLine, Academic Search Premier, Eric Mixed methods, health care
Research Design	none	None	Literature summary
Level of Evidence			VII
Study Aim/Purpose	Delineate procedures to analyze three approaches for content analysis in qualitative design	Provide an overview of mixed methods in health care research	describes the frequency of mixed methods in published health services research and compares the presence of methodological components indicative of rigorous approaches across mixed methods, qualitative, and quantitative articles.
Methods/ Study Appraisal	"identified three distinct approaches: conventional, directed, and	Overview and background	Reviewed empirical articles from 4 journals and determined if

	summative. All three approaches are used to interpret text data from a predominately naturalistic paradigm" Utilized hypothetical data drawn from end-of-life care		qualitative, quantitative or mixed design. "Random samples of qualitative and quantitative articles were selected using a random number generator and did not adjust for journal or year assessed the frequency of key methodological components reported across articles, then compared rates by article type." (p 727) articles were coded, conducted a statistical analysis to determine whether there were trends over time in the prevalence of mixed methods articles.
Primary Outcomes/Measures /Results	"Key differences among conventional, directed, and summative approaches to content analysis center on how initial codes are developed. In a conventional content analysis, categories are derived from data during data	Four factors determine approach: Theoretical perspective: explicitly based on theory or implicitly indirectly based on theory Priority: Quantitative or qualitative primary Sequence of data collection: qualitative or quantitative first or	Research Question 1: How has the frequency of mixed methods studies published in health services journals changed over time? from 2003 through 2007. Only 2.85 percent (n = 47) of empirical articles were mixed methods studies; 6.18 percent (n = 102) of

	analysis. The researcher is usually able to gain a richer understanding of a phenomenon with this approach. With a directed content analysis, the researcher uses existing theory or prior research to develop the initial coding scheme prior to beginning to analyze the data. The summative approach to content analysis is fundamentally different from the prior two approaches. Rather than analyzing the data as a whole, the text is often approached as single words or in relation to particular content. An analysis of the patterns leads to an interpretation of the contextual meaning of specific terms or content"	none Point of data integration: At data analysis, at data interpretation or combination	empirical studies represented qualitative research. Quantitative research represented 90.98 percent (n = 1,502) of empirical articles. All journals combined published an average of 10.8 mixed method articles per year, or 3.27 percent of empirical articles annually. A quadratic trend was seen across the 5 years (R2 = 0.65), indicating a slight increase in mixed method articles in the first 2 years and then a decrease for the remaining years." (p 729) Research Question 2: How are mixed methods articles being used to elucidate health services research? Mixed methods articles were categorized into four overlapping categories: Articles on organizational and individual decision making processes (n = 18 studies) combined qualitative interviews with

			quantitative administrative data analyses to assess decision making about processes or impediments to processes (p 730)
Author Conclusions/ Implications of Key Findings	The question of whether a study needs to use a conventional, directed, or summative approach to content analysis can be answered by matching the specific research purpose and the state of science in the area of interest with the appropriate analysis technique" (p 1286)	"there are established rules for controlling validity in standard quantitative and qualitative research. These same rules must be followed when the methods are combined." (p 274)	Mixed methods provide more comprehensive picture than the two methods alone. However, care must be taken to use rigorous methodologies "Whatever frameworks are used, it is essential that authors who engage in mixed methods research studies meet two primary goals (developed by the American Educational Research Association 2006): Mixed methods researchers should (1) conduct and report research that is warranted or defensible in terms of documenting evidence, substantiating results, and validating conclusions; and (2) ensure that the

			conduct of research is transparent in terms of clarifying the logic underpinning the inquiry" (p 740)
Strengths/limitations			Review of over 1,000 articles. Literature review, not systematic review applied to only four journals
Source of Funding	. not indicated	Not indicated	National Institute on Drug Abuse
Comments	My assumption is a conventional content analysis would be appropriate for the project	Assume project will use implicit theoretical approach based indirectly on theory of planned behavior. Quantitative data will have priority over qualitative. Data will not be collected in sequence. Am not sure about data analysis	Mixed method useful for describing decision making process such as procedure for SC and site preference. However, following rigorous methods may be challenge a priori

	31	32	33
Article Title	A 4 mm needle reduces the risk of IM injections without increasing backflow to skin surface in lean diabetic children and adults	Evaluation of skin and adipose tissue thickness for optimal insulin injection.	Effect of injection duration on bruising associated with subcutaneous heparin: a quasi-experimental within-subject design
Author, year, Journal	Birkebaek, N. H., Solvig, J., Jorgensen, C., Smedegaard, J., & Christiansen, J. S. (2008, September). *Diabetes Care*, *31*(9), e65.	Akkus, O., Oguz, A., Uzunlulu, M., & Kizlgul, M. (2012). *Journal Diabetes Metabolism*, *3*(8). http://dx.doi.org/10.4171/2155-6156.1000216	Akpinar, R. B., & Celebioglu, A. (2008). *International journal of Nursing studies* 45, 812-817 .

	http://dx.doi.org/		
Data Base & Key Words	MedLine SC, needle size	MedLine SC, adipose thickness, needle size	CINHAL SC injection duration site reactions
Research Design	Descriptive intervention	Case control	Quasi-experimental
Level of Evidence	VI	IV	IV
Study Aim/Purpose	Measure distance from from skin to muscle in lean DM pts and use of 4 mm needle to reduce frequency of IM compared to 6 mm	Compare skin and SC adipose tissue between health controls and DM pts and associates BMI and waist circumference	Compare the effects of 3 SC injection durations on bruising
Methods/ Study Appraisal	21 lean children / 32 lean adults		36 subjects received 3 injections from same investigator using 3 techniques descriptive statistics
Primary Outcomes/Measures /Results	No distance < 4 mm from skin to fascia in abdomen or thigh.	Highest skin and adipose tissue thickiness associated with higher waist circumference and BMI	30 second injection and waiting 10 seconds before withdrawing after 10 second injection resulted in less bruising than 10 second
Author Conclusions/ Implications of Key Findings	4 mm needles reduce risk of IM can inject without elevated skin fold using 90 degree angle in thigh Use 45 degree angle and skin fold with 6 mm needle in thin pts	Largest skin thickness 3.92 mm Short needles appropriate in pts w > BMI Average skin thickness Arm: 1.95 mm Abdomen 2.35 mm Thigh 1.97 mm SC adipose tissue Arm 6.42 mm Absomen 15.73 Thigh 7.92	Slow injection causes low pressure, less trauma. Waiting to withdraw needle may allow absorption.
Strengths/limitations	Small study, abstract summary		
Source of Funding	Novo Nordisk		
Comments	Supports use of	Use of needles >	Evidence of nursing

	needles < 5mm for SC	6mm without pinching skin or with 90 degree angle may = IM	practice to decrease bruising 30 sec injection OR 10 sec injection leaving needle in for 10 sec

	34	35	36
Article Title	A study on the effect of the duration of subcutaneous heparin injection on bruising and pain	Does needle size matter?	Skin and subcutaneous adipose layer thickness in adults with diabetes at sites used for insulin injections: implications for needle length recommendations
Author, year, Journal	Zaybak, A., & Khorshid, L. (2007 Journal of Clinical Nursing 378-385 doi.org/10.111/j.1365-2702.2006.01922	Gill, H. S., & Prausnitz, M. R. (2007, September). *Journal of Diabetes Science adn Technology*, *1*(5), 725-729.	Gibney, M. A., Arce, C. H., Bryon, K. J., & Hirsch, L. J. (2010). *Current Medical Research & Opinion*, *26*(6), 1519-1530.
Data Base & Key Words	CINHAL SC, pain, bruising, duration,	CINHAL SC needle size, needle gauge, pain, needle insertion	
Research Design	Quasi experimental within patient	Review article	
Level of Evidence	IV	VII	
Study Aim/Purpose	Determine effect of injection duration on bruising and pain	Review development of smaller needles	
Methods/ Study Appraisal	50 pts SC heparin administered 10 seconds and 30 seconds Visual Analog Scale to measure pain		
Primary	10 second injection	Likelihood of pain	

Outcomes/Measures /Results	= 64% bruising 30 second = 42% pain significantly lower with 30 sec vs 10 sec	and bruising decreases with higher gauge needles Mechanics of needle insertion, force of insertion also impacts pain	
Author Conclusions/ Implications of Key Findings	Duration has effect on bruising and pain		
Strengths/limitations			
Source of Funding			
Comments	Extend injection duration	Needle tip sharpness, lubrication can reduce the force of insertion Suggests rationale for needle change after drawing up medicatioin	

	37	38	39
Article Title	Performing subcutaneous injections: a literature review.	Adherence to therapy: Using an evidence-based protocol	Evaluation of bruises and areas of induration after two techniques of subcutaneous heparin injection
Author, year, Journal	Annersen, M., & Wilmann, A. (2005, Third Quarter). *Worldviews on Evidence-Based Nursing*, 122-130.	Moore, L. A., Kaufman, M. D., Algozzine, R., Irish, N., Martin, M., & Posey, C. R. (2007, November/December). *Rehabilitation Nursing*, *32*(6), 227-232.	Wooldridge, J. B., & Jackson, J. G. (1988, September). Heart & Lung 17(5) 476-482
Data Base & Key Words			
Research Design	Systematic Review		

Level of Evidence	I		
Study Aim/Purpose			
Methods/ Study Appraisal			
Primary Outcomes/Measures /Results			
Author Conclusions/ Implications of Key Findings			
Strengths/limitations			
Source of Funding			
Comments	Most significant reference: Need to describe what nurses are doing	Evidence for air sandwich and dry needle	Change needle and use of air bubble

	40	41	42
Article Title	Management strategies for improving the tolerability of interferons in the treatment of multiple sclerosis.	Randomized clinical trial to assesspain and brising in medicines administered by means of subcutaneous and intramuscular needle injections: is it necessary to have needles changed?	Effects of changing needles prior to administering heparin subcuatneously.
Author, year, Journal	Girouard, N., & Theoret, G. (2008). Canadian Journal of Neuroscience Nursing 30(4) 18-24	Lamblet, L. C., Meira, E. S., Ferreira, B. C., & Mathucchi, S. D. (2011, September/October). *Latino-American Enfermagen*, *19*(5), 1063-1071.	Kingman, L. (2000, Jan-Feb). *Heart Lung*, *29*(1), 70-75.
Data Base & Key Words			
Research Design			
Level of Evidence			
Study Aim/Purpose			
Methods/ Study			

Appraisal			
Primary Outcomes/Measures /Results			
Author Conclusions/ Implications of Key Findings			
Strengths/limitations			
Source of Funding			
Comments	Site rotations and needle change	RCT no advantage to needle change	No decrease in bruising w needle change

	43	44	45
Article Title	Patient education: Giving a subcutaneous injection.	New injection recommendations for patients with diabetes.	Higher incidence of injection site reactions after subcutaneous bortezomig administration on the thigh compared with the abdomen
Author, year, Journal	National Institutes of Health. (2012). www.cc.nih.gov/ccc/patient_education/pepubs/subq.pdf	Frid, A., Hirsch, L., Gaspar, R., Hicks, D., Kreugel, G., Liersch, J.,...Strauss, K. (2010). *Diabetes & Metabolism*, *36*, S3-S18.	Kaminura, T., Miyamoto, T., Yokota, N., Takashima, S., Chong, Y., Ito, Y., & Akashi, K. (2012). European J Heamatology http://dx.doi.org/10.1111/ejh.12055
Data Base & Key Words			
Research Design		Systematic review	
Level of Evidence		I	
Study Aim/Purpose			
Methods/ Study Appraisal			

Primary Outcomes/Measures /Results			
Author Conclusions/ Implications of Key Findings			
Strengths/limitations			
Source of Funding			
Comments	5/8 inch needle	Short needle, change needle purge	

	46	47	48
Article Title	Pain following controlled cutaneous insertion of needles with different diameter	Evidence-based practice guidelines: A survey of subcutaneous dexamethasone administration.	New injection recommendations for patients with diabetes.
Author, year, Journal	Arendt-Neilsen, L., Egekvist, H., & Bjerring, P. (2006, March/June). *Somatosensory and Motor Research*, *23*(1/2), 37-43.	Walker, J., Lane, P., & McKenzie, C. (2010). *International Journal of Palliative Nursing*, *16*(10), 494-498	Frid, A., Hirsch, L., Gaspar, R., Hicks, D., Kreugel, G., Liersch, J.,...Strauss, K. (2010) *Diabetes & Metabolism*, *36*, S3-S18.
Data Base & Key Words			
Research Design			Systematic review
Level of Evidence			I
Study Aim/Purpose			
Methods/ Study Appraisal			
Primary Outcomes/Measures /Results	Supports use of <5 mm needles		
Author Conclusions/ Implications of Key Findings			
Strengths/limitations			
Source of Funding		Supports need for standard SC admin guidelines in palliative care	Recommends needle change and purge needle
Comments			

	49	50
Article Title	Intramuscular injections: To swab or not to swab	WHO best practices for injections and related procedures toolkit.
Author, year, Journal	Cocoman, A., & Murray, J. (2010) Retrieved from http://www.inmo.ie/MagazineArticle/PrintArticle/6696	World Health Organization. (2010).
Data Base & Key Words		
Research Design		
Level of Evidence		
Study Aim/Purpose		
Methods/ Study Appraisal		
Primary Outcomes/Measures /Results		
Author Conclusions/ Implications of Key Findings		
Strengths/limitations		
Source of Funding	ETOH irritating, not needed, if used, must dry	Does not recommend ETOH for SC injections Water cleanse
Comments		

Appendix B

The Subcutaneous Administration of Bortezomib Guideline Project Logic Model

Will the development of a standardized guideline for nurses who administer subcutaneous bortezomib in community oncology practice settings lead to standardized practice when administering this chemotherapy agent?

RESOURCES	ACTIVITIES	OUTPUTS	SHORT & LONG-TERM OUTCOMES	IMPACT
In order to accomplish our set of activities we will need the following: *A value proposition proposal for stakeholder buy in* *Identification and acceptance of cross functional project team (internal)* *The Subcutaneous Administration of bortezomib Survey (SABS)* *Evaluate and contact potential study sites* *Identify and select clinical sites agreeing to participate in project*	*In order to address our problem or asset we will accomplish the following activities:* *Champion project proposal through required committees* *Submit and activate SOW for funding* *Contract with clinics capable of participating* *Obtain 2 way CDA with site(s)* *Develop SABS* *Submit SABS for content validity review and amend as needed* *Submit SABS to*	*We expect that once accomplished these activities will produce the following evidence of service delivery:* *RNs will utilize standard guideline for administering SC bortezomib relative to:* *Site selection* *Needle size* *Changing needles before administering injection* *Use of air sandwich technique* *Duration of injection*	*We expect that if accomplished these activities will lead to the following changes in 1-3 then 4-6 years:* *1 – 3 years: Standard guidelines for SC bortezomib will be incorporated into the clinical literature as a framework for standardizing techniques in community and academic sites. Hypothesis generating for pharmacokinetic study to evaluate PK of injections in arm ensuring safe, effective site selection* *4 – 6 years: Guidelines and*	*We expect that if accomplished these activities will lead to the following changes in 7-10 years:* *Patients staying on effective therapy with reduced adverse events will obtain maximum benefit including responses and survival.* *Produce exemplar for pharmaceutical companies to describe how drugs are administered during clinical trials, in addition to standard outcomes data. Increased*

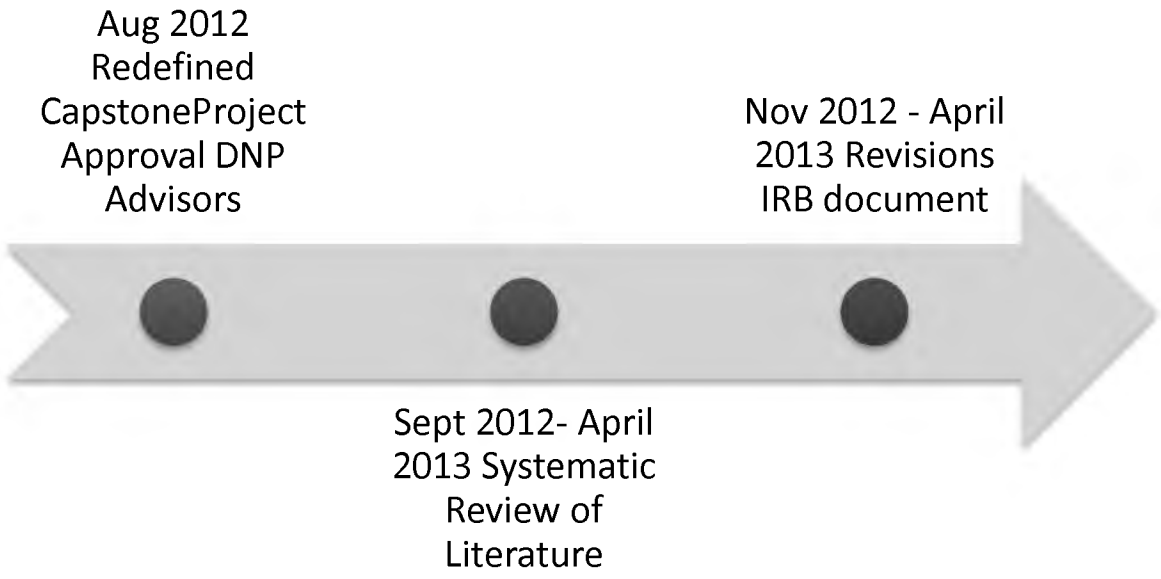
Budget for study *Mechanism for collecting data from survey instruments* *Approval from Global Medical Affairs, legal and compliance* *IRB exemption Regis and Clinical Network* *Method to identify nurses meeting eligibility criterion* *Mechanism to present, explain and encourage participation*	*legal* *Obtain IRB exemptions* *Reformat SABS to web based survey format* *Educate site coordinator, explain and provide cover letter, confidentiality agreement and project process information* *Establish weekly contact with site coordinator* *Receive Excell spreadsheets with aggregated data* *Review spreadsheet for missing data* *Submit spreadsheets to biostatisticians, indicating missing data points* *Perform content analysis on qualitative responses* *Collaborate with clinical advisor to identify themes* *Analyze data*		*project will become hypothesis generating for clinical studies to validate the guideline results in decreased injection site reactions and pain. Supports nurse sensitive patient outcomes of managing adverse events*	*inclusion of nursing outcomes studies incorporated into clinical trials for drug development Improved patient outcomes as nursing standards are included and described in clinical trials.*

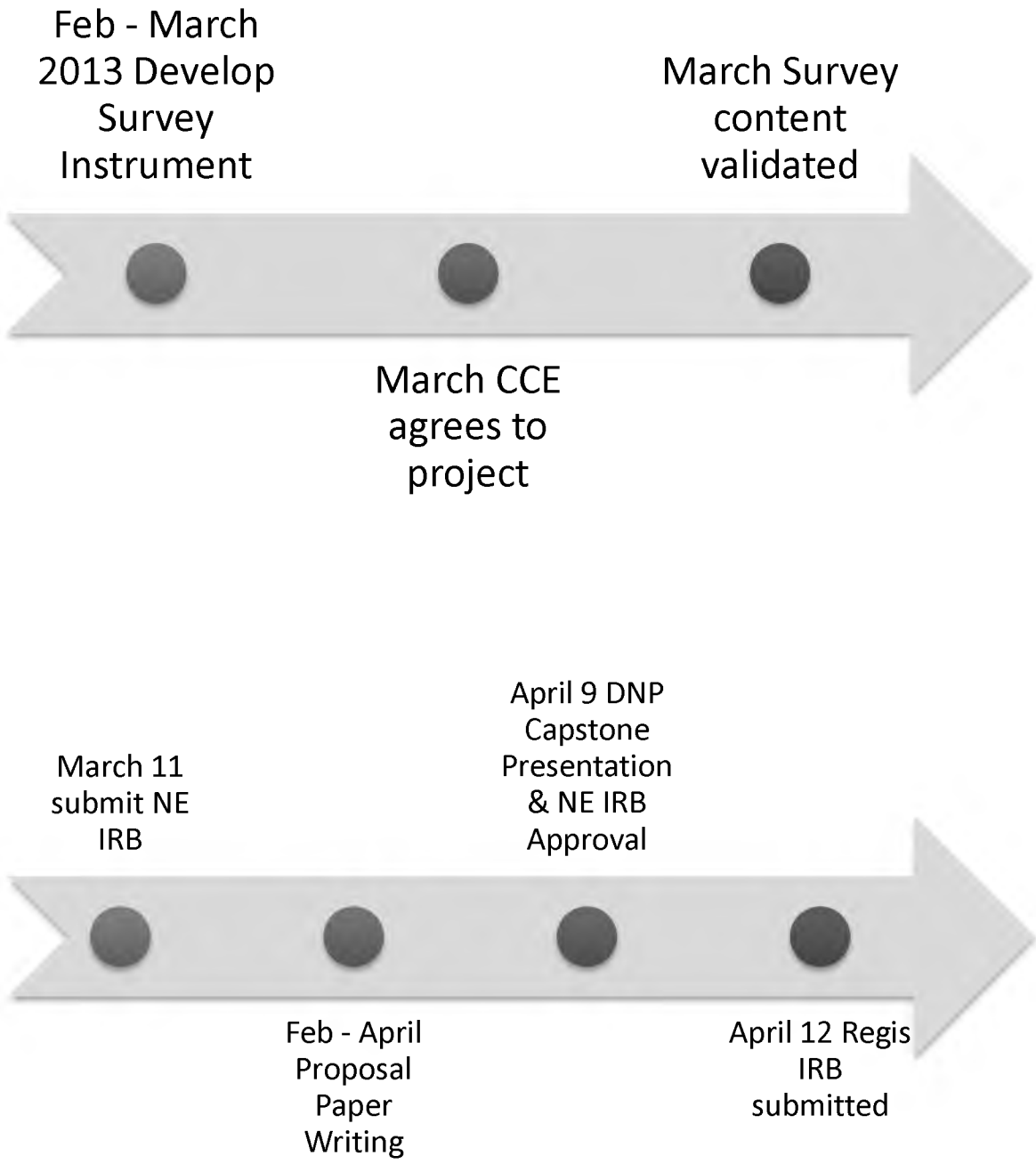
	Present descriptive data and summary of qualitative themes to advisors *Formulate interpretations of data for each variable* *Compare/ contrast data to clinical literature* *Construct guidelines for each pertinent variable based on clinical literature and survey responses* *Draft practice guideline for SC administration of bortezomib* *Present data, interpretations and draft guideline to participating network clinical coordinators for review, discussion and revisions* *Develop final guideline (2 additional drafts)* *Present, explain and*			

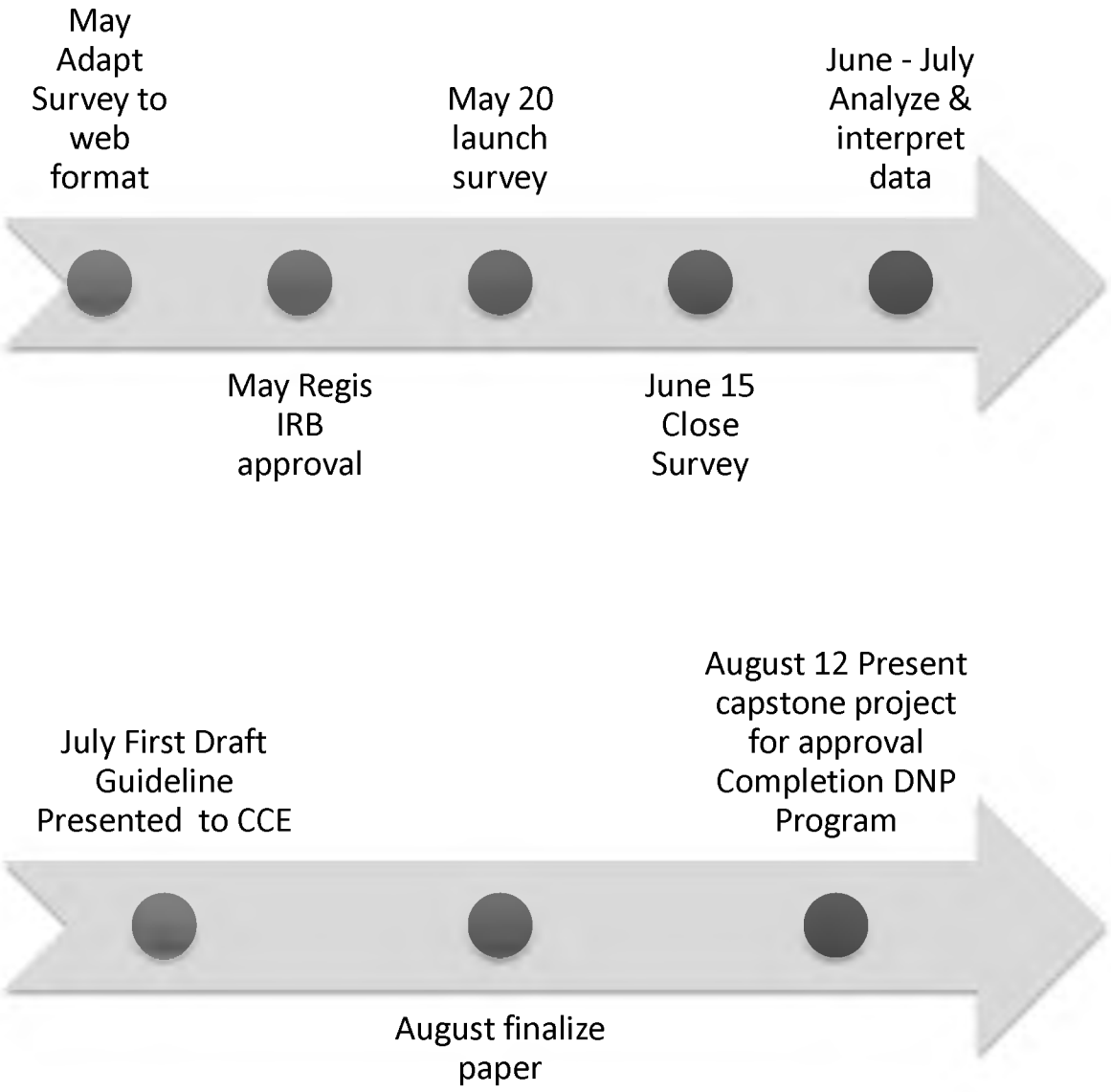
	instruct final guideline to network clinical coordinators *Engage in sessions to recommend methods for implementing practice improvement guideline and monitor acceptance* *Follow up with clinical coordinators in 3 months to evaluate implementation and acceptance of practice guideline*			

Appendix C

Time Frame for Completion by August 2013




Feb - March 2013 Develop Survey Instrument
March Survey content validated
March CCE agrees to project
March 11 submit NE IRB
April 9 DNP Capstone Presentation & NE IRB Approval
Feb - April Proposal Paper Writing
April 12 Regis IRB submitted


May
Adapt
Survey to
web
format
May Regis
IRB
approval
May 20
launch
survey
June 15
Close
Survey
June - July
Analyze &
interpret
data
July First Draft
Guideline
Presented to CCE
August finalize
paper
August 12 Present
capstone project
for approval
Completion DNP
Program

Appendix D

Budget and Resources

Estimated budget for the project $23,000.

Direct Costs:

- New England IRB $600
- Survey Monkey subscriptions $204
- Administrative support to convert survey to electronic format $300

Indirect costs:

Salary for project investigator time over 20 weeks (March through June 2013) for approximately 15 hours per week (300 hours) at $73 per hour. Activities included:

- Draft survey
- Collaborate with content experts and redraft survey
- Prepare IRB documents for New England and Regis University IRB
- Consult with CCE on implementing survey
- Supervise administrative assistant to translate paper document to web format
- Weekly phone conversations with CCE manager of research
- Access final aggregated survey
- Evaluate survey for completeness
- Consult with statisticians to run SAS
- Analyze quantitative responses
- Analyze qualitative responses for themes
- Compare survey results to literature
- Develop draft guideline

- Review results and draft guideline with CCE
- Develop final guideline
- Discuss final guideline with CCE for implementation
- Develop and present summary of results to Millennium Global Medical Affairs

Appendix E

Subcutaneous Administration of Bortezomib Survey

Sponsor of Survey: Jasmine Martin, MSN, APRN
303-973-5768

Purpose: The purpose of this survey is to understand oncology nurses practice, opinion and perceptions about administering subcutaneous bortezomib at Cancer Clinics of Excellence. This survey is being done in partial fulfillment for a Doctor of Nursing program at Regis University. The information that is gained from your participation will be used to contribute to oncology nursing practice and provide information about content needed for developing a standardized guideline for administering subcutaneous bortezomib at Cancer Clinics of Excellence. This project may improve patient care and quality outcomes by reducing injection site reactions and pain for patients receiving subcutaneous bortezomib. Information from the project may be used in future presentations or publications.

All of your responses will be **anonymous** and **confidential**; no identifying information will be linked to you in any way.

Participation: You have been selected to participate in this survey because you have administered subcutaneous bortezomib in 2012. Your participation is voluntary. By completing this survey you consent to participate. If you choose not to participate, simply do not complete the survey. There is no consequence to your position or practice for not participating; you will not be compensated for your participation.

Directions:

- This survey will take approximately 20 minutes to complete.
- Please answer each question as completely as possible **based on your own experience with, and opinion or perception about administering subcutaneous bortezomib.**
- Most questions are multiple choices.
- Some questions request a brief, concise explanation for your response.
- There are no right or wrong answers; the purpose is to describe your personal practice, opinion and perception.

Thank you again for your participation in this survey.

Section I

Questions 1 – 6 ask about your oncology and nursing experience. All information will be aggregate; no information can be linked directly to the participants.

1. **Highest nursing degree I have earned is:**
    a. ADN
    b. BSN
    c. MSN
    d. MSN, NP
    e. MSN, CNS
    f. DNP

g. PhD Nursing
Other degree – please describe

2. **I am certified by the Oncology Nursing Certification Corporation (ONCC) or other nursing certification organization as: (check all that apply)**
   a. I am not certified by a credentialing organization
   b. OCN
   c. AOCNP
   d. AOCNS
   e. AOCN
   f. CPHON
   g. CBCN
   h. APRN – BC
   Other – please describe
3. **I have been practicing oncology nursing for**
   a. Less than 1 year
   b. 1-5 years
   c. 6 – 10 years
   d. 11- 20 years
   e. > 20 years

4. **I have been in nursing for**
   a. Less than 1 year
   b. 1-5 years
   c. 6 – 10 years
   d. 11- 20 years
   e. > 20 years

5. **Gender**
   a. Male
   b. Female

6. **My age is**
   a. Less than 21 years old
   b. 21-29 years old
   c. 30-39 years old
   d. 40-49 years old
   e. 50-59 years old
   f. 60 or older

Section II
Questions 7 – 28 ask about your personal *experience administering subcutaneous* bortezomib in the clinic. Please choose the answer that most closely describes *your experience* and explain your answer when requested.

7. Who is responsible for ordering bortezomib will be administered by the subcutaneous route? (Circle all that apply)
   a. Oncologist

b. Nurse Practitioner
c. Clinical Pharmacist

8. **Are you able to provide input into the decision regarding route of administration for delivering bortezomib to patients?**
   a. Always
   b. Sometimes
   c. Rarely
   d. Never

9. **To approximately how many patients do you administer subcutaneous bortezomib in a month?**
   a. 1 – 5
   b. 6 – 10
   c. More than 10

10. **To approximately how many patients do you administer intravenous bortezomib in a month?**
    a. 1 – 5
    b. 6-10
    c. More than 10

11. **How often are you responsible for the reconstitution/preparation of bortezomib?**
    a. Always
    b. Sometimes
    c. Rarely
    d. Never

12. **What anatomical sites do you use to administer subcutaneous bortezomib? (circle all that apply)**
    a. Abdomen
    b. Thigh
    c. Arm

13. **What site do you prefer to administer subcutaneous injections of bortezomib?**
    a. Abdomen
    b. Thigh
    c. Arm

14. **Why do you prefer the above site for injections?**

15. **Do you document site of injection?**
    a. Yes
    b. No

16. **How do you rotate SC injection sites?**

a. **Rotate to different anatomical sites (ie abdomen to thigh and thigh to abdomen)**
b. **Rotate injection sites within same anatomical area (ie rotate injections on the abdomen)**
c. **Rotate per nurses discretion (no designated pattern of injection site rotation)**
d. **No rotation of injection site, use site previously used**

17. Do you have an anatomical map in the patient chart to guide site rotation for each injection?
a. **Yes**
b. **No**

18. What site preparation do you use prior to administering the injection? (check all that apply)
a. Ice
b. Alcohol prep
c. EMLA cream
d. None
e. Other – please describe
f.

19. What size needle do you use for administering the subcutaneous injection?
a. 25 gauge needle that is 5/8 inch or shorter
b. 25 gauge needle that is longer than ½ inch in length
c. What ever needle the reconstituted drug comes with
d. Unsure

20. Do you routinely put a new needle on the syringe before administering the injection?
a. Yes
b. No

21. What angle do you use to administer the SC injection when using a 4 – 6 mm needle?
a. 45 degree
b. 90 degree

22. What angle do you use to administer the SC injection when using a >6 mm needle?
a. 45 degree
b. 90 degree

23. What do you do to inject into adipose tissue
a. Pinch the skin to a tent
b. Administer in fatty areas
c. Other
Please describe

24. Prior to injecting the drug do you
a. Expel air from the syringe

b. Pull air into the syringe
Please explain your rationale

25. Approximately how long does it take to administer each ml of subcutaneous bortezomib injection?

a. 3 – 5 seconds
b. 5 – 10 seconds
c. 10-30 seconds
d. More than 30 seconds
e. It depends on (explain)
f.

26. Do you routinely apply pressure to the site after the injection?

a. **Yes**
b. **No**

27. Does this oncology clinic have a standard guideline for administering subcutaneous bortezomib?

a. Yes
b. No
c. Unsure

28. The technique you use to inject subcutaneous bortezomib is based on (check all that apply):

a. My clinical experience
b. Clinical practice guidelines
c. Demonstration from colleagues
d. In-service or education seminar – please describe
e. Other – please describe

Section III
Questions 29 – 38 explore your *opinion* about administering subcutaneous bortezomib. Please choose the answer that most closely describes *your opinion* and explain your answer when requested.

29. Overall, is there a difference in the time it takes to administer subcutaneous versus intravenous bortezomib?

a. Much less time for subcutaneous
b. Somewhat less time for subcutaneous
c. Somewhat more time for subcutaneous
d. Much more time for subcutaneous
Please explain your answer

30. Overall, in your clinical opinion, is the subcutaneous route more or less convenient for nurses to administer than the intravenous route?

a. Subcutaneous is much more convenient
b. Subcutaneous is somewhat more convenient
c. Subcutaneous is somewhat less convenient

d. Subcutaneous is much less convenient

Please explain your answer

31. For patients who have received both intravenous and subcutaneous bortizomib, what route of administration do you believe patients prefer?

a. Prefer intravenous
b. Prefer subcutaneous
c. No preference

Please explain you answer

32. For patients receiving subcutaneous bortezomib, what site do you believe they generally prefer for the injections?

a. Abdomen
b. Thigh
c. Arm

33. Why do you believe patients generally prefer the above site for injections?

34. In your clinical opinion, do privacy concerns for patients receiving the injection influence subcutaneous injection site selection?

a. Yes
b. No
c. Please explain

35. What is the layout in your facility where subcutaneous injections are primarily given?

a. Private examination room
b. Open infusion suite with chairs
c. Open infusion suite with curtains around each chair
d. Nurses station
e. Other: please describe

36. Your clinical decision determines where to administer subcutaneous bortezomib injections

a. Completely agree
b. Somewhat agree
c. Somewhat disagree
d. Disagree completely

37. **The patient's preference determines where to administer subcutaneous bortezomib injections**

a. Completely agree
b. Somewhat agree
c. Somewhat disagree
d. Disagree completely

38. **If your technique for administering subcutaneous bortezomib differs from a practice guideline developed by Cancer Clinics of Excellence (CCE), you would change your technique to be consistent with the guidelines**
    a. Completely agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Disagree completely
    Please explain your answer

Section IV

Questions 39-44 are about your practice setting and your *perception* of the practice. Please choose the answer that most closely describes *your perceptions*. Because these questions explore your perceptions, please briefly explain your answers.

39. **All the nurses in this clinic use the same technique to administer subcutaneous bortezomib.**
    a. Completely agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Completely disagree
    Please explain your answer
40. **It is important to patients that all nurses follow the same technique when administering subcutaneous bortezomib.**
    a. Completely agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Completely disagree
    Please explain your answer

41. **Patients have noticed and commented that there are differences in techniques between nurses administering subcutaneous bortezomib.**
    a. Completely agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Completely disagree
    Please explain your answer
42. **It is important to the physician(s) that all nurses follow the same technique when administering subcutaneous bortezomib.**
    a. Completely agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Completely disagree
    Please explain your answer

43. **A practice guideline is important in this clinic to standardize how and where subcutaneous bortezomib will be administered.**

a. Completely agree
b. Somewhat agree
c. Somewhat disagree
d. Disagree completely

Please explain your answer

44. **If other nurses in this clinic are using techniques for administering subcutaneous bortezomib that differed from a CCE practice guideline, they would change their techniques to be consistent with the guidelines.**
    a. Completely agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Disagree completely

    Please explain your answer

Thank you again for your time and consideration to these questions.

Appendix F

Institutional Board Approvals and CITI Certificate

Approval of Submitted Proposal...
Institutional Review Board
This message was sent with High importance.
You forwarded this message on 5/16/2013 5:01 PM.
Sent:Thursday, May 16, 2013 3:36 PM
To: Martin, Jasmine R
Cc: Ernst, Diane M; Gilbert, Marcia a.; Institutional Review Board
Dear Ms. Martin…

The Institutional Review Board has thoroughly reviewed your protocol submission, supplementary materials, and site approval letter for your study entitled *Subcutaneous Administration of Bortezomib Practice Improvement Project.* I am pleased to inform you that the study has been approved as an Exempt proposal per Category # 2. You may begin study implementation and data collection upon receipt of this email. An official letter of approval for your study files will be forthcoming. We wish you success with your planned investigation!

Patsy McGuire Cullen, PhD, CPNP

Chair, Institutional Review Board

(303) 964-5132

pcullen@regis.edu

irb@regis.edu

For IRB – Summary Paragraph outlining an Evidence Based Practice Project
This project is an evidence-based practice (EBP) project in which a quality improvement plan, program evaluation, or simple educational or standard of care intervention (with a pre-test and post-test evaluation) will be completed. The project will be internal to an agency and inform the agency of issues in health care quality, cost, and satisfaction. The results from this project are not meant to generate new knowledge or be generalizable across settings but address a specific population, at a specific time, in a specific agency. These projects translate and apply the science of nursing to the health care field. EBP Projects utilize the acronym “PICO” rather than using a

hypothesis. PICO stands for: P – Population or disease; I – Intervention or Issue of Interest; C – Comparison or Current Practice; and O – Outcome. Some PICO projects will not include the "C." Each PICO can be written in the form of a question and will use this template to write the question: *In ___Oncology nurses in the Cancer Clinics of Excellence Network who have administered Subcutatnous bortezomib_____ (P), how does __techniques in a practice guideline_____ (I) compared to/with ___current practice as described from survey results_____ (C) affect/influence/predict ___adoption of a practice guideline_____ (O)?* (Melnyk & Fineout-Overholt, 2011, p. 31)

April 9, 2013
Jasmine Martin, MSN
Cancer Clinics of Excellence
5750 DTC Parkway Suite 101
Greenwood Village, CO
RE: NEIRB# 13-131: "Subcutaneous Administration of Bortexomib: A Nurse Survey"
Dear Ms. Martin:
This is to inform you that New England Institutional Review Board (NEIRB) has reviewed the claim of exemption for the above-captioned project. NEIRB has determined that this research activity, as conducted at the above location, is exempt from NEIRB review, under the following categories:
☐ Research involving the use of survey procedures or interview procedures or observation of public behavior for which subjects cannot be identified, OR release of the information would not be harmful to the subject.

Amendments and or changes to the research must be submitted to NEIRB for review, as changes may affect the exempt status.
Please call me if you have any questions about the terms of this determination.

_____
Erin Brower, MS, CIP
Director
Copy: NEIRB Chair
Traci Kalberer, Cancer Clinics of Excellence
85 Wells Avenue . Suite 107 . Newton, MA 02459 Phone: 617-243-3924 . Fax: 617-969-

1310 www.neirb.com

CITI Collaborative Institutional Training Initiative
Human Research Curriculum Completion Report
Printed on 7/24/2013
Learner: Jasmine Martin (username: jasminemartin)
Institution: Regis University
Contact Information1921 W Sanibel Ct
Littleton, CO 80120
Department: Nursing, DNP program
Phone: 303-973-5768
Email: jasminemartin@comcast.net
Social Behavioral Research Investigators and Key Personnel:
Stage 1. Basic Course Passed on 08/04/12 (Ref # 8400736)
Required Modules
Date
Completed
Introduction 08/04/12 no quiz
History and Ethical Principles - SBE 08/04/12 4/5 (80%)
The Regulations - SBE 08/04/12 5/5 (100%)
Assessing Risk - SBE 08/04/12 5/5 (100%)
Informed Consent - SBE 08/04/12 5/5 (100%)
Privacy and Confidentiality - SBE 08/04/12 4/5 (80%)
Regis University 08/04/12 no quiz
For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.
Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Appendix G

Permissions and Agency Letters of Support

RE: Request for permission to use graphics in a CDA publication
CaroleAnn Maloney [caroleann_maloney@bd.com]
You replied on 7/12/2013 8:25 AM.
Sent: Wednesday, July 10, 2013 11:15 AM
To: Martin, Jasmine R
Attachments: DERMEPLI_SER45_Office.jpg (199 KB); PLI-INCORRECT_Office.jpg (120 KB); PLI-CORRECT_Office.jpg (106 KB); PN_sizes_Press.jpg (2 MB); INJ_ZONESHF_Office.jpg (142 KB); FIT figure 10 (skin thickn~1.JPG (48 KB); site rotation scheme FIT.PNG (261 KB); BD4181_FIT_CANADA_pg14_ILL.jpg (238 KB)
Yes, you have our permission to use these photos with the following credit: Photos courtesy of Forum for Injection Technique (FIT) Canada 2013

See attached the requested photos.

Good luck!

CaroleAnn Maloney, RD, CDE
Clinical Education Specialist

BD Medical - Diabetes Care
2100 Derry Rd. W, Suite 100 Mississauga, ON L5N 0B3
Office: 905-288-6246 Mobile: 905-965-0838 Fax: 905-288-6006
Email: CaroleAnn_Maloney@bd.com Website: www.BD.com

RE: Request to use TPB diagram
Icek Aizen [aizen@psych.umass.edu]
Sent:Wednesday, December 05, 2012 7:03 AM
To: Martin, Jasmine R
Dear Jasmine Martin,

The theory of planned behavior is in the public domain. No permission is needed to use the theory in research, to construct a TPB questionnaire, or to include an ORIGINAL drawing of the model in a thesis, dissertation, presentation, poster, article, or book. If you would like to reproduce a published drawing of the model, you need to get permission from the publisher who holds the copyright. You may use the drawing on my website

(http://www.people.umass.edu/aizen/tpb.diag.html) for non-commercial purposes so long as you retain the copyright notice.

Best regards,

Icek Ajzen, Professor Emeritus
University of Massachusetts
Amherst, MA 01003
http://www.people.umass.edu/aizen

RE: Request regarding The Neutropenia Oncology Nurses Survey
Anita Nirenberg [anirenbe@hunter.cuny.edu]
You forwarded this message on 12/11/2012 11:17 AM.
Sent: Tuesday, December 11, 2012 9:43 AM
To: Martin, Jasmine R
Attachments: NONS survey.doc (57 KB)[Open as Web Page]
Hi Jasmine,
So, here it comes.
I would like to see how you're adapting the instrument and that you will give proper acknowledgement (I know that you will).
Take good care of my "baby".
Good luck
Anita
Anita Nirenberg DNSc, RN, PNP, BC, AOCNP
William Randolph Hearst Professor of Clinical Nursing
Hunter-Bellevue School of Nursing, Hunter College
City University of New York
425 East 25th St
New York, NY. 10010
212 481-4359: email:anirenbe@hunter.cuny.edu

CANCER CLINICS OF EXCELLENCE

Jasmine Martin, MSN, APRN
1921 W Sanibel Ct.
Littleton, CO 80120

May 2, 2013

Dear Jasmine,

Cancer Clinics of Excellence (CCE) is a network of twenty-two community based Medical Oncology practices from fourteen unique states. The mission of our network is to provide evidence based, personalized care to patients in their community. Our practices participate in clinical trials and studies to improve care and provide cutting edge treatments for our patients.

Your request to survey nurses (RNs) within our network administering SC bortezomib (Velcade), and describe their opinions and perceptions of SC bortezomib is approved. We hope that the insight provided will assist in improving patient care, patient experience and clinical outcome.

CCE would like to review any presentations or publications created that reference CCE or are based on the CCE survey data prior to final presentation or publication.

CCE supports your efforts and we look forward to sharing improvement opportunities with our practice staff.

Please feel free to contact me if you have additional information needs.

Sincerely,

Nancy Beegle
Cancer Clinics of Excellence
VP of Clinical Operations
nbeegle@cce.us.com
303-220-9951

From: Solomon, Stefanie
To: nbeegle@cce.com
Cc: Martin, Jasmine
Subject: Millennium Study
Date: Wednesday, May 01, 2013 6:41:35 PM

Ms. Beegle,

This note is in regard to the subcutaneous bortezomib nursing survey sponsored by Millennium Pharmaceuticals. In addition to the corporate use of the survey data, we are aware that Jasmine Martin, DNPc, MSN, will be using these data as part of her doctoral program at Regis University.

Please let me know if you have any questions.

Best regards,

Stefanie Solomon
Sr Counsel
Millennium Pharmaceuticals, Inc.
The Takeda Oncology Company
40 Landsdowne Street
Cambridge, MA 02139
Ph:(617) 551-2948

Appendix H

The Subcutaneous Administration of Bortezomib Practice Guideline

Cancer Clinics of Excellence

Date Issued: July 10, 2013

Last Revised: July 31, 2013 by Jasmine Martin, DNP, MSN, APRN

Approved by:
DISCLAIMER: THE PROCEDURE DESCRIBED DOES NOT REFLECT THE MANUFACTURER (MILLENNIUM PHARMACEUTICALS, THE TAKEDA ONCOLOGY COMPANY) RECOMMENDATIONS FOR ADMINISTERING SUBCUTANEOUS BORTEZOMIB.
The procedure is based on evidence from the clinical literature and a survey of nurses as part of an academic project.
Pages: 22 (including references)
Rationale, Purpose and Outcomes:

The Cancer Clinics of Excellence (CCE) network is committed to delivering proven, evidence-based treatment to people with cancer. This evidence based treatment protocol (ETP) provides Registered Nurses (RNs) with guidelines on the administration of subcutaneous bortezomib (SCB). The guideline is based on evidence in the clinical literature on administration of subcutaneous injections and from a survey of 43 nurses in the CCE network describing current SCB injection techniques as well as their opinions about SCB.

Bortezomib (Velcade) is an effective treatment for patients with multiple myeloma (Driscoll, Burris, & Annunziata, 2012). The subcutaneous (SC) route of administration has been shown to be equally efficacious as the intravenous (IV) route, but with less peripheral neuropathy (PN). Clinical studies and the package insert on SCB described the concentration for preparing the drug and that the injections were administered in the abdomen and thigh (Arnulf et al. 2012; Moreau et al. 2011; Moreau et al. 2012; Velcade 2012). A retrospective study of 15 patients suggested higher incidence of injection site reactions in the thigh than abdomen (Kaminura et al. 2012). Studies of SCB and the package insert do not describe how the injections were administered.

The clinical literature is inconclusive on the best way to administer SC injections in general (Annersen & Willman, 2005). However, clinical studies have shown needle size, angle of injection, use of an air bubble and giving injections over 10 to 30 seconds have resulted in decreased bruising, site reactions and increased patient satisfaction (Birkebaek, Solvig, Jorgensen, Smedegaard, & Christiansen, Frid et al. 2010; Gibney, Arce, Bryon & Hirsch, 2010; Gill & Prausnitz, 2007; Moore et al. 2010; Wooldridge & Jackson, 1988; Zaybak & Korshid 2007).

A 2013 survey of 43 CCE RNs who had administered SCB suggested there is agreement that SCB is more convenient than IVB and nurses believe patients prefer SCB to IVB. There were differences in techniques used and generally strong agreement that a practice guideline would be beneficial and would be followed by CCE nurses.

The purpose for a guideline is to provide RNs at CCE with a standardized method for administering SCB. The expected outcome of implementation and adoption of a practice guideline by oncology RNs is to specifically impact the nursing sensitive outcomes of patients with multiple myeloma. Nursing sensitive patient outcomes (NSPO) are those outcomes that can be influenced directly by nursing interventions (Given & Sherwood, 2005). Oncology NSPOs that may be realized with consistent SC injection techniques include:

Table 11 Nursing Sensitive Patient Outcomes and Measures

Outcome	Measures
Symptom control and management	• Lower incidence of peripheral neuropathy • Reduced injection site reactions and pain
Functional status	• Completion of effective treatment length of therapy
Psychological health status	• Reduced discomfort and anxiety associated with injection and treatment

Economics	• Patient perception about treatment • Reduced clinic time • Reduced cost • Cost effective treatment compared to other treatment options

Responsible:

All RNs in the CCE network who administer bortezomib by the subcutaneous route to patients.

Abbreviations:

CCE Cancer Clinics of Excellence

ETP Evidence Based Treatment Protocol

IV Intravenous

IVB Intravenous bortezomib

NSPO Nursing Sensitive Patient Outcomes

RN Registered Nurse

SC Subcutaneous

SCB Subcutaneous bortezomib

Guideline Procedure:
Graphics used with permission courtesy of Forum for Injection Technique (FIT) Canada 2013

Procedure	Rationale and References
Verify order and appropriate dilution for the route of administration ordered.	Bortezomib can be administered either by the intravenous or subcutaneous route. **For subcutaneous route of administration**: The volume of 0.9% sodium chloride used to reconstitute VELCADE for subcutaneous administration is less than the volume used for IV administration — **For subcutaneous reconstitution, add 1.4 mL of sterile 0.9% sodium chloride solution to the powder contained in the vial of VELCADE** — **This reconstitution will result in a final concentration of 2.5 mg/mL VELCADE** — **The reconstituted product should be a clear and colorless solution free of particulate matter** ▼ Apply stickers to the vial and syringe that identify the intended route of administration **For intravenous route of administration**: The volume of 0.9% sodium chloride used to reconstitute VELCADE for IV administration is greater than the volume used for subcutaneous administration — **For IV**

	reconstitution, add 3.5 mL of sterile 0.9% sodium chloride solution to the powder contained in the vial of VELCADE **— This reconstitution will result in a final concentration of 1 mg/mL VELCADE** **— The reconstituted product should be a clear and colorless solution free of particulate matter** ▼ Apply stickers to the vial and syringe that identify the intended route of administration **(Velcade package insert, 2012)** **(Level of Evidence II)**
2. Review procedure and rationale with patient	
3. Select appropriate site for administration and rotation (See Figures 1, 2 and 3). If patient has had prior SCB injection(s), inspect prior site(s) and document current condition and patient report of previous injection(s) site(s) and experience(s). Inject at least 1 inch from prior injection sites	**Clinical studies only administered SCB in the abdomen and thigh, rotating between sites with each injection (Moreau et al, 2011; Moreau et al. 2012; Arnulf et al. 2012). There is no data on administering SCB in the arm. One study reported more injection site reactions in the thigh than abdomen with SCB (Kaminura et al. 2012). CCE**

nurses indicated preference for using the abdomen. If only the abdomen is used, rotate the location to a different quadrant on the abdomen with every injection (See Figure 1). Within the quadrants on the abdomen, injections should be at least 1 inch from any prior injections (See Figure 2).

(Level of Evidence V)

Figure 1. Abdominal Injection Sites and Rotation

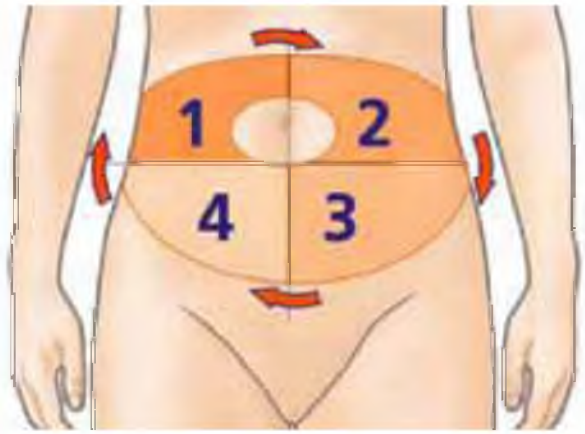


Figure 2. Rotations within abdominal quadrants

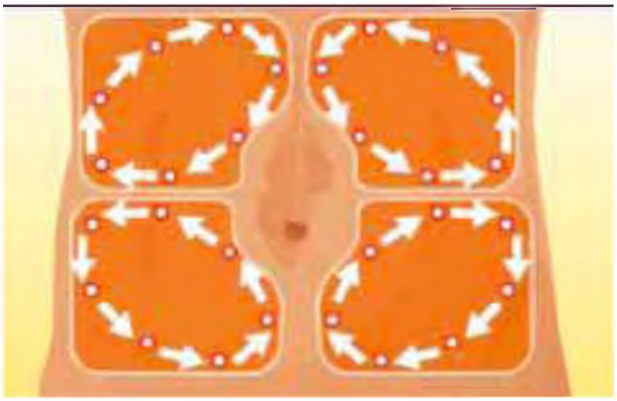
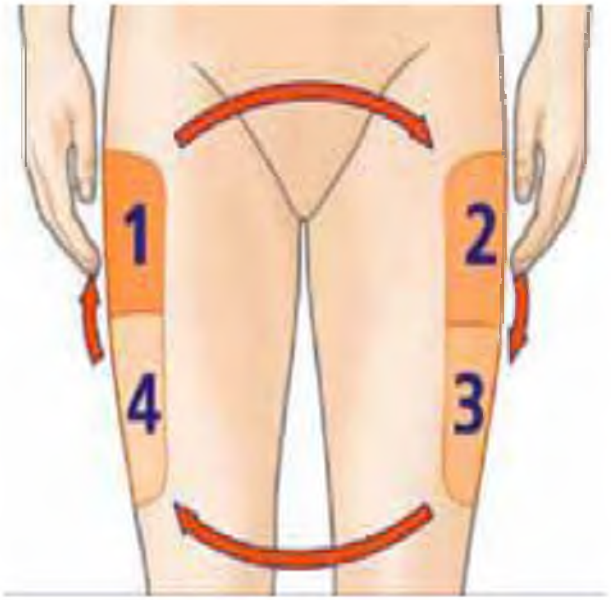


Figure 3 Site Rotation Thighs

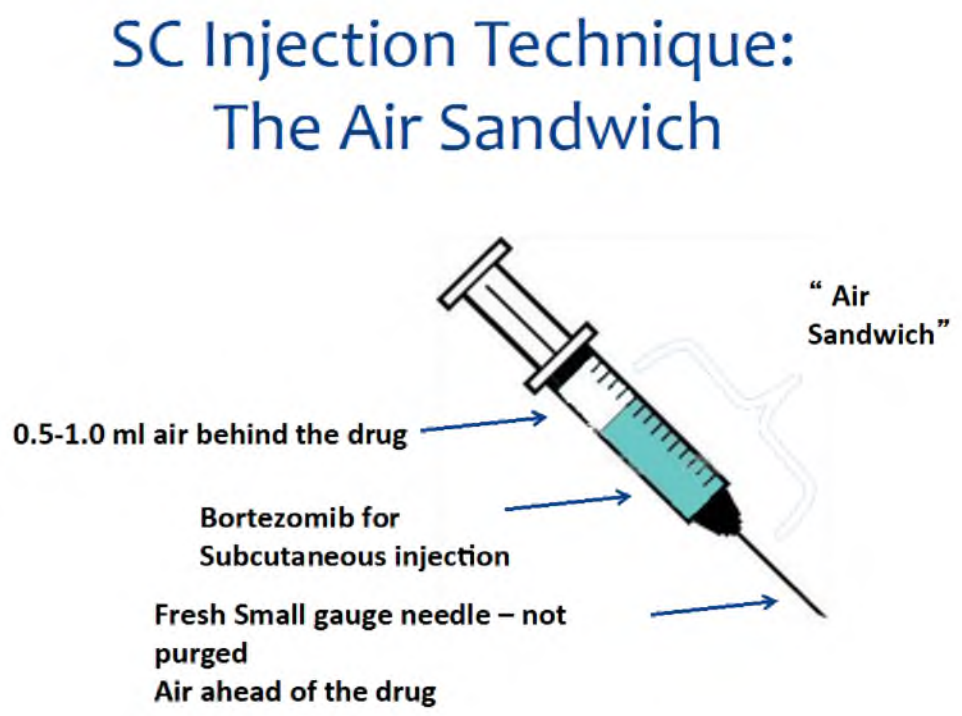


4. Place new needle on syringe

Use of a dry needle ensures bevel has not been dulled when inserted into the vial and eliminates tracking drug when inserting the needle into the skin (Agac & Gunes 2011)

	(Level of Evidence II)
5. Pull air into syringe to create an air bubble (See Figure 4). "Applying a fresh non-primed needle to the syringe with bortezomib, then drawing in an additional 0.5 to 1 mm of air, inverting the needle, and injecting" (Kurtin, 2013). ***NOTE: This technique is never to be used with Intravenous injections.***	**Randomized studies with SC interferon and heparin have shown use of an air bubble (air sandwich) technique resulted in significantly less bruising, pain, and injection site reactions and improved patient satisfaction and compliance (Moore, 2007; Wooldridge & Jacson 1988). The air sandwich technique has been recommended by the International Myeloma Foundation, and may prevent tracking drug when inserting and removing the needle (IMF, 2012; Kurtin, Knop & Milliron, 2012; Kurtin 2013; Kurtin S. n.d.; Murray et al. 2012) (Level of Evidence III for Moore et al. & Wooldridge & Jackson. Level VII for Kurtin and IMF)**

Figure 4 Air Bubble Technique



6. Wash hands, put on clean gloves, and clean injection site	**Prevent contamination and cross – contamination from staff to patient (Hunter 2008)**
7. Pinch tissue with thumb and index finger (See Figures 5 and 6)	**Skin thickness does not vary significantly in adults, whereas subcutaneous adipose tissue does vary in different anatomical sites, between genders, with increased body mass index (BMI) and waist circumference (Akkus et al 2012; Gibney et al. 2010). Pinching**

tissue helps ensure injection will be in adipose tissue and not into muscle. Using thumb and index finger may reduce grasping muscle tissue

(Level of Evidence III)

Figure 5 Correct Skin Lift: Pinch Skin with Thumb and Forefinger

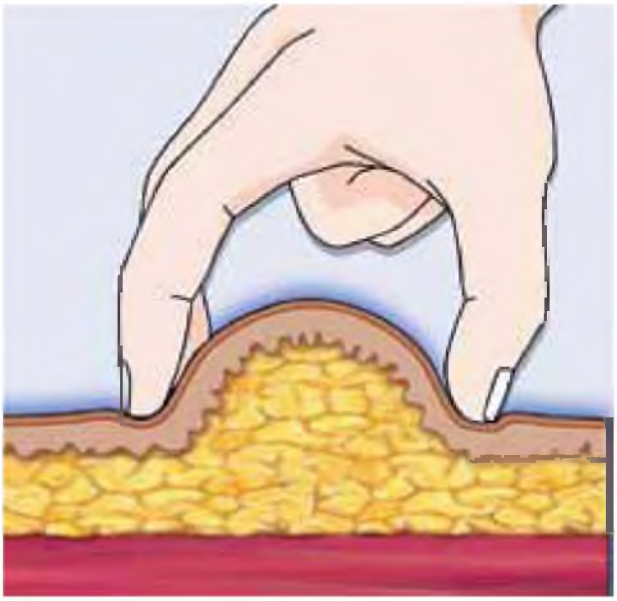
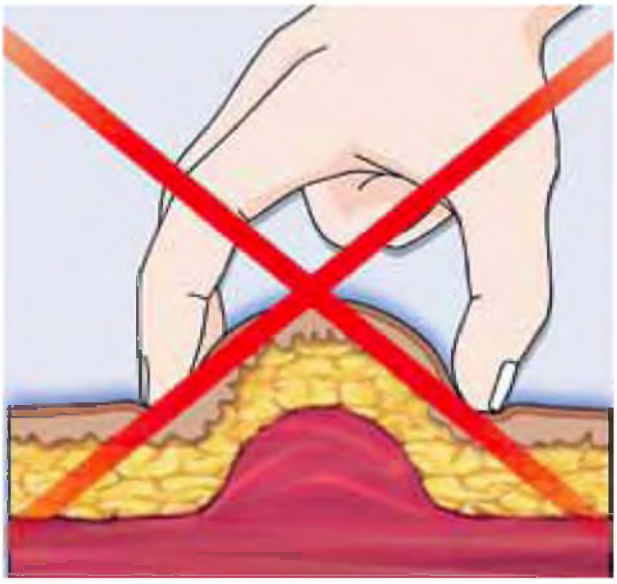


Figure 6 Incorrect Skin Lift: Avoid Grasping Muscle Tissue



8. Insert needle with smooth, steady motion using 45 degree angle when using a needle longer than 6 mm

NOTE: Angle of insertion is dependent on needle length. (See Figures 6 and 57)

Needle length Conversion:

4 mm = 5/32 inch

5 mm = 3/16 inch

6 mm = 1/4 inch

8 mm = 5/16 inch

9.5 mm = 3/8 inch

12.7 mm = 1/2 inch

15.8 mm = 5/8 inch

There is consistency in describing the angle of insertion to ensure entering subcutaneous tissue rather than risking intramuscular (IM) injections based on needle size. A study of 388 adult diabetics demonstrated small needles, 4mm to 6 mm in length, inserted at a 90 degree angle without raising a skin fold will be in the SC tissue more than 98% of the time. Needles 6mm to 8 mm inserted at 90 degrees will result in IM injections 5% and 15% of the time. A 12.7mm (1/2 inch) needle will result in IM injections 45% of the time when inserted at 90 degree angle and 21% of

the time when inserted at 45 degree angle (Gibney, Arce, Bryon, & Hirsch, 2010). A study of 499 subjects, including 297 healthy controls, suggested the use of longer needles (> 6mm) without pinching the skin or inserting at a 90-degree angle might result in an IM injection (Akkus et al., 2012).

(Level of Evidence III)

Figure 7 Proper Injection Technique for 45 Degree Angle Insertion into Skin Lift. To be used with Needles Longer than 6 mm (1/4 inch)

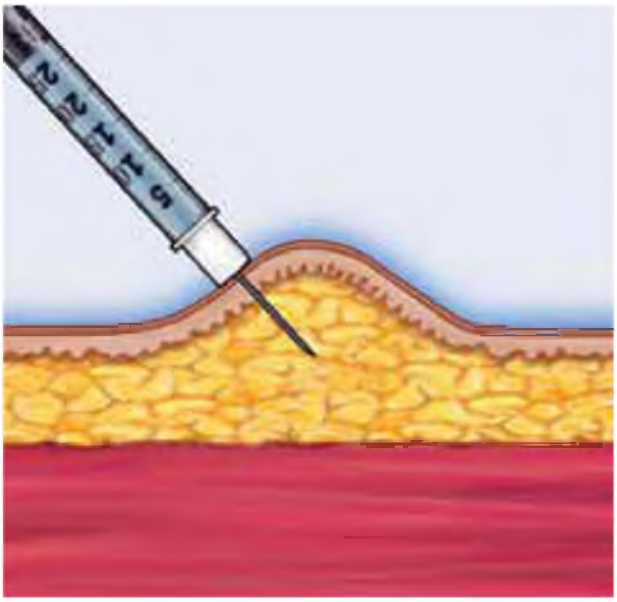


Figure 8 Proper Injection Technique for 90 Degree Angle Insertion into Skin Lift (depicted right). 90 degree angle is to be used with needles 6mm or shorter. 90 Degree Insertion without a skin lift (depicted left) may result in IM injection.

9. Inject medication slowly over 10 - 30 seconds. Use a *minimum* injection time of 10 seconds per ml.	**Slow injections can reduce tissue damage caused by increased pressure. Experimental studies on SC injection duration demonstrated 30-second SC injections resulted in statistically significantly less pain and bruising than 10-second injections (Akpinar & Celbioglu, 2007; Chan 2001; Zybak & Khorshid, 2007). (Level of Evidence III)**
10. Wait briefly before withdrawing the needle.	**Prevent backflow of medication. (Akpinary & Celebioglu, 2006; Hunter 2008) (Level of Evidence IV)**
11. Apply gentle pressure with dry	

gauze, and do not massage site.	
12. Assess site.	
13. Document site of administration in chart. Use anatomical site chart if available.	
14. Instruct patient to report any unusual redness, swelling, warmth. Reinforce teaching on side effects to monitor and report.	**Patient education about safety is a core professional role. Having oncology patients involved in preventing treatment errors and identifying adverse events results in trustful relationships (Schwappach, Hocreutener & Wernli 2010).** **(Level of Evidence VI)**

Summary of guideline for administering SC bortezomib:

1. Use small gauge short needles.
2. Change the needle on the syringe before administering the injection.
3. Add an air bubble to the syringe to create an air sandwich.
4. Use a skin lift to ensure injection into adipose tissue.
5. Inject at a 45-degree angle into a skin lift for needles longer than 6mm (1/4 inch). A 90 degree angle may be used into a skin lift for needles shorter than 1/4 inch.
6. Inject slowly, over 10 to 30 seconds.

7. Wait briefly before withdrawing the needle.

The techniques described in this guideline are based on evidence from the clinical literature. Levels of evidence are from Melnyk's Hierarch of Evidence (Table 2).

Table 2 Melnyk's Hierarch of Evidence (2005)

	Description	**Strength**
Level of Evidence		
I	**Evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCT), or evidence – based clinical practice guidelines based on systematic review of RCTs**	**Strongest**
II	**Evidence from at least one well-designed RCT**	
III	**Evidence from well-designed controlled trials without randomization**	
IV	**Evidence from well designed case-controlled and cohort studies**	
V	**Evidence from systematic reviews of descriptive and qualitative studies**	

VI	**Evidence from a single descriptive or qualitative study**	
VII	**Evidence from the opinion of authorities and/or reports of expert committees**	**Weakest**

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