The effect of clinical practice guideline representation on nursing care planning

by

Douglas Gregory Csima
B.Sc.N, McMaster University, 2007

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# Supervisory Committee

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Dr. Elizabeth Borycki, (School of Health Information Science)
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Dr. Maxine Alford, (BC Cancer Agency)
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# Abstract

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Evidenced based nursing seeks to integrate new knowledge from current research into practice. The use of clinical practice guidelines is one method of accomplishing this. The purpose of this study was to assess the effect of differing clinical practice guideline representation formats on the quality of nursing care plans and on the experiences of nurses. To accomplish this, an experimental study taking place in a laboratory setting was executed. BC Cancer Agency nurses volunteered as the participants. The nurses were given case scenarios and asked to generate nursing care plans with the assistance of clinical practice guidelines. The clinical practice guidelines were presented in two formats: Portable Document Format (PDF) and Web Based Interactive (WBI). The quality of the care plans was rated using a validated evaluation tool. Participants were asked to 'think-aloud' during the care planning process and their experiences were recorded, transcribed, and analyzed through a cognitive task analysis. This study revealed advantages and disadvantages to both formats and provided insight into nurses' experiences. This study also showed no statistically significant difference in the quality of care plan documentation, regardless of clinical practice guideline format. This study highlights the importance of evaluating health informatics projects in healthcare settings to ensure positive outcomes in measures of user experience and measures of documentation quality.

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# Chapter 1: Introduction

The nursing profession is challenged to meet the dynamic needs of a population affected by several comorbidities and chronic health problems. Nursing staff working in oncology settings are responsible for providing increasingly complex care to a growing number of clients. Care providers are constantly working to ensure that they are providing the highest standards of care, and clients are demanding no less. Improvements in health information technology may provide an opportunity to improve the quality of care provided and alleviate some of the pressures placed on nurses in challenging healthcare environments.

## Purpose

The importance of evaluating informatics applications in nursing has been stressed by several experts (Urquhart, 2009; Currie, 2005). Without accurate evaluation, it is difficult to be sure if nursing informatics applications are contributing to quality of care in a positive way. It is also important to ensure that investment in these applications is a worthwhile financial investment. The first purpose of this research was to evaluate the effect of clinical practice guideline representation on the quality of nursing documentation. The second purpose of this research was to capture the experiences of the nurses during their use of various clinical practice guideline representations.

## Background

### Clinical Practice Guidelines

There are two major types of clinical practice guidelines. Evidence based and consensus based. Evidenced based clinical practice guidelines are a form of evidenced

based practice. Evidence based practice is defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett, 1997, p. 3). Evidenced based nursing refers to nursing care delivery that applies knowledge from current research to ensure patients receive the most appropriate care (Anderson & Willson, 2008). Good clinical practice relies on both clinical expertise and external evidence. Clinical expertise is required to determine if external evidence is applicable to an individual patient, and external evidence ensures that practice behaviours do not fall out-of-date (Sackett, 1996). Clinical practice guidelines fall under the umbrella of evidence based practice, because they are tools designed to assist health professionals with providing the highest quality of care, based on the most accurate and current information from the research literature. In some cases, clinical guidelines do not rely heavily on published research, but instead rely on expert consensus and opinion. These guidelines are called consensus based guidelines (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). It should be mentioned that even evidence based guidelines require a combination of social engagement and methodological rigour (Brouwers, Stacey, & O'Connor, 2010). Evidenced based guidelines cannot show decisively which intervention is the most appropriate (Wensing, Bosch, & Grol, 2010). It is up to the clinician to ultimately make a decision. For this reason, guidelines are a form of decision support and are intended to standardize high-quality care and improve patient outcomes by assisting practitioners in making efficient and effective decisions. Decision support systems will be further discussed later in this thesis.

In addition to contributing to more desirable patient outcomes, clinical practice guidelines are also intended to reduce practice variation and inappropriate resource use

associated with unnecessary practice variation. Guidelines can also reassure clinicians about the appropriateness of their decisions, empower patients when patients are given the opportunity to review them, assist with continuing quality improvement initiatives, and drive further research initiatives (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). The importance of clinical practice guidelines in the healthcare environment is elevated because research is ongoing and contributions are constantly being made to the medical and nursing knowledge base.

There is some uncertainty as to whether clinical practice guidelines achieve their goal of improving clinical practice. A review of fifty-nine evaluation studies conducted in 1993 found that all but four showed an improvement in the process of care, and two out of eleven studies showed an improvement in the outcome of care following the introduction of clinical practice guidelines (Grimshaw & Russel, 1993). The authors identified that successful introduction of clinical guidelines is most probable when guidelines are: 1) developed internally, 2) disseminated to users through a specific educational intervention, and, 3) deliver patient specific reminders at the time of consultation (Grimshaw & Russel, 1993). On the other end of the spectrum, guidelines that are developed externally, or at a national level, which are published in journals and offer only general reminders to practitioners, have a lesser probability of success (Grimshaw & Russel, 1993). Other authors have also questioned whether clinical practice guidelines might contribute to negative outcomes or patient harm (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). These authors have hypothesized several potential areas where guidelines can lead to negative outcomes. If guidelines are based on evidence that is misleading, misinterpreted, or lacking accuracy, guidelines can result in

the delivery of ineffective or harmful interventions. Additionally, if guidelines are based on expert opinion and consensus, the developers may base decisions on misconceptions or personal experiences that may not reflect population norms (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). Furthermore, while guidelines are intended to reduce practice variation, guidelines that are too strict may not allow for practitioners to individualize care to meet the specific needs of their patients. These inflexible guidelines may also fail to acknowledge the complexity of clinical decision making (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). Other potential harmful outcomes resulting from flawed guidelines include negative changes to public policy, the removal of access to certain services, confusion from conflicting guidelines, the perpetuation of outdated practices, unfair auditing or quality monitoring, and increased potential for malpractice litigation (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). This potential for negative outcomes underlines the importance of evaluation strategies for decision-makers that are considering implementing practice guidelines. It should not be assumed that practice guidelines, or any information technology, will lead to exclusively positive outcomes.

It is apparent that guidelines have the potential to improve the process and outcomes of clinical decision making. Improvement however, is not guaranteed and requires high-quality guidelines and successful implementation of those guidelines. In 2001, Graham et al. reviewed the quality of drug therapy clinical practice guidelines in Canada. The authors concluded that there was a large variation in the quality of the guidelines, and that much improvement was needed with regard to the methodological rigour and guideline development process. The authors also suggested that all clinical practice guidelines

should be reviewed and evaluated by an independent group using a standardized instrument, and the results should be made available to potential end-users (Graham, et al., 2001). While there are tools to assist with guideline development and appraisal, knowledge is limited on the effectiveness and efficacy of guideline implementation strategies, leaving decision-makers to use their judgement to maximize the benefits made possible through guidelines (Grimshaw et al., 2006; Grimshaw et al., 2005). Vastly different implementation approaches may be required depending on the clinical setting and what the clinical practice guideline attempts to address.

As mentioned earlier, the effective dissemination of a clinical practice guideline is a major factor in successful implementation. A guideline is more likely to be effective if the intended users are educated specifically about the guideline itself, and the problem that it seeks to address (Francke, Smit, de Veer, & Mistiaen, 2008). The likelihood of effective implementation is further improved if education is combined with other implementation components, such as reminders and evaluation. Of course, for a guideline to be effective, it must not be ignored. This fact has led to research into the source of variance in adherence to practice guidelines. In 2007, McKinlay et al. found that several factors influence physician adherence to guidelines. Interestingly, both patient and physician characteristics had an impact on the variance in adherence. Older physicians and those with more experience more consistently completed actions recommended by the guidelines. The gender of the physician did not have an impact on adherence. Patient characteristics such as gender and age did have an impact on the physician adherence, but the race and socioeconomic status of the patient did not (McKinlay et al., 2007). These

results show that there are several contextual factors affecting adherence to clinical practice guidelines, independent of the structure and content of the guidelines.

It has been suggested that a strategy to increase adherence and outcomes associated with guidelines is to adapt the guidelines to the local context where they will be used (Harrison, Legare, Graham, & Fervers, 2010). Guidelines may need to be adapted to the local context due to differences in organizational structure, or unique cultural or regional circumstances (Harrison et al., 2010). A guideline adaptation process should involve consideration of local evidence, the scope of practice, and the model of healthcare delivery in the specific area. The adaptation process should be systematic while involving end-users, with particular focus being placed on maintaining the integrity of the original guidelines (Harrison, et al., 2010). Many clinical settings have developed a unique model for care delivery, and practice guidelines must reflect this unique care delivery process.

### Clinical Practice Guideline Representations

There is great variability in the way guidelines are presented and formatted. Different forms of guideline representations may be appropriate for different users in unique settings. Formats also vary based on the purpose of the guideline. Presenting a guideline with the appropriate physical layout and structure is an important part in the development stage of a practice guideline (Field & Lohr, 1990). The debate about the most effective format has been ongoing since the introduction of guidelines themselves (Field & Lohr, 1990). A review of studies completed on the effectiveness of guideline implementation strategies concluded that there is not enough evidence to suggest that one single format of guideline or strategy for implementation is more effective than others (Grimshaw et al., 2006).

The use of algorithms in clinical practice guidelines is a strategy to organize and summarize the recommendations made in an original practice guideline document. Algorithms are "flow diagrams that consist of branching-logic pathways which permit the application of carefully defined criteria to the task of identifying and classifying different types of some entity" (Hadorn, 1995, p. 93). Algorithms in health care can be used as aids for diagnosis, or to determine the best treatment in a certain situation. Algorithms that accomplish both of these tasks are called management algorithms (Hadorn, 1995). Algorithms are convenient and result in higher retention and better compliance than standard text guidelines, and can be easily transferred to computerized formats (Hadorn, 1995). A criticism of algorithm-based guidelines, however, is that they impose rigidity on practitioners and cannot account for the variations in patient presentations and preferences (Hadorn, 1995). Additionally, not all algorithmic guidelines are well-supported with data from the literature and may therefore lack validity (Hadorn, 1995). If these potential disadvantages can be avoided, then the algorithmic guideline has several potential advantages over standard text guidelines.

### Clinical Practice Guidelines and Information Technology

Developing guidelines can be a time consuming and resource consuming process. As a result, there is some incentive to develop guidelines that can be shared across institutions. Information technology has provided a pathway for guidelines to be disseminated and shared between developers and users, as well as between institutions. If guidelines are to be shared electronically, a standardized guideline format and language is considered critical (Ohno-Machado, et al., 1998). The GuideLine Interchange Format (GLIF) is an example of a standardized clinical practice guideline language format. The GLIF format

represents guidelines using a unique model comprised of a hierarchical class and attribute structure. The format is encoded in a unique syntax to allow for the possibility of interpretation by both human users and computer software. Software could be designed to present the GLIF-formatted guideline in a variety of ways depending on the intended users and purpose. The GLIF format utilizes the algorithms as the basis for the standardized representation of practice guidelines.

### Clinical Decision Support System (CDSS)

This section will provide an overview of clinical decision support systems (CDSSs). It is necessary to review CDSSs because clinical practice guidelines are designed to support clinical decision making. If these guidelines are integrated into a nursing information system, they represent a form of CDSS. Musen, Shahar, and Shortliffe (2006) define a CDSS as any computer program designed to help healthcare professionals to make clinical decisions. A CDSS can assist practitioners with a range of different types of decisions in a variety of ways. From a nursing perspective, decision support could assist with any part of the planning of care, such as formulating the nursing diagnosis, selecting interventions, or monitoring outcomes. According to Musen et al. (2006), good clinical decision making has three prerequisites: accurate data, pertinent knowledge, and appropriate problem solving. A CDSS could assist a practitioner with meeting these requirements. For example, a CDSS could collect, manage, and present data to a nurse in an organized manner. The system could also provide the nurse with background knowledge necessary for decision making. Finally, the CDSS could generate specific recommendations based on patient data and a built-in information model. CDSSs can also be useful in alerting clinicians of potential problems that require decision making. Musen

et al. (2006) describe these tools as *tools for focusing attention*. A clinical example of this would be the flagging of abnormal laboratory results or potential drug interactions.

Historically, the first decision support systems to be developed included an abdominal pain diagnostic support tool, an infection management tool, and a clinician alerting tool (Musen, et al., 2006). These systems had varying levels of success, but served as an introduction of the concept of CDSSs, and provided developers with valuable lessons. While early barriers to CDSS development were abundant, changes in the attitudes of professionals, increased acceptance of computer based tools, increased pressure to provide high quality care, and financial pressure to provide cost-effective care, have all led to the further development of CDSSs (Musen et al., 2006). A review of controlled clinical trials assessing the effectiveness of computer-based CDSSs on physician performance and clinical outcomes found that CDSSs can enhance clinical performance for drug dosing and preventive care, but not credibly for diagnosis (Hunt, Haynes, Hanna, & Smith, 1998). This review focused on physician CDSSs, and it should be noted that there is limited research available on nursing CDSSs and nursing practice guidelines.

### Classification of CDSSs

With the definition of CDSSs being so broad, it is helpful to further categorize the systems. This categorization will also provide further background on the characteristics of CDSS. Musen et al. (2006) suggest five dimensions of CDSS. These dimensions include: system function, mode of giving advice, style of communication, underlying decision making process, and human-computer interface. The underlying decision making process dimension is out of the scope of this paper, but the other relevant dimensions will be described. The first CDSS dimension pertains to the general function

of the system. The first type of system functions is to assist in understanding the reality of a situation. The second type of function is to assist with determining appropriate actions. From a nursing perspective, a CDSS can be described to either assist with diagnostic decisions (such as what data to collect), or assist with planning decisions (such as planning interventions or determining outcomes). The second CDSS dimension describes the method by which the system provides advice or support. A system can assist with decisions in a passive manner, by providing information that has no direct impact without a clinician's acknowledgement. In passive CDSS, the clinician actively seeks the decision support. Alternatively, a system can provide active support by taking action without clinician involvement. The third dimension describes the style of communication that the CDSS employs. Musen et al. (2006) describe two styles of communicating: consulting and critiquing. The consulting model generates advice about diagnosis or management by accepting data, and asking questions. In the critiquing style, the CDSS expresses agreement or suggests alternatives to decisions after they are made by a clinician. For example, if a nursing CDSS determines that a patient is at risk of falls based on the results of a diagnostic test, a care plan entry may be automatically generated for that patient. This would be an example of a consulting style of communication. Alternatively, if a nurse attempted to generate a care plan entry for fall risk, a critiquing CDSS might require that evidence (such as fall scale assessments) be required to support this decision.

The final dimension describes the human-computer interaction of the CDSS. This dimension serves as a general description of CDSS user interface, the usability, the effect of the CDSS on work-flow, user attitudes, and system performance. The BCCA Symptom Management Guidelines are used in this study as the basis for the clinical

practice guideline tool. These guidelines offer decision support that assists with planning decisions in a passive manner, whereby the clinician must actively seek the decision support in a consulting communication model.

### CDSSs in Nursing: Examples from the Literature

The above descriptions of CDSSs are relevant for all types of health care professionals. This section will focus specifically on nursing CDSSs by reviewing relevant literature. A meta-synthesis of the literature on nursing CDSSs was performed by Anderson and Willson (2008). The authors searched MEDLINE, CINAHL, and Cochrane databases for articles on CDSSs designed to support nursing decision making. Seventeen articles were found, six of which focused on a CDSS implementing evidence based practice. This article shows that CDSSs can have several applications in nursing. These examples will be further described in the following paragraphs.

### CDSS and Prioritizing Care

When care is sought by a client, a nurse is very often the first health care professional that will make contact with the client. The nurse is often responsible for determining the severity of the complaint, and making a decision about the most appropriate initial action to take. CDSSs can assist the nurse in this domain. For example, O'Cathain, Sampson, Munro, Thomas, and Nicholl (2004), explored nurses' views towards a decision support system designed to direct telephone callers with health problems to the most appropriate services. The nurses in this study viewed the system as essential to their decision making process. A similar CDSS example is described by Dong et al. (2005), in which software assisted nurses with determining the level of care needed by emergency department patients. This triage tool was found to improve the consistency of nurse decision making.

Additionally, the triage decisions of nurses using the CDSS were more likely to match the decisions recommended by an expert panel (Dong et al., 2005). These results parallel the results of other studies done on triage tools (Eley, Desley, Wollaston, Miller, McKay & Wollaston, 2005).

### CDSSs in Wound Care and Coagulation Control

Other examples of CDSSs in nursing focus on assisting the nurse in making decisions about how to treat a disease or condition that has already been diagnosed. Often these conditions are chronic conditions that require continuous nursing care and monitoring. Pressure ulcers, for example, are a particularly problematic chronic condition in the long term care population. The treatment and prevention of pressure ulcers has been a target of CDSS development. Research into pressure ulcer and wound care CDSSs did not show that the CDSS resulted in improved patient outcomes. It did suggest, however, that CDSSs may contribute to the knowledge of care providers (Clarke, Bradley, Whytock, Handfield, van der Wal & Gundry, 2005; Zielstroff et al., 1996).

In addition to supporting the care of pressure ulcers, CDSSs have also been used to assist practitioners with decisions pertaining to coagulation control in patients. Typically, physicians are responsible for manipulating anticoagulant dose regimes in patients requiring treatment. Physicians prescribing performance was noted to improve after the introduction of a CDSS which assisted the physician by providing evidence based recommendations (Garg et al., 2005). The usefulness of CDSSs in anticoagulant therapy can be further extended by allowing nurses to relieve the pressures on specialists and physicians. In 2000, Fitzmaurice, Hobbs, Murray, Holder, Allan, and Rose showed that nurse-led anti-coagulation clinics utilizing a CDSS and near-patient testing had no

negative effects on patient outcomes. This example is evidence that CDSSs may have an impact on the role nurses play within the health care team.

### CDSS Critique

After reviewing some uses of CDSSs in nursing, it is important to note a possible critique. In an attempt to develop an electronic nursing record system with computerized decision support built on clinical pathways, Hao, et al. (2006) found that most nursing information systems only assisted the nurse in developing care plans step-by-step once the nursing diagnosis has been identified. The authors go on to suggest that the real challenge surrounds decision support that assists the nurse in identifying a diagnosis based on patient data. Further criticisms are that CDSSs do not fully address the needs of practitioners and are a threat to professional autonomy (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). For these barriers to be overcome, the implementation of CDSSs or clinical guidelines must take into account the specific social environment of the practice setting (Kaplan, 2001).

### Nursing Documentation and the Nursing Care Plan

Documentation is a fundamental component of nursing practice (Potter, Perry, Wood & Ross-Kerr, 2010). Documentation is important as both a record of care and a channel of communication amongst the health care team. Strong documentation skills allow a nursing team to effectively plan care with the goal of improving patient outcomes. The nursing care plan is an example of a specific type of nursing documentation. While there is no standardized nursing care plan format, care plans are based on the nursing process and typically include a list of problems (or nursing diagnosis), a corresponding list of goals, and a corresponding list of therapies (or nursing interventions) (Potter, Perry,

Wood & Ross-Kerr, 2010). Care plans are dynamic records which are continually amended to reflect a patient's changing needs. It is suitable then, that the goal of the care plan is to organize patient information in a manner which allows nurses to prioritize care, improve communication and continuity of care, and deliver consistent care (Potter, Perry, Wood & Ross-Kerr, 2010). While some have questioned the value of nursing care plans (LaDuke, 2008), and there is a lack of evidence to suggest that care plans have a positive effect on patient outcomes, it is a mistake to understate the importance of these records as a communication tool in the health care system (Törnvall & Wilhelmsson, 2008). As Coiera (2000) suggests, the communication space is the largest part of a health system's information space, and it should not be ignored, as it is the source of several system pathologies. Furthermore, Coiera (2000) argues that these pathologies lead to substantial clinical morbidity and mortality which may be difficult to measure.

### Problems with Paper-based Care Plans

Several shortcomings have been identified with paper-based nursing documentation systems. These problems include: 1) a lack of structure and standardization, 2) redundancy, 3) poor acceptance and limited use of care plans, and 4) high documentation efforts (Törnvall & Wilhelmsson, 2008; Mahler et al., 2007). In an effort to solve these problems and improve the quality of nursing records, resources have been invested in the development of computerized nursing information systems despite an unclear understanding of whether or not these computerized systems will improve nursing practice or patient outcomes in a cost effective manner (Urquhart, 2009).

### Evaluating Nursing Information Systems

As previously mentioned, the purpose of this research is to evaluate the quality of care plans generated with the use of varying clinical practice guideline representations. This section will discuss previous studies evaluating nursing care plans or information systems. While there have been few papers focusing on practice guidelines alone, several studies have attempted to evaluate how information systems affect nursing documentation and patient outcomes. In a systematic review assessing the effects of nursing record systems on nursing practice and patient outcomes, Currell and Urquhart (2003) found that "the studies identified provide no evidence of any measurable difference, in nursing practice or patient outcomes, between the use of one kind of nursing record system or another" (p. 10). The authors went on to conclude that, while there are several studies on this topic, there are few of sufficient methodological rigour to yield reliable results. Typically, clinical information systems are evaluated after they have been implemented, and outcome measures have included: user satisfaction, clinical outcomes, and financial impact (Nahm, Vaydia, Ho, & Scharf, 2007). The present study takes a different approach by utilizing a laboratory setting. The methods will be further described later in this thesis.

### Computerized Nursing Information Systems and Nursing Care Plans

Several evaluation studies have attempted to assess the effect of clinical information systems on nursing documentation, but few have focused on nursing care planning specifically (Urquhart, 2009). This section will describe research focusing on care planning. In 1992, Smook published a study outlining an attempt to evaluate a computerized care planning system in two small hospitals. Smook was unable to report relevant conclusions, stating that confounding and system-level changes occurring in the

hospitals clouded the results. The author stressed the importance of a large sample size, the use of control, and objective measures of quality for future research in the area. A later study followed this advice, utilizing a randomized controlled trial approach to compare an electronic nursing information system with a paper-based documentation system (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001). The authors included 60 psychiatry ward patients over approximately three months. Quality was measured by external nursing experts using a checklist developed by the authors. Results showed that overall ratings of quality were similar between both groups, but electronic nursing documentation was more thorough, containing a higher number of nursing problems, aims, and tasks (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001). Also published in 2001, Larrabee et al. attempted to determine the effect of a nursing information system on the completeness of nursing documentation in a 100-bed urban university hospital. Unlike the previously mentioned studies, this study included a re-training intervention. The authors concluded that the nursing information system did not improve documentation in the first six weeks. Following the retraining intervention, however, documentation using the system significantly improved. These results indicate that the quality of information produced by a nursing information system may be related to the end-users knowledge and skill level.

Unlike the above studies which took place in hospital settings, Daly, Buckwalter, and Maas (2002), attempted to determine the effect of a computerized care planning system on both patient and organizational outcomes in a long term care facility. This study involved a sample of 20 patients. Consistent with previously mentioned studies (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001; Larrabee et al., 2001),

this study showed significant differences in the number of documented nursing interventions and activities. While these organizational outcomes were improved, no differences were observed in patient outcomes between the two groups. The patient outcomes were measured by improvements in independence with activities of daily living (Daly, Buckwalter, & Maas, 2002).

In an article published three years later, Smith, Smith, Krugman, and Oman (2005) attempted to answer questions related to nursing attitudes, charting time requirements, and completeness of documentation following the implementation of an electronic care planning and documentation tool. The concept of completeness is defined as the presence or absence of eighty-nine core patient care elements, which were chosen because they were considered applicable to all patients. The authors found that 34% of the charts were found to be more complete following the intervention (Smith, Smith, Krugman, & Oman, 2005). This finding is consistent with other studies, and shows a positive relationship between computerized nursing information systems and the completeness of nursing documentation (Daly, Buckwalter, & Maas, 2002; Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001; Larrabee et al., 2001).

### Nursing Care Plans: Quantity vs. Quality

After identifying the need to focus on the quality of information outcomes rather than quantity of information outcomes, Mahler et al. (2007) developed an instrument to audit the quality of nursing documentation based on an extensive review of the literature and a review of legal requirements. This instrument contained both a quantitative and qualitative checklist, and was used to audit nursing documents at time-points before and after the implementation of a computer based nursing documentation system in four

wards of a university hospital in Germany. In their findings, the authors confirmed the results of prior studies, showing an increase in quantity of documented problems, outcomes, and interventions. The quality component of the audit tool also showed that, overall, the quality of nursing documentation improved following the intervention (Mahler et al., 2007).

In summary, the work that has been published in this area has shown consistent improvements on the quality and completeness of nursing documentation following the implementation of a computerized nursing information system in hospital contexts. Researchers have not been able to determine, however, whether this change in quality of documentation is likely to lead to improved patient outcomes. It is important to remember that increased numbers of documented nursing problems, goals, and interventions, may not indicate improvements in quality. Common limitations identified in prior research include the lack of ability to recruit large samples, the lack of a control group, the lack of a validated outcome measurement tool, and difficulty controlling for significant organizational and technical variables (i.e. staff characteristics and system characteristics). It is important to review these studies, because this study used the quality of care plans as an outcome measure and the introduction of a clinical practice guideline as the intervention.

### Cognitive Task Analysis

Decision making is a very complex process, which is still not fully understood. Cognitive task analysis provides a methodological framework for analyzing human cognition during information processing and decision making processes (Kushniruk & Patel, Cognitive Approaches to the Evaluation of Healthcare Information Systems, 2005).

While the randomized clinical trial is the gold standard approach for studying system and clinical performance, it is not well suited for analyzing human and social issues involved with how systems are used and whether they are used (Kaplan, 2001). A clinical practice guideline could be very effective in a laboratory environment, but when used in a real clinical setting, the same benefits may not be realized. For this reason, having an understanding of the nurses thoughts during the performance of a care planning task may help identify potential barriers to guideline adherence. A common approach to cognitive task analysis is the 'think-aloud' approach. In this approach, participants are asked to describe their thoughts and actions out loud while completing tasks of varying complexity (Kushniruk & Patel, Cognitive Approaches to the Evaluation of Healthcare Information Systems, 2005). This approach was used in this research and will be described in further detail in Chapter 2. In order to analyze the data obtained from think-aloud transcripts, a content analysis approach was taken. The content analysis approach will also be further described in Chapter 2 of this thesis.

**Summary**

This background section defined clinical practice guidelines. It also explored how clinical practice guidelines may be used to affect nursing behaviours and decision making. While various formats of clinical practice guidelines have been developed and proposed, there is no gold standard format. Improvements in information technology offers additional opportunities to develop new formats of practice guidelines and other clinical decision support systems. A review of the literature, however, did not show exclusively positive outcomes following the implementation CDSSs or clinical practice guidelines.

It is difficult to fully understand the consequences of implementing new resources intended to assist nurses. One method of measuring outcomes is to examine nursing performance. Nursing documentation and the nursing care plan can be analyzed to determine possible effects of an intervention on nursing performance. Unfortunately, as discussed earlier, there is not a strong evidence-based relationship between nursing performance outcomes and patient care outcomes. As a result, it may be increasingly important to consider other outcome measures, such as nurse attitudes and experiences. Cognitive task analysis was reviewed as a method for collecting these attitudes and experiences, while also allowing for new themes and potential problems to emerge.

Increasing popularity of clinical practice guidelines may lead to the investment of significant financial resources despite incomplete information about the actual utilization and effects that such guidelines may have on the quality of nursing care and subsequent patient outcomes. From the patient perspective, better care is needed in the proposed area of study, a cancer outpatient clinic. Specifically, a survey of cancer patients in British Columbia found low quality ratings for coordination and continuity of care, noting that care providers were not always familiar their medical history (Watson, Mooney, & Peterson, 2007). Effective care planning, with the support of a clinical practice guideline and a reduction in the variation of care, is one strategy for addressing this problem. For this to be successful, however, nurses must actually utilize the decision support that is available through the clinical practice guidelines. Factors affecting this utilization must be understood for benefits to be realized, and proposed changes to clinical practice guidelines must be evaluated to ensure improvement in outcomes.

# Chapter 2: Research Methods

This study attempted to answer the following research question: Does a Web Based Interactive (WBI) representation of clinical practice guidelines lead to improved care planning when compared to a static Portable Document Format (PDF) guideline? A second question this research sought to answer was: What are the experiences of nurses while using two different representations of clinical practice guidelines? The following methods were used to answer these research questions.

## Sample

Nurses working at the BC Cancer Agency (BCCA) in Victoria, British Columbia, Canada, were asked to participate in this study. Eleven nurses volunteered as participants. This number was based on the successful outcome of a similar study, using a similar sample size (Borycki, Lemieux-Charles, Nagle, & Eysenbach, 2009). The BCCA has cancer centres across the province of British Columbia with varying functions. This research was carried out in the Vancouver Island Centre, located at 2410 Lee Avenue, Victoria, British Columbia, Canada, V8R 6V5, adjunct to the Royal Jubilee Hospital. This centre is a full service centre which provides oncology consultations, chemotherapy, and radiation therapy treatments, as well as services including prevention, screening, genetic counselling, and supportive care (BC Cancer Agency, 2008). Study participants completed a demographic questionnaire and computer attitude questionnaire for baseline data. These questionnaires are included in Appendix A and Appendix B respectively.

## Setting

This study took place in a laboratory setting. The environment simulated a nursing station environment similar to that of the Vancouver Island Cancer Centre. Nursing care planning occurs at the nursing station, and is an important activity. While a real nursing station environment would likely possess disruptions and distractions, the laboratory environment allowed the nurse to focus exclusively on the study task. Following the administration of the two questionnaires, the nurses began care planning tasks. In the first task, nurses were given a case scenario and the PDF guideline. In the second task, the nurses were given the case scenario and the WBI guideline. Nurses were not given any information resource besides the case scenario and the practice guidelines. In the WBI task, nurses were not allowed to use other functions of the computer, such as internet resources, unless they were directly linked from the guideline. This controlled for differences in information seeking between the two guideline formats. This phenomenon was noted in previous research (Borycki, Lemieux-Charles, Nagle, & Eysenbach, 2009). The detailed step-by-step procedure is described later in this chapter.

## Materials

Two case scenarios were generated based on the BC Cancer Agency's Symptom Management Guideline Registered Nurse Workshop case scenarios (M. Alford, personal communication, April 27, 2010). These case scenarios were used by educators during the educational workshops, which served to assist with the implementation of the clinical practice guidelines. Each case scenario presented a scenario where a hypothetical cancer patient was receiving treatment at the cancer centre. The first case scenario involved a woman diagnosed with ovarian cancer, who was experiencing nausea and vomiting symptoms. The second case scenario involved a man with nasopharyngeal cancer, who

had an abnormal level of white blood cells and a fever. The case scenarios are included in Appendix C.

The case scenarios described in the previous paragraph were intended to introduce a situation where a nurse might benefit from using a BC Cancer Agency clinical practice guidelines (BCCA Professional Practice Nursing, 2005). These clinical practice guidelines are known in the BC Cancer Agency as Symptom Management Guidelines (SMGs). The SMGs were developed in portable document format (PDF). The unchanged SMGs were used as the PDF guideline format and served as a control. The PDF version of the SMGs can be found in Appendix D (Fever and Neutropenia) and Appendix E (Nausea and Vomiting). The PDF guidelines were viewed in Adobe Acrobat Reader.

The WBI guidelines were based on the SMGs, but provided hyperlinks to assist with navigation, and were modified to allow nurses to view only the content that they sought. The content of the WBI guidelines was not altered, only the organization of the content was altered. The WBI format was created to allow for differing levels of granularity in content. This format of guideline was designed to incorporate features of a direct manipulation interface, an interface that promotes exploratory learning and allows the user to feel more in control (Johnson, Johnson & Zhang, 2005). The WBI guideline was created using Dynamic HTML, and was run using the Chrome web browser application. The WBI guideline was designed with the goal of making it more interactive and increasing the user's involvement in the process of seeking information. This was done by separating the four major sections of the SMGs (General Information, Health Assessment, Management, and Resources) into separate pages. These pages were displayed as tabs, which could be accessed from the home page. Users could use the tabs

to navigate to any section of the SMG from any other section, or from the home page. This was done with the intention of allowing participants flexibility in the way they navigated through the guideline.

In an effort to reduce the amount of information on the screen at any given time, collapsible menus were used to toggle whether information was shown or hidden. Suggested interventions for managing symptoms based on severity were accessible via a pop-up window, by clicking on the image of the level of severity that the user believed matched the case scenario. Links from the text to appendices or other resources also generated pop-up windows with the requested content. Example screen shots of he WBI version of the SMGs is included in Appendix F.

## Study Design

A within group, laboratory-based, experimental study was done similar to the design utilized by Borycki, Lemieux-Charles, Nagle, and Eysenbach (2009). Participants evaluated a patient case scenario with the PDF guideline and the WBI guideline. Following completion of demographic and computer attitude questionnaires, participants began the study task. The participants were randomized to receive one of the two possible descriptive case scenarios of a cancer patient. Participants were then asked to complete a nursing care plan for the case scenario using the PDF guideline format as a reference tool. For the second case scenario, participants were asked to perform the same task using a different case, but this time with the WBI guideline as their reference tool. This order was done under the assumption that exposure to the WBI guideline would affect the information gathering and reasoning strategies of participants. This phenomenon has been shown in previous studies (Patel, Kushniruk, Yang, & Yale, 2000). In both tasks,

participants were not given any reference material outside of what was provided in the guidelines. Participants were asked to 'think-aloud' or verbalize their thoughts and actions. These transcripts contribute to a better understanding of how the technology affects the process of care planning and use of guidelines. Following the creation of two care plans, the study task was completed and a post-task interview was conducted to gain further insight into the nurses' attitudes about the guidelines. The post-task semi-structured interview questions are shown in Appendix G.

## Randomization

As mentioned in the previous paragraph, study participants were randomized to receive two possible descriptive case scenarios of a cancer patient: Case 1 or Case 2. To accomplish this randomization, a sequentially numbered opaque sealed envelopes (SNOSE) approach was used, with permuted block randomization. The approach followed that described by Doig and Simpson (2005). Block randomization is a process that ensures that there is a balance in which case scenario is received first by participants. The block size was four participants. This ensures that, following every fourth participant, two will have received Case 1 first, and two will have received Case 2 first. This method is useful for small study group sizes when the number of participants is uncertain.

## Instrumentation

The introduction of new healthcare technology can change work-flow, impact patient care, and affect employee satisfaction (Nahm, Vaydia, Ho, & Scharf, 2007). As a result, evaluation is considered an essential component of the implementation process (Nahm, Vaydia, Ho, & Scharf, 2007). There are several outcome measures that evaluators can use

to assess the new technology. These include: user satisfaction, system performance, system acceptability, clinical performance, medical error rates, adherence to practice guidelines, quality of documentation, and financial impact (Nahm et al., 2007). This study was concerned with the quality of documentation as a clinical performance outcome of clinical practice guidelines. The study also used 'think-aloud' user dialogue as an indicator of user satisfaction and system performance.

Several nursing informatics evaluation frameworks have been developed and reviewed. The evaluation frameworks reviewed by Currie (2005), are designed to evaluate the impact of an application on the entire clinical environment. The frameworks described would not be useful for the present study, as the present study sought to isolate the effect of the guidelines on the quality of nursing documentation. In order to measure the quality of nursing care plans, a validated instrument was selected. This tool is called the Quality of Diagnoses, Interventions, and Outcomes (Q-DIO) (Müller-Staub, Lunney, Lavin, Needham, Odenbreit, & van Achterberg, 2008). This tool is the only known validated tool designed to assess the quality of nursing care planning. This tool consists of 29 items ranked on Likert-type scale. The list of items is included in the Appendix H of this paper.

In addition to assessing the quality of nursing documentation, this study tested the usability of both the WBI and PDF practice guidelines. The step-by-step study precedure follows.

## Procedure

This section will describe the study procedure step-by-step.

1. The participant consent forms were reviewed and participants were given the opportunity to ask questions. All participants agreed and signed consent forms.

2. Following the consent process, participants were given the demographic questionnaire (Appendix A). Participants were advised that they may withhold demographic information, should they wish to. Only one participant withheld her age. Many participants asked for clarification about the 'current position' question. If asked for clarification, participants were asked to make the distinction between being a 'staff nurse' or a 'nurse manager', and to specify the physical areas in which they worked. Some participants indicated that they worked in a variety of settings within the agency.

3. After completing the demographic questionnaire, participants were administered the Pretest for Attitudes Toward Computers in Healthcare v.2 (Kaminski, 2006). This can be found in Appendix B. Participants were read the directions at the top of the page. Some participants asked for clarification on some of the items in the questionnaire. If this was the case, the investigator responded, “choose the best response that reflects your attitude, and enter '3' for 'not certain'.”

4. Following completion of the Pretest for Attitudes Toward Computers in Healthcare v.2 questionnaire, participants were prepared for the care planning activities. First, participants were shown the nursing documentation document (Appendix I). This document had an area for nurses to document both structured care plans, nursing notes, and unstructured 'free text' note space. They were told that the task would be to “document a plan of care for the hypothetical patient in the case scenario with the assistance of the clinical practice guidelines”. Participants were told that other resources, such as online resources, had been disabled. Participants were told that each of the two care planning tasks should take 15-20 minutes. No time limit was enforced.

5. Participants were then oriented to the laptop computer and the wireless mouse. The computer set-up prevented participants from accessing other information resources.

6. Participants were asked to 'think-aloud' throughout the process as the computer program 'HyperCam' would record the computer screen along with the audio of participant verbalizations. Participants were told that the investigator may remind them to verbalize their thoughts throughout the exercise. The following HyperCam parameters were used:

- Screen area: Whole screen, 1364×768 pixels
- Frame rate: 10 frames per second
- Video compressor: Xvid MPEG-4 Codec
- Frame compression quality: 85%
- Sound: 2 Channel (stereo), record sound from microphone (default recording device), sample size 16 bit, sample rate 22050 samples per second.

7. The participants were told that if they felt the case scenarios lacked details and felt they needed to know more information, they could write down any important informational needs on the documentation, but that the investigator could not answer any questions about the content in the case.

8. Participants were then asked to select an envelope which contained a case scenario. Once the case was revealed, the investigator brought up the respective PDF guideline and asked the participant to begin.

9. Participants were advised when 10 and 15 minutes had passed, but were not stopped at any point. Most participants completed each task in under 20 minutes. Participants had

to be reminded frequently to verbalize their thoughts and describe their actions while navigating the guidelines.

10. When the participant informed the investigator that they had completed their documentation, the investigator stopped the recordings, filed the nursing care plan document, and repeated the task with the second case scenario and the respective WBI guideline.

11. Prior to using the WBI guideline, participants were informed that the guideline worked similarly to a website with click-able links. Participants were informed that the mouse icon would change from an image of a pointer to an image of a hand when participants were hovering over a link that they could click on. This was the only training they received prior to commencing the task.

12. When using the WBI guideline, the investigator would only intervene if the participant accidentally terminated the application. In some cases, participants would ask the investigator to assist with navigation, but assistance was not provided unless the application was terminated.

13. Following the completion of the second case scenario task, the investigator stopped the recording and filed the second nursing care plan document.

14. The HyperCam recording was then started again and the participant was informed that they would be asked semi-structured interview questions, and that their answers would be audio recorded. The semi-structured interview questions used can be found in Appendix G.

15. The interview would often uncover ideas that required further exploration. It was common for the investigator to ask additional questions. For example, if it was observed

that a participant did not enter an area of the guideline, the investigator may have asked if the participant did so intentionally or unintentionally.

16. Following the post-task semi-structured interview, the audio recording was stopped and the participant was thanked. This marked the end of their involvement.

## Analysis

As indicated earlier, this study employs cognitive usability analysis methods. Participants' 'think-aloud' speech was transcribed into text documents. These 'think-aloud' verbalizations were recorded in both case scenarios and in the post-task semi-structured interview. In order to analyze the large amount of content, a content analysis approach was taken. Content analysis is a process whereby text data is coded and organized into categories (Hsieh & Shannon, 2005). This allows the investigator to classify large amounts of text into a manageable and representative group of categories.

There are several approaches to qualitative content analysis with the common goal of better understanding a phenomenon, and contributing to the knowledge base on a particular subject. Various approaches differ in how codes are selected for inclusion. Hsieh and Shannon identify three distinct approaches. In the first approach, named Conventional Content Analysis, codes are derived during analysis from the data. This is useful when existing theory or research literature on a phenomenon is limited. This approach requires that the participants be free to provide data with little guidance or direction (Hsieh & Shannon, 2005).

The second approach identified by Hsieh and Shannon is the Directed Content Analysis approach. This approach begins with the identification of a theory or knowledge base to define codes prior to data analysis. During data analysis, additional codes may be

identified, but the goal is to offer additional evidence either supporting or not supporting the previously identified theory (Hsieh & Shannon, 2005).

The third approach identified by Hsieh and Shannon is called Summative Content Analysis. This approach begins with the identification of keywords. The keywords are then counted and statistically analyzed. This approach has advantages as it has increased internal consistency and can be used to make strong comparisons.

Of the three approaches of content analysis defined by Hsieh and Shannon (2005), this study utilized a Conventional Content Analysis approach. The definition of codes is driven by a the analysis of raw text transcripts without previously defined codes from the literature. It should be noted that some codes and categories focusing on usability and interface design were named after coding schemes published by Kushniruk and Patel (2004). The use of these preexisting coding schemes did not restrict the observation or prevent the creation of new codes. This is a key difference between Conventional Content Analysis and Directed Content Analysis approaches (Hsieh & Shannon, 2005). While this study does not statistically analyze codes, it does count the instances of codes and compare the frequency of occurrences of various codes, with the goal of identifying patterns.

As described in the procedure, the final step of data collection wasa post-task, semi-structured interview. The transcripts from this interview were also coded and included in the content analysis. Questions were designed to be open-ended, allowing participants to express their views and preferences openly, and giving the best opportunity for new themes to emerge from the data. This is an important feature of conventional content analysis (Hsieh & Shannon, 2005).

Prior research has shown that employing cognitive engineering methods in the system development process has led to improved efficiency and higher user satisfaction with a clinical information system (Jaspers, Steen, van den Bos, & Geenen, 2004). Kushniruk and Patel (2005) suggest that there is a continuum of approaches in the evaluation of clinical information systems ranging from experimental approaches to naturalistic approaches. This usability study was in a controlled, laboratory based environment and is therefore at the experimental end of the continuum.

## Ethical Considerations

The data collection in this study directly involved participants in research activities. It was made clear to participants that their performance in the study would have no impact on their working environment, and that all data collected would be made anonymous. The case scenarios were created based on a typical patient of a cancer centre and did not represent any real patients. Ethical approval was granted by the University of Victoria Human Research Ethics Board on May 10, 2011. This ethics approval was renewed on April 27, 2012. The research project was also granted ethical approval from the University of British Columbia British Columbia Cancer Agency Research Ethics Board on October 20, 2011. This ethics approval was renewed on September 6, 2012.

# Chapter 3: Study Findings

This section of the thesis will discuss the findings from the study. It will be broken up into four sections. The first section will discuss the participant demographics. This will be followed by an analysis of participants' attitudes towards computers as measured by a questionnaire. The third section will address the quality of the nursing care plans generated by the participants. Finally, the fourth section will review the qualitative data from the 'think-aloud' and conventional content analysis.

## Participant Demographics

All of the participants involved in the study were female (n=11). The mean age of participants was 45.7, with the median age being 43. Participants were very experienced, with the mean years of nursing experience being 20.9 years. The median years of nursing experience was 23 years. Many of the participants were long-time employees of the BCCA, with mean years of experience with the BCCA being 13.3, and the median years with BCCA being 15. The median education level of the participants was a bachelors degree in nursing (n=7), the highest education level was a masters degree in nursing (n=1), and the lowest level of education was a nursing diploma (n=3). The following chart shows the demographic characteristics of the participant group.

| Participant Number | Gender | Age | Years of Nursing Experience | Years with BCCA | Highest Level of Education |
|---|---|---|---|---|---|
| 1 | Female | 51 | 29 | 20 | Bachelors |
| 2 | Female | 63 | 35 | 20 | Diploma |
| 3 | Female | 39 | 15 | 0.5 | Bachelors |
| 4 | Female | 61 | 40 | 22 | Diploma |
| 5 | Female | 43 | 1.5 | 1.5 | Bachelors |
| 6 | Female | 38 | 7 | 6 | Bachelors |
| 7 | Female | 53 | 32 | 25 | Masters |
| 8 | Female | 26 | 3.5 | 0.8 | Bachelors |
| 9 | Female | | 26 | 15 | Diploma |
| 10 | Female | 43 | 23 | 20 | Bachelors |
| 11 | Female | 40 | 18 | 15 | Bachelors |
| Mean | | 45.7 | 20.9 | 13.3 | |
| Median | | 43.0 | 23.0 | 15.0 | |

**Table 1: Participant demographics.**

## Attitudes Towards Computers

Prior to commencing the study task of creating a care plan for case scenarios, participants were asked to complete a questionnaire entitled *Pretest for Attitudes Toward Computers in Healthcare* v.2 (Kaminski, 2006). The items in this questionnaire are listed in Appendix B. The purpose of this tool was to measure baseline attitudes and perceptions towards the use of computers in a healthcare setting. The scale is a 32-item, Likert-type scale with statements about computers such as: “In healthcare, computers could save a lot of paperwork” (Item 2). Participants had the option to 'agree strongly', 'agree', answer 'not certain', 'disagree', or 'disagree strongly'. The 32-item scale had positive statements that were scored 2 points for 'agree strongly', 1.5 points for 'agree', 1 point for 'not certain', 0.5 points for 'disagree', and 0 points for 'disagree strongly'. This scoring was reversed for negative statements, with 2 points for 'disagree strongly', 1.5 points for

'disagree', 1 point for 'not certain', 0.5 points for 'agree', and 0 points for 'agree strongly'. The scores from the positive statements and the scores from the negative statements were summed to represent the total score. Participants could then be categorized into one of six categories, which are shown in the table below (Kaminski, 2006).

| Score | Interpretation |
|---|---|
| Below 0 points | Positive indication of cyberphobia. Beginner stage in experience with computer basics or applications. Ambivalence or anxiety may occur, related to the use of computers in healthcare. May appreciate help learning basic computer skills. |
| 0 to 12 points | Indicates some uneasiness about using computers. Very basic knowledge of computer basics and applications. Unsure of usefulness of computers in healthcare. |
| 13 to 25 points | Moderate comfort in using computers. Has basic knowledge of computers and applications. Limited awareness of applications of computer technology in healthcare. |
| 26 to 38 points | Feels comfortable using user-friendly computer applications. Aware of the usefulness of computers in a variety of settings. Has a realistic view of current computer capabilities in healthcare. |
| 39 to 50 points | Confident in ability to use a variety of computer programs. Sees computers as beneficial in the development of society. Enthusiastic view of the potential of computer use in healthcare. |
| 51 to 64 points | Very confident that they can learn to use a computer to boost creativity, and perform routine functions. Recognizes the unique value of using information technology in society. Idealistic, positive view related to computer applications in healthcare. |

**Table 2: Pretest Attitudes Towards Computers in Healthcare score interpretations**

The mean score for all participants was 50.5. The median score was 50. In total, five out of eleven participants scored in the highest category of favourable pretest attitudes towards computers in healthcare. The mean score for participants in this category was 55.8, suggesting that these users are very confident that they can learn to use a computer to boost creativity, and perform routine functions. They recognize the unique value of using information technology in society. They have an idealistic, positive view related to computer applications in healthcare.

The remaining six participants scored in the second highest category of pretest attitudes towards computers in healthcare. The mean score for these participants was 46.1. This score indicates that these six participants are confident in their ability to use a variety of computer programs. They see computers as beneficial in the development of society and have an enthusiastic view of the potential for computer use in healthcare. There were no participants that scored below the top two categories of pretest attitudes towards computers in healthcare. The following chart shows the Pretest Attitudes Towards Computers in Healthcare score for each participant.

| Participant | P.A.T.C.H Score |
|---|---|
| 1 | 44.0 |
| 2 | 56.0 |
| 3 | 52.5 |
| 4 | 47.5 |
| 5 | 46.0 |
| 6 | 44.5 |
| 7 | 60.0 |
| 8 | 53.0 |
| 9 | 44.5 |
| 10 | 57.5 |
| 11 | 50.0 |
| Mean | 50.5 |
| Median | 50.0 |

**Table 3: P.A.T.C.H score for each participant**

The above chart shows the scores of participants which indicate that participants do not have negative pretest attitudes towards computers in healthcare. In fact, participants appear to have very positive attitudes and appear confident in their ability to use computers to benefit healthcare.

## Quality of Nursing Care Plans

The unit of analysis to measure the quality of nursing care plans was individual client care plans. The total scores measured using the Q-DIO scale were compared between the two types of care plans: the ones generated with the assistance of the PDF guidelines, and those generated with the assistance of the WBI guidelines. A higher score on the Q-DIO scale indicates a higher measured quality of nursing care plan. The following table displays the mean, standard deviations, and ranges for the Q-DIO scores for each condition.

| | PDF Guideline (n=11) | | WBI Guideline (n=11) | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Q-DIO score | 36.91 | 12.76 (6-54) | 30.91 | 12.77 (4-48) |

**Table 4: Descriptive statistics for the Q-DIO.**

The table above indicates that care plans generated with the assistance of a PDF guideline had a higher mean score of quality than care plans generated with the assistance of the WBI condition, with similar variability between the conditions.

A paired-samples t-test was conducted to compare Q-DIO scores in the PDF and the WBI conditions. Prior to conducting the *t*-test, however, it was necessary to ensure the data fit the assumptions of a *t*-test such as those outlined by Bryman & Cramer (2012). These assumptions were met, as the scores in each group were normally distributed, the scores under investigation were continuous, and there was equal variance between groups. The paired-samples t-test showed that the differences in quality scores for the PDF and WBI conditions were not statistically significant at the $p<0.05$ level; $t(10)=1.884$, $p = 0.089$ (two-tailed). In summary, while average quality scores in the PDF group were higher than those in the WBI group, this difference was not significant at the $P<0.05$ level.

## The User Experience: Think-aloud Analysis

A major component of the study process was the cognitive task analysis which included asking participants to 'think-aloud'. In think-aloud, participants were asked to verbalize their thoughts while completing the study tasks and using the practice guideline tool. The think-aloud data was transcribed and coded. This allowed for the identification of common themes. This approach emphasizes important issues, such as attitudes towards the guidelines and end-user acceptance of the new system, both of which have been shown to be important factors in successful nursing information system implementation (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001; Larrabee et al., 2001). Not only does the think-aloud approach allow for the study of these human issues, it also may offer possible explanations for the quantitative findings of this research.

Following completion of the study, all screen capture recordings and interview audio recordings were transcribed and time-stamped. Each participant had three transcripts. The first transcript was the think-aloud data from the first case scenario, where they employed the PDF guideline. The second transcript was the think-aloud data from the second case scenario, where they employed the WBI guideline. The final transcript was generated from the audio recording of the post-task interview. The transcripts were kept separate to allow for comparison of specific types of events. For example, the number of instances that a participant expressed frustration in cases where the PDF guideline was used can be compared to the number of instances where this occurred in the WBI guideline.

The coding process employed a similar approach to that described by Kushniruk and Patel (2004), whereby categories are defined to identify specific occurrences of user problems and aspects of user experiences and preferences. The five major categories identified were: *guideline application and uses*, *navigation and usability, information*

*content*, *work-flow,* and *guideline structure and cognitive processes*. These categories were then further broken down into specific codes. In the early stages of the coding process, new codes were created whenever no existing code accurately described an event. After the sixth participant's think-aloud data was coded, the creation of new codes was no longer required, as previously developed codes were used, and no new codes were needed to describe emergent participant problems.

In the following sections of this paper, each major category will be described in detail. Within each category, important codes will be highlighted. Also, an analysis of the data obtained from the participant transcripts will be presented. Specific quotes from participants will be shared to provide an example of an instance of a coded event.

The following table lists the major categories and important codes.

| Category | Code |
|---|---|
| Guideline Application and Use | • Applying grading scale<br>• Seeking non-specific information/catch-all<br>• Referencing guideline information<br>• Validating Preexisting knowledge<br>• Opening resources<br>• As education tool<br>• Communicate with standardized language for multidisciplinary/inter-facility<br>• Contribute new knowledge to guide plan |
| Navigation and Usability | • Organization of information improves speed/ease of navigation<br>• Information missed due to navigational requirements<br>• Scrolling is problematic, reduction of scrolling is positive<br>• Unsure of outcome of action or potential action<br>• Unable to close pop-over or navigate back<br>• Difficulty accessing information due to navigation demands<br>• Feeling 'lost' or 'uncomfortable'<br>• Broken link<br>• Accidental termination |
| Information Content | • Does not contribute new knowledge<br>• Acknowledgement of value<br>• Information not suitable for intended user<br>• Information important in certain situations only (low or high urgency)<br>• Section of guideline not useful<br>• Too much information<br>• Not specific enough to patient |
| Work-flow | • Guideline structure not consistent with work-flow |
| Guideline Structure and Cognitive Processes | • Guideline structure consistent with problem solving<br>• Guideline structure not consistent with problem solving |

**Table 5: List of major categories and codes**

The above table lists the major categories that will be discussed in the remainder of this chapter in the order that will be presented.

### Guideline Application and Use

The first major category was *guideline application and use.* As defined in this study, this category was used for instances where the user stated for what task they intended to use, or actually used, the guideline. This category also includes statements that described the use of a specific section of the guideline, free from any feedback about the usefulness of the section of the guideline in performing that task. It was valuable to track the instances of this category because the practice guideline tool is a multidisciplinary, comprehensive tool, that addresses several stages in the nursing process. As a result of these factors, it was important to have an understanding of what parts of the guideline were used, with what frequency, and for what task. This information was analyzed by tracking codes in the category of *guideline application and uses.*

There were eight codes in this category that described a variety of specific applications of the practice guidelines. These codes will be described in a table below, but it is important to note that the most common use of the practice guideline, regardless of the format of the guideline, was to apply a grading scale to the case scenario. All participants used this section of the tool at least once (n=11). The grading scale that is being referred to is the National Cancer Institute's Common Terminology Criteria for Adverse Events Version 3.0 (NCI CTCAE) scale, which is contained in the practice guideline and is used to categorize different types of nursing management options (National Cancer Institute, Cancer Therapy Evaluation Program, 2006). In the following example, the participant describes her use of the grading scale section of the guideline for both assessment and management of the patient in the case scenario:

> So I would grade her as a moderate to grade two, a moderate grade two. With weight loss, and obviously dehydration since she's coming in to get hydrated. So I'm

> assuming she's being seen within 24 hours. That's what should have happened if it's a grade two, according to these guidelines. (Participant 1, Case 1-PDF, 00:06:37 --> 00:06:48)

As this quote shows, it is clear that the participant is using the grading scale section of the guideline to make judgements about how to complete the task related to the case scenario. While the guidelines were used for several different tasks, the task of applying a grading scale to the case scenario was the most common. This guideline application accounted for one third of all instances across the eight *guideline application and use* codes. In other words, utilizing the grading scale was the most frequent application of the SMGs. The following table shows the distribution of instances in more detail.

| Guideline application and use | Instances | Percentage |
|---|---|---|
| Applying grading scale | 28 | 33.33 |
| Seeking non-specific information/catch-all | 12 | 14.29 |
| Referencing guideline information | 11 | 13.1 |
| Validating Preexisting knowledge | 10 | 11.9 |
| Opening resources | 6 | 7.14 |
| As education tool | 6 | 7.14 |
| Communicate with standardized language for multidisciplinary/inter-facility | 6 | 7.14 |
| Contribute new knowledge to guide plan | 5 | 5.95 |

**Table 6: Guideline application and use codes**

The above table gives an indication of what tasks the participants tended to use the guidelines to assist with across both PDF and WBI formats. This information may be useful to guideline developers so that they have a better understanding of whether or not their tool is being used as intended.

Breaking down the above table and separating the codes based on whether they occurred while the participants were using the PDF or WBI formats, provides an

indication of how the various formats affect the usage patterns of users. The code with the most discrepancy was *opening resources*. For this code, all 6 of the events occurred while the participant was using the WBI format. The following quote illustrates an example of a code for *opening resources*:

> OK, so I'm just looking under Resources. So, interesting, it says click for anti-biotic guidelines. I'm going to look it up because I haven't seen that before. (OPENS LINK) And this looks like our old telephone nursing line. (Participant 5, Case 2-WBI, 00:07:25 --> 00:07:39)

The above quote describes the participant using the guideline to assist with looking up resources related to the case scenario. Interestingly, every one of the six times that a user opened a resource linked in the guideline, it was while the participants were using the WBI format. The following table shows the breakdown of the code and which format of practice guideline was being used when the event was coded. If the code occurred in the post-task interview, it was categorized in a separate category shown in the table as *interview*.

| Guideline application and use | PDF | WBI | Interview |
|---|---|---|---|
| Applying grading scale | 12 | 11 | 5 |
| Seeking non-specific information/catch-all | 6 | 5 | 1 |
| Referencing guideline information | 7 | 4 | 0 |
| Validating preexisting knowledge | 4 | 2 | 4 |
| Opening resources | 0 | 6 | 0 |
| As education tool | 2 | 1 | 3 |
| Communicate standardized language for multidisciplinary/inter-facility | 0 | 2 | 4 |
| Contribute new knowledge to guide plan | 1 | 2 | 2 |

**Table 7: Guideline application and use codes codes by format**

The above table shows the breakdown of the g*uideline application and use* code by the phase of the study that they occurred. If the events occurred while the participant was using the PDF guideline, they are summed in the PDF column. If the events occurred during the second phase of the study, while participants used the WBI guideline, they are summed in the WBI column. Finally, if the events occurred in the post-task interview, they were summed in the Interview column.

Participants were also asked in the interview to describe how frequently they used the guidelines in practice. Six participants answered this question (56%), with four participants (36%) stating their use as 'limited', one participant (9%) stating that they used the guidelines twice weekly, and one participant (9%) stating that they used the guidelines daily. The g*uideline application and use* category focused on how participants used the guidelines but did not address how participants navigated throughout the guideline. These factors were addressed in the second major think-aloud code category, *Navigation and usability.*

### Navigation and Usability

The second major category addressed various navigation and usability events. Broadly defined in this study, *navigation and usability* coded events captured instances in the think-aloud process where participants had a problem browsing throughout the guideline, or locating information within the guideline. The category was defined to also include instances where participants commented on structural factors that contributed to, or detracted from, their use of the guidelines. Structural factors were defined as factors that do not relate to the information content of the guideline, such as visual appearance and accessibility.

### Organization of Information and Navigability

There were nine codes for *navigation and usability* events. The most commonly used code was *organization of information improves speed/ease of navigation.* This code was applied fifteen times and represented 19% of all codes in this category. The following quote is from a case scenario where the participant was using the WBI guideline. The quote provides an example of an event that was coded in the code *organization of information improves speed/ease of navigation:*

> So I click on the grade to open a new window. See, I'll tell you right now, I like that better. Because I know I don't have to go back and read through all that other stuff. I'm getting right to what I need. That's the most important thing. (Participant 9, Case 2-WBI, 00:04:17 --> 00:04:28)

The above quote provides an example of a participant who is making a comment about the differences in organization of information between the two guideline formats. She explains that she prefers the WBI guideline format because it allows her to get the information she needs without browsing through information that she does not need. This change in the organization of information improved the speed of navigating in this case. Out of fifteen instances of this code, fourteen (93%) were describing the WBI guidelines, and one (7%) described both formats of guidelines. This could be an indicator that participants enjoyed the change in organization of the information in the WBI guidelines.

### Missed Information Due to Navigational Requirements

The second most frequently triggered code in this category was *information missed due to navigational requirements.* As defined in this study, this code was said to have occurred when a participant confirmed that they did not access a section of the guideline that they otherwise would have accessed, due to being unable to navigate to that section. Of the thirteen times this event occurred, on twelve occasions (92%), it occurred as a

result of the navigational demands of the WBI guideline. The following quote is an example of a code for *information missed due to navigational requirements:*

> No, I didn't know I could click on the grade, because, on our thing (PDF guidelines), they're all just in order, which is kind of hard to navigate through. So it's nice to know I could click on it. (Participant 8, Interview, 00:09:36 --> 00:09:47)

In the post-task interview, the participant in the quote above was asked if they were aware that they could click on an image-link to open a new window to display more information. The purpose of the question was to rule out the possibility that the user intentionally avoided clicking on the link. The participant answers that it would have been 'nice to know' that they could click on it, indicating that the navigational requirement was indeed the barrier to their ability to access the desired information.

### Difficulty Accessing Information Due to Navigational Demands

The code *information missed due to navigational requirements* is similar to another code, *difficulty accessing information due to navigational demands*. The primary difference between these two codes is that in the latter code, the participant was able to eventually resolve the navigational issue. This code was also triggered more by participants using the WBI guidelines, with four out of seven instances (57%) compared to one of seven instances (14%). The remaining two instances (29%) occurred during the interview where participants did not identify a particular guideline format when describing their difficulty accessing information. In other words, in two instances, the code was *non-specific.*

### Scrolling to Navigate

The third most common code was *scrolling is problematic/reduction of scrolling is positive*. This code was triggered in instances that the participant made a negative comment about the requirement to use the scroll bar to navigate through the guideline. The code was also triggered when participants commented that reducing the need to navigate with the scroll bar was a positive change. The following quote is an example of an event in this code:

> OK, um, I like the first page (Web Based), how you can just go to whichever area you need, as opposed to having to scroll through all of the info (Participant 11, Interview, 00:18:27 --> 00:19:00).

The quote above occurred during the post-task interview for participant 11. In the quote, the participant reflects on her preference for navigating without the need to scroll. The reduction in scrolling as the primary means to navigate was a feature of the WBI guideline.

### Navigation Problems

Participants had other problems with navigation during the study task. These additional problems were captured by the code *unsure of outcome of action or potential action, unable to close pop-over or navigate back, accidental termination*, and *broken links*. These navigation problems were much more frequently observed while participants used or commented on the WBI guidelines. Of a combined total of twenty-seven instances of the aforementioned four codes, twenty-two (81%) were attributed to the WBI guidelines, and five (18%) were attributed the PDF guidelines. The following quote provides an example of the code *unsure of outcome of action or potential action*:

> The tabs I'm not too comfortable with, because they're not set up the same way my windows are. Because I'm looking

> up there and thinking, if I click that, will it shut the whole thing down? (Participant 5, Case 2-WBI, 00:15:13 --> 00:15:33)

The quote above is an example of a participant feeling uncomfortable because they are unsure of how their potential action of clicking the 'X' box on a web browser tab will affect the other open web browser tabs. Similarly, the participant indicates in the following quote that they are *unable to close the pop-over or navigate back:*

> OK, now how do I go back? So I just go back there? I see... Does that (CLICKS 'REFRESH PAGE') take me there, to the beginning? (Participant 9, Case 2-WBI, 00:06:46 --> 00:06:54)

In the quote above, the participant identifies that she has opened a pop-over window and is unable to navigate back to the previous page, what she calls 'the beginning'. She is also unsure of the outcome of the action of clicking on the 'refresh page' browser button. This is another example of a *navigation and usability* problem. The complete number of codes for the *navigation and usability* category can be seen in the table below. The codes are sorted by frequency. Each code is broken down into whether it addressed the PDF or WBI guidelines. In instances where participants were not specifically addressing the characteristics of either the PDF or WBI guidelines, the codes were categorized in the table as *non-specific.* The table shows clearly that *navigation and usability* codes were much more likely to occur when participants were using, or commenting on, the WBI guidelines.

| Navigation and Usability | PDF | WBI | Non-specific | Total | Percentage |
|---|---|---|---|---|---|
| Organization of information improves speed/ease of navigation | 0 | 14 | 1 | 15 | 19% |
| Information missed due to navigational requirements | 1 | 12 | 0 | 13 | 16% |
| Scrolling is problematic, reduction of scrolling is positive | 2 | 2 | 6 | 10 | 13% |
| Unsure of outcome of action or potential action | 1 | 9 | 0 | 10 | 13% |
| Unable to close pop-over or navigate back | 1 | 8 | 0 | 9 | 11% |
| Difficulty accessing information due to navigation demands | 1 | 4 | 2 | 7 | 9% |
| Feeling 'lost' or 'uncomfortable' | 2 | 4 | 1 | 7 | 9% |
| Broken link | 3 | 2 | 0 | 5 | 6% |
| Accidental termination | 0 | 3 | 0 | 3 | 4% |
| Total | 11 | 58 | 10 | 79 | |

**Table 8: Navigation and usability codes**

As the above table shows, navigation and usability issues most frequently occurred when participants were using the WBI guideline format (73% of the time).

### Information Content

The third major category that arose during the analysis of the data was the information content of the practice guidelines. Participants were asked to perform the study task with the practice guidelines as their only resource tool. This category of codes captured participant feedback about the information content in the guidelines. It did not focus on the structure or format of the guidelines, or how the information was used. It should be noted that the information content in the PDF and WBI guidelines was identical, and that participants were told this prior to beginning the study task. There were eight codes in this category with a combined total of 72 instances. This equated to a mean number of 6.5

instances per participant (n=11). Each code in this category will be described in the following sections.

### Knowledge Contribution of Guideline

The most frequently coded item in the information content category was *does not contribute new knowledge*. This code emerged when a participant gave the feedback that the information in the guideline was information that they already possessed. The data were coded this way when participants made the statement that they considered the information in the guideline to be general nursing knowledge. In other words, the information was considered to be information that nurses are expected to have previously learned, applied, and committed to memory. There were sixteen instances of this code, accounting for 22% of all codes in this category. The following quote is an example of a statement coded in this category:

> Because I've got experience in the area, it's a lot of reading through, and it's like, 'yeah, yeah, I know that, I know that'. (Participant 7, Interview, 00:25:23 --> 00:25:42)

The above statement indicates that the participant has confidence in her decisions as a result of her practice experience, and that reviewing the guidelines does not lead to her acquiring new information or knowledge. The following is another quote that illustrates that the participant does not feel the information in the guideline provides her with new knowledge:

> For me, as a nurse we usually know what chemotherapy agents cause nausea and vomiting (CIRCLING CAUSITIVE FACTORS SECTION) Same with radiation therapy. Most of us are quite familiar with the other medications as well that could cause that. (Participant 11, Interview, 00:14:53 --> 00:15:03)

This second statement provides specific examples of items that the participant feels confident about, implying that the information offered in the guideline is not providing her with new knowledge.

### Value of Guideline Information

The second most frequently coded item for the information content category was a*cknowledgement of value.* This code emerged when a participant explicitly stated that they found the guidelines to be valuable, or indicated that the guidelines have achieved their stated purpose of suggesting currently accepted approaches to treating cancer related symptoms. There were twelve occurrences of this code, which represented 17% of all codes in this category. The following quote is an example of a participant acknowledging the value of the guidelines:

> And I'm also very new to using this here, I've been peripherally associated with BCCA. So, my ease of this is basically as a neophyte. But yes, I think it's very very valuable.(Participant 4, Interview, 00:15:07 --> 00:15:26)

In this quote, the participant first shares that she is new to using the tool, then expresses her opinion that the guidelines are a valuable tool.

### Suitability of Guideline Information Content

Another common code for the theme of information content was *information not suitable for intended user*. This code addresses the situation where the guidelines include information that may be relevant to the case scenario, but not suitable for the intended user. There are two types of scenarios where this occurs. The first scenario describes a situation where the guideline information is more suitable to healthcare providers other than nurses. The following quote illustrates this situation:

> But a lot of this stuff, yeah I can review, but a lot of this stuff has to be ordered by a physician. (Participant 1, Case 2-WBI, 00:11:01 --> 00:11:07)

The above quote is an example of a participant sharing the feedback that the information provided in the guideline may be more suited to the physician than it is suited to the nurse. The second scenario occurred when the intended user was the patient, but the information was considered by the nurse to be unsuitable for the patient. The following quote illustrates this second scenario:

> Patient information, let's see what's here. Oh, that takes us back here, I don't think the patient would be too interested in that, that's too hard to read. (Participant 5, Case 2-WBI, 00:09:59 --> 00:10:15)

In the above quote, the participant reviews information in the guideline that is intended to be provided to the patient. She quickly comes to the conclusion that the guideline information would not be suitable for the patient due to the complexity of the language being used in the resource. Taken together, these scenarios where information was not suitable for the intended user occurred ten times, accounting for 14% of all codes in this category. The researcher found that this code occurred more frequently in the WBI format than the PDF format. Out of ten total instances of *information not suitable for intended user*, nine instances occurred while participants were using or commenting on the WBI format (90%). Only one instance occurred while participants were using or commenting on the PDF format (10%).

### Information Content and Context

The third most common code in the information content category was *information important in certain situations only (low or high urgency).* This code occurred ten times, accounting for 14% of all the codes in this category. This code was defined as instances

where a participant described that information offered in the guideline was not useful considering the specific context of the case. In other words, information that may have been valuable at an earlier stage of the disease, is no longer valuable, and, in fact, may inhibit the user in finding the information that was needed. The following quote is from the post-task interview, and is an example of this code:

> Investigator: Did you know that there is a grading scale for the first case (PDF)? Participant: Um, I knew there would have been one but febrile neutropenia is always an emergency anyways so I wouldn't go to that. (Participant 8, Interview, 00:05:13 --> 00:05:36)

The above quote is from an interview. After the investigator asked about whether a section of the guideline was intentionally overlooked by the participant, the participant responded that they did know that section was there, but they chose to ignore it because it was not appropriate for the level of urgency that the case required. The participant believed the case scenario presented an emergency, and did not think the section of the guideline was applicable to such an emergency situation.

The following quote is another example of an instance where the participant considered the use of the guideline inappropriate due to the situation's level of urgency:

> Again, having said that, if it's an emergency situation then I wouldn't use it. If it's there for patient teaching and you've got the time, then yes, I could see using this. (Participant 4, Interview, 00:13:53 --> 00:14:07)

In the above quote, the participant recognized the value of the information, provided they have the time available to teach the patient. The participant did not find the guideline valuable in an emergency situation. In other words, the information was useful, but dependent on context.

### Usefulness of Guideline Sections

The code discussed in the previous paragraph addresses situations where the participant considers the guidelines to be not useful in certain contexts. When the participant considered a section of the guideline not useful regardless of the context, a different code emerged. The name of this code was: *section of the guideline not useful.* This code occurred more frequently (six times) when participants were using or commenting on the PDF format than when using or commenting on the WBI format (two times). The following quote provides an example of the code, *section of the guideline not useful:*

> So, grade 2, and she's been vomiting 4 times per day. I would say I'm probably not using a lot of the things on the...I'm scrolling down down down because it's pretty obvious that it's related to her chemo and she has classic signs of dehydration. (Participant 5, Case 1-PDF, 00:03:22 --> 00:03:32)

In the above quote, the participant is describing how she is scrolling down through the PDF guideline, skipping the 'causative factors' section of the guidelines because she believes the information contained in this section is not useful in her assessment.

### Quantity of Information

Another code that emerged under the information content category addressed the issue of quantity of information in the guidelines. Specifically, the code *too much information* emerged when the quantity of information proved to be a barrier in communicating information appropriately, or in a timely manner. This code occurred eight times, accounting for 11% of the overall codes for this category. The following quote is an example of an occurrence of the *too much information* code:

> Investigator: If the guidelines were going to be re-done, what comments would you have? Participant: One quarter of the length that they are. (Participant 6, Interview, 00:02:57 --> 00:03:10)

The above quote occurred in the interview. In this quote, the interviewer is inquiring as to whether the participant would have any comments if the guidelines were to be revised. In the quote, the participant comments on the length of the guideline, suggesting that their length could be decreased to one-quarter of their current length. The below quote comments on ease of use based on presentation, PDF versus WBI.

> P: It's hard because you want all the information. The reason I like the computer is because there is too much information on the sheets. (Participant 5, Interview, 00:01:42 --> 00:01:50)

The above excerpt is from an interview. In this quote, the participant states that, while she wants all the information, the PDF format presents too much information. This is being compared to the WBI format, which the participant reports that she prefers.

### Specificity of Information Content

The final code in the information content category is *not specific to patient.* This code addresses scenarios where the participant felt the guideline was not helpful because the information was not specific enough to the situation presented in the case scenario. This code occurred seven times, accounting for 10% of all codes in the category. The following quote gives an example where the participant found the guideline isn't specific enough to the hypothetical patient in the case scenario:

> So, it's talking about the specific chemo agents, extensive radiation. Not talking about local areas of concern for esophagopharyngeal radiation, which I'm assuming he's having. He's 66, he's at higher risk. Nothing here on comorbidities. (Participant 4, Case 1-PDF, 00:05:21 --> 00:05:41)

In the above quote, the participant shares her assumption that the patient is having esophagopharyngeal radiation, and that the guideline does not discuss local areas of

concern for this type of radiation. Therefore, the guideline does not provide specific enough information to help with the care of the patient.

The following table shows the breakdown of coded instances for the information content category, and which practice guideline format was being used, or commented on, when the code occurred. If the code occurred while the participant was using the PDF guideline, or speaking specifically about the PDF guideline, they are summed in the PDF column. Codes occurring while participants used or commented on the WBI guideline are summed in the WBI column. If the information content code occurred in the post-task interview, and the participant did not specify a particular guideline format in their comment, it was categorized in the separate category shown in the table as *non-specific.*

| Information Content | PDF | WBI Interactive | Non-Specific | Total | Percentage |
|---|---|---|---|---|---|
| Does not contribute new knowledge | 6 | 5 | 5 | 16 | 22% |
| Acknowledgement of value | 1 | 3 | 8 | 12 | 17% |
| Information not suitable for intended user | 1 | 9 | 0 | 10 | 14% |
| Information important in certain situations only (low or high urgency) | 2 | 3 | 5 | 10 | 14% |
| Section of guideline not useful | 6 | 2 | 1 | 9 | 13% |
| Too much information | 4 | 1 | 3 | 8 | 11% |
| Not specific enough to patient | 4 | 2 | 1 | 7 | 10% |
| Total | 24 | 25 | 23 | 72 | |

**Table 9: Information content codes**

### Work-flow

The final category addresses the practicality of the guidelines in terms of how they fit into the natural flow of work. This final category is called *work-flow.* Work-flow can refer to how well the use of the guidelines physically fit into the typical work environment of a nurse. For example, if the guidelines are paper-based, their physical

location can positively or negatively impact accessibility, and therefore, work-flow. There was only one code in this category, addressing instances where nurses commented that the guideline was not consistent with work-flow. In no instances did participants comment that the guidelines fit well into their physical work-flow.

The code *guideline structure not consistent with work-flow* occurred on seventeen occasions. The following quote provides an example of a participant describing the location and use of the guideline as not being consistent with the work environment of the participant:

> And I notice that we've only got two in the clinic (PHYSICAL COPIES OF GUIDELINES). We've got one in telephone management, and one in radiation. There's none in patient support, that's where four nurses work every single day. (Participant 2, Interview, 00:10:20 --> 00:10:27)

In the above quote, the participant is discussing the lack of accessibility of the guidelines in their current workplace. This lack of accessibility results in the guidelines not being consistent with work-flow. The next quote makes a comparison between paper-based and WBI formats with regards to consistency with work-flow.

> I: Tablet devices? P: Very positive, because going from paper chart, it has been an issue, #1 trying to chart in your lap, but also having to flip through all of the different pages is quite time consuming. The other thing i find is, having access to the info right there, as opposed to having to excuse yourself to get the information. you can show them the information. So I can see it kind of working cool. (Participant 11, Interview, 00:27:36 --> 00:28:10)

The above quote is from the interview. The investigator is asking the participant for their opinion on having the guidelines available on a tablet device. The participant discusses the negative aspects of having to leave the situation to get the physical

guidelines, and also the cumbersome nature of the PDF guidelines being time consuming. With these details, the participant is expressing that the guidelines are not consistent with work-flow in their present state.

### Guideline Structure and Problem solving Cognitive Processes

The way information is presented to clinicians has been shown to have an effect on the reasoning strategies of clinicians (Patel, Kushniruk, Yang, & Yale, 2000). It was observed during the think-aloud that some participant's problem solving cognitive processes were similar to the guideline structure, while other participants had difficulty aligning their thought process with the guideline structure. It appeared that the structure and visual presentation of the guidelines themselves could facilitate or hinder problem solving. In other words, the structure of the guidelines were either consistent or not consistent with how the nurse used the guidelines to approach the problem. Two codes were used to capture evidence of this phenomenon in the think-aloud transcripts. The first of two codes in this category is called: *guideline structure consistent with problem solving*, and resulted in a total of seven occurrences. The following quote illustrates a participant finding that the structure of the guideline is consistent with their problem solving:

> Investigator: Is this how you would use the guideline in your practice, from start to finish, one section by one? P: Yes, I don't see a lot of febrile neutropenia in my position. But yes, that's how I would. (Participant 10, Case 1-PDF, 00:14:55 --> 00:15:11)

The above quote is from the interview. In this quote, the investigator is asking the participant if they use the guideline one section after another, from start to finish. Or in other words, the investigator is asking if the structure of the guideline is consistent with

the participant's problem solving. The participant agrees that the structure of the guideline is how she would use it in practice, making it consistent with her reasoning.

The second code in this category is: *guideline structure not consistent with problem solving* and occurred 13 times in the think-aloud transcripts. The following quote is an example of this code in a transcript:

> I: So you clicked on Nursing Management there. Is there a reason you clicked on that first? P: I guess just to see where she's at in the scale and then work from there (Participant 8, Case 2-WBI, 00:02:06 --> 00:02:31

In the above quote, the participant goes directly to the nursing management section of the guideline, bypassing the *definition* and *causative factors* sections of the guideline that come beforehand. This is evidence that the layout of the guideline is not consistent with her process of problem solving. If the nurse first recognized and defined the problem, then determined possible causes of the problem, and finally continued on to assess the severity of the symptoms, it would be more closely aligned with the layout of the guideline. In this particular case, the layout of the guideline is not aligned with the problem solving process.

When discussing how the guidelines align with the nurses' problem solving and work-flow, however, one important point should be made. Nurses in the study had already been using the PDF version of the guidelines in their practice. Their previous use of this format of the guideline may have altered their problem solving and reasoning strategies over time to suit the format of the guideline being used. Evidence of a similar phenomenon was observed by Patel, Kushniruk, Yang, and Yale (2000), when they found that the introduction of a computer-based record system impacted physician's information gathering and reasoning strategies. It is therefore possible that work-flow events may be

attributable to the participants prior adaptation to the PDF format, and not exclusively to differences between the two guideline formats. This observation was also made by Newton (2012) who observed nurses following the introduction of Symptom Management Guidelines. Specifically, Newton observed that five months following the introduction of the guidelines, nurses were beginning their conversation with patients by asking about what symptom they had. This provides evidence that the introduction of the practice guidelines may have altered the reasoning and problem solving strategies of the nurses. Furthermore, the current study found that the participants seemed to focus on a single problem from the case, as evidenced by their heavy use of the grading scales. They were less likely to think about prevention, long term planning, and the other symptoms presented. This finding further supports the findings from Newton (2012), which suggested that the nurses modified their practice to fit the tool rather than fitting the tool into their practice.

# Chapter 4: Discussion

This study had two major research goals. The first goal was to evaluate the effect of changes to clinical practice guideline representations on the quality of nursing care plan documentation. The second goal of this study was to capture the experiences of the nurses during their use of various representations of clinical practice guidelines. This chapter will evaluate the study findings and determine if the study goals were met. In addition, this chapter will explore the study findings as they relate to prior research and present implications to the fields of health information science and nursing. Finally, this chapter will suggest areas for further research, and study limitations will be addressed.

## Effects of Practice Guideline Representations on Quality of Care Plans

Clinical practice guidelines have been developed for at least the last 70 years (Field & Lohr, 1990). Over this time, guidelines have come in various formats. Field and Lohr (1992) found that guidelines varied "quite dramatically, both logically and graphically, in their modes of presentation." (p. 245). The first goal of this study attempted to add to the body of literature available to compare difference in outcomes based on presenting varying practice guideline representations. The first research question asked: Does a Web Based Interactive (WBI) representation of clinical practice guidelines lead to improved care plans when compared to a static Portable Document Format (PDF) guideline? The study attempted to answer this question by measuring the quality of care plans produced by participants. The first step in accomplishing this was to design a study task that resulted in a nursing care plan. The second step was to accurately score the quality of the nursing care plans that were produced. Once care plan quality was

measured, it was possible to compare the quality of care plans generated. The findings showed that care plans generated while participants used the PDF format scored higher mean scores for quality than the WBI format. This result, however, was not statistically significant at the $p<0.05$ level.

To date, no previous research has attempted to measure the quality of hand-written care plans generated with the assistance of varying representations of practice guidelines. Prior research has, however, assessed the impact of electronic nursing information systems on the quality of electronic nursing documentation and shown an improvement in documentation outcomes (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001; Daly, Buckwalter, & Maas, 2002; Smith, Smith, Krugman, & Oman, 2005; Urquhart, 2009). This improvement in documentation outcomes is inconsistent with the negative impact that the WBI guideline had on documentation outcomes in the present study. The discrepancy in results between previous research and the current study, however, may imply that the improvement in nursing documentation following the implementation of a nursing information system may be attributable to the electronic documentation functions of the nursing information system rather than to electronic clinical decision support functions, such as electronic practice guidelines.

A more important measurement of quality, however, is the measurement of patient outcomes. As discussed in the introduction, a review of the effects of nursing record systems on nursing practice and health care outcomes, found that, while using computerized record systems led to limited improvements in documentation quality, it led to no improvements in patient outcomes (Urquhart, 2009). While Heater, Becker, and Olson (1988) showed that research-based nursing interventions lead to better patient

outcomes, a systematic review of the impact of written nursing care plans and nursing record systems on patient outcomes showed a lack of robust research (Moloney & Maggs, 1999). There has been little research done on these topics since, as the complexities in contexts of practice, variations in care, patient characteristics, and lack of nursing autonomy has made the task very difficult (O'Connell & Warelow, 2001).

### Experience of Nurses

The second goal of this study was to capture the experiences of the nurses during their use of various representations of practice guidelines. To achieve this goal, participants were asked to think-aloud and verbalize their thoughts while completing the study tasks and using the practice guideline tool. In addition, the computer screen output was captured and recorded. The videos were transcribed and coded according to the cognitive usability analysis methods described in the literature (Kushniruk & Patel, Cognitive Approaches to the Evaluation of Healthcare Information Systems, 2005). The coded transcripts provided a thorough understanding of the participants' experiences using the practice guidelines. Specific quotes from individual participants were captured to further understand and summarize the participants' experiences. In addition, the comparison of the frequency of code occurrences provided even more information about the differences in participant experiences between the practice guideline formats.

Five themes emerged from the cognitive task analysis which were discussed in the results. Through the cognitive task analysis, participants made it clear that they found the practice guidelines to be valuable, but did admit that some sections of the guideline were not useful. This could explain the feedback that the organization of information in the guidelines was not compatible with nursing work-flow, information needs, and reasoning

strategies. Participants commented that they utilized certain sections of the guidelines more than other sections, which was confirmed in the study. Findings showed that participants most frequently used the NCI CTCAE grading scale section of the guidelines.

Participants commonly stated that the practice guidelines did not contribute new knowledge, but participants did show that the guidelines were an effective tool to seek non-specific information, validate preexisting knowledge, and provide a reference to support decisions. Participants stated that the guideline's usefulness did depend on the context. In some situations, participants suggested that the information in the guidelines was not specific enough to the case scenario, inappropriate considering the severity of the case scenarios, or simply too exhaustive in information content. Nurses expressed in the interviews that this was also the case when using the guidelines in their practice with real patients.

Regardless of the type of guideline used, participants had several specific navigation problems. The most common problem was that participants could not locate information due to navigational requirements. Other problems included difficulty closing pop-up windows and being unsure of the outcome of a potential action. These navigation problems occurred more frequently when participants used the WBI guidelines. Participants did, however, state that the organization of information in the WBI guideline improved the speed and ease of navigation. Specific to the PDF format guideline, users indicated the requirement to use the scroll bar as a navigation method was frustrating and inefficient.

The findings from the usability component of the study have some similarities with other usability studies on nursing information systems. For example, the participants in the current study reported that the lack of familiarity with the WBI guideline format negatively influenced it's usefulness. This is similar to the finding that learning how to use an Electronic Nursing Record system proved to be demanding, time consuming, and contributed to negative experiences of nurses (Viitanen, Kuusisto & Nykänen, 2011). Interestingly, however, the participants in the current study reported that the guidelines were useful in promoting collaborative or inter-disciplinary care. This is not consistent with the findings from study by Viitanen et al. (2011), which showed that the nursing record system inhibited collaborative care by making it more difficult for physicians to access nursing records.

This research is unique, in that it examines the impact of computerized practice guidelines representations upon the quality of paper-based nursing care plan documents that are developed by nurses. In other words, the study measured how computerized guideline tools affected the quality of non-computerized nursing documentation. The current study did not examine a complete nursing information system or an electronic nursing documentation tool. Therefore, it is difficult to compare results of this study to previous research.

The following figure summarizes the user experiences that may inhibit successful implementation of practice guidelines in both formats.

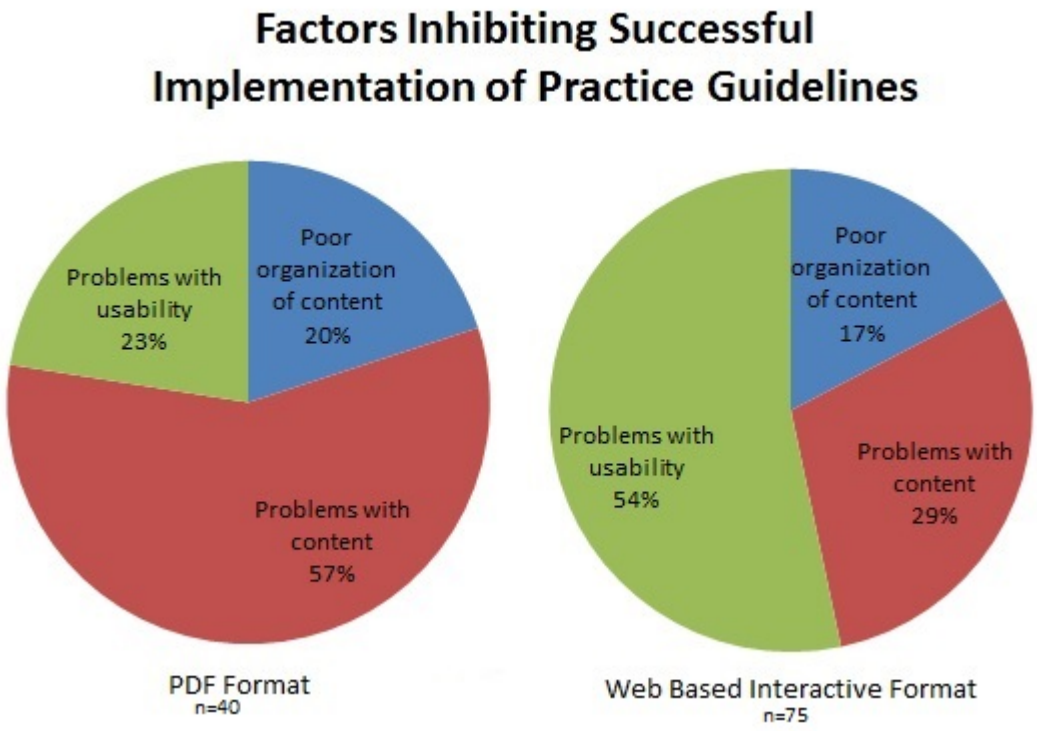


**Figure 1: Comparing factors inhibiting practice guideline implementation.**

The above figure shows that a higher portion of inhibiting factors in the WBI guideline representation are due to problems with usability, such as problems with navigation. In the PDF guideline, factors inhibiting successful implementation were more likely due to problems with content, such as a failure to contribute new knowledge to a clinical situation. While problems with usability may inhibit the chance of successful adoption of guidelines, problems with content and content development may actually lead to unintended outcomes (Woolf, Grol, Hutchinson, Eccels, & Grimshaw, 1999). This study did not measure other factors that have been shown to inhibit successful implementation, such as organizational factors, patient characteristics, staff time and peer support, and level of education provided (Francke, Smit, de Veer, & Mistiaen, 2008).

As a follow up to the previous figure which identifies inhibiting factors, the following figure suggests keys to positive user experiences:

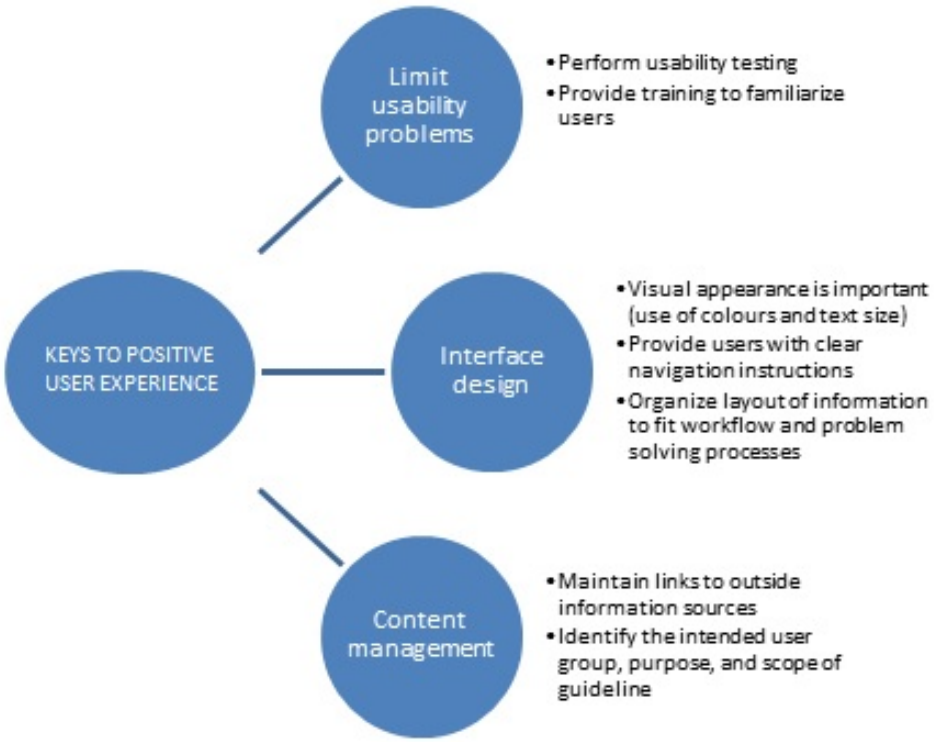


**Figure 2: Nursing guidelines: Keys to positive user experiences**

The above figure provides specific strategies to promote a positive user experience, based on the results from this study. The specific tasks of performing usability testing (involving users in development) and providing training are examples of previously identified strategies to improve user experience (Francke, Smit, de Veer, & Mistiaen, 2008). Strategies for content management proposed based on the results of this study also echo proposed strategies in the literature (Field & Lohr, 1992).

## Implications for Health Informatics Practice

The findings of this research have important implications for health informatics practice. Prior to starting the project, the researcher expected that the WBI practice guideline representation would be well-received by participants, and would contribute to

improved documentation quality based on previous research findings which showed improvements in outcomes following implementation of a nursing information system (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001; Daly, Buckwalter, & Maas, 2002; Smith, Smith, Krugman, & Oman, 2005; Urquhart, 2009). This was not the case. While there did not appear to be a clear preference for a particular guideline representation, the quality of nurse care plan documentation did not increase when participants used the WBI guideline. This result has implications for health informatics practice in two major areas: development of decision support tools and evaluation of decision support tools.

In the development phase of a project, health informatics professionals should consider the possibility that the tool may or may not lead to improved nursing or patient outcomes. Development of a new tool, or modification of the representation of a preexisting tool, must be done cautiously, and the concepts of usability and work-flow must be considered when designing the new electronic guideline representation. Specifically, designing a user interface that allows the users to limit the amount of information on the screen to only the information that the user is seeking may improve the user experience. When attempting this, health informatics professional should ensure that important information is not missed by the user as a result of these changes to user interface design.

Understanding that there is a possibility for negative outcomes makes evaluation an important aspect of health informatics professional work. This research showed that cognitive task analysis is a method that can provide rich, detailed information, directly from end-users about a wide range of topics. Specifically, conventional content analysis

can be applied to evaluate clinical practice guideline representations prior to implementation. This method of evaluation is open-ended, and allows for unforeseeable issues to be identified, when they may not have been apparent otherwise. For example, the difficulty that many participants had closing pop-up windows in the WBI guidelines was unexpected, particularly considering the effort made in the design of the WBI guidelines to include multiple options for users to take to close these windows.

This research also attempted to measure the documentation quality of a nursing care plan quantitatively in response to two different guideline representations. This quantitative measurement should also be considered when evaluating changes to health information systems that might affect the quality of nursing documentation. In summary, the findings of this study underscore the importance of developing appropriate representations of practice guidelines that are well-adopted by health care professionals and can be shown to contribute to positive outcomes.

It is important to educate health informatics professionals about practice guideline implementation and how to best incorporate electronic guidelines into the clinical practice setting. The complexity of the healthcare environment, including variability of contexts of practice, individual nurse characteristics, and patient characteristics, must not be overlooked, and can reduce the generalizability of a research study (O'Connell & Warelow, 2001). It is important for developers to understand the characteristics of the end-user, such as user attitudes, experience with computers, and level of education when designing clinical practice guidelines. This is supported by studies such as that done by McKinlay et al. (2007), which found that a physician's level of experience had an impact on adherence to clinical guidelines. If it is understood that complexities in the

characteristics of the end-user may have an impact on desired outcomes, practice guideline developers are better able to identify problems and develop corresponding solutions.

### Implications for Health Informatics Research

This research successfully utilized both qualitative and quantitative evaluation methods in a laboratory-based simulated healthcare environment. This method proved to be particularly useful considering the small size of the pool of potential participants. The within-group experimental design used in this study allowed each participant to contribute to the data gathered about both guideline representation formats. These methods, however, did introduce some limitations which will be described in detail in the Limitations section. Initial steps to maximize efficiency and reduce the limitations of usability testing methods have already been explored in other research conducted by Baylis, Kushniruk and Borycki (2012).

The use of a validated evaluation tool from the literature provided credibility to the current research. Additionally, using this tool to quantitatively measure the quality of nursing documentation provided an important perspective with which to consider the qualitative data obtained from the cognitive task analysis. While the cognitive task analysis provided rich data about the participant's experience, the quantitative measure provided insight as to how these differences in experience impacted the participant's performance.

Another area of research that should be further explored is the use of patient decision support tools. If a decision support tool is available to nurses to assist with assessing the severity of symptoms and appropriate actions to take, it could also be valuable for the

patient to have access to a similar tool to support health access and self-care decision making. The concept of integrating clinical practice guidelines and patient decision support tools to promote shared, patient-centred decision making is encouraged by van der Weijden, Boivin, Burgers, Schünemann, and Elwyn (2012).

## Implications for Nursing Practice

As discussed in the introduction, one of the main goals of clinical practice guidelines is to improve clinical practice outcomes. There is uncertainty as to whether clinical practice guidelines actually achieve this goal (Urquhart, 2009). Grimshaw and Russel (1993) concluded that the successful introduction of clinical guidelines is most probable when guidelines are: 1) developed internally, 2) disseminated to users through a specific educational intervention, and 3) when patient specific reminders are delivered at the time of consultation. The Symptom Management Guidelines at the BC Cancer Agency were developed internally and disseminated through a specific educational intervention, but did not deliver patient specific reminders.

Another important factor for successful practice guidelines is finding the most appropriate and successful form of delivery to practitioners, which has been long debated (Field & Lohr, 1992). Unfortunately, 21 years after Field and Lohr published their 1992 book, consensus on the most effective guideline representation format has still not been thoroughly achieved. This may be due to the high variability of desired outcomes by those developing and implementing the guidelines (Field & Lohr, 1992). As the world moves towards greater reliance on computers to conduct daily business, the healthcare system will undoubtedly follow suit. A workable and efficient WBI format of practice

guideline needs to be achieved to allow practising nurses to work efficiently in an increasingly computerized environment.

While the current research did not find the quality of nursing care plan documentation to be higher for a WBI format, prior research has resulted in such a finding (Ammenwerth, Eichstädter, Haux, Pohl, Rebel, & Ziegler, 2001; Daly, Buckwalter, & Maas, 2002; Larrabee et al., 2001; Smith, Smith, Krugman, & Oman, 2005; Urquhart, 2009). The unique aspect of the current research was that, although it studied the difference between WBI vs PDF guideline presentation, both conditions used a paper-based nursing documentation format for the care planning task. The difference between previous research and the current study may imply that the benefit of a computerized system comes not at the point of guideline presentation, but rather at the point of documentation. The current findings suggest that the use of technology to improve the presentation of guidelines may have small effects on care plan quality when compared to technologies that assist in producing care planning documentation. These results provide valuable insight for those planning and designing electronic care plan systems.

An important measure of the quality of nursing practice is the measurement of patient outcomes. As discussed in the introduction, a review of the effects of nursing record systems on nursing practice and health care outcomes found that, while using computerized record systems led to limited improvements in nursing documentation quality, the technology led to no improvements in patient outcomes (Urquhart, 2009). Future research needs to determine if there is a relationship between nursing documentation and patient outcomes.

## Limitations

There were several limitations of the study. which were noted at various stages of the project. The Q-DIO tool was used to evaluate the quality of the nursing care plans. The Q-DIO tool was tested and found to be a reliable instrument for measuring documentation quality of nursing diagnoses, interventions, and outcomes in an acute care hospital (Müller-Staub, Lunney, Lavin, Needham, Odenbreit, & van Achterberg, 2008). The tool has not been tested for reliability in a clinic environment or laboratory environment. Furthermore, the tool was designed to measure cumulative nursing documentation for actual patients. The present study only measured initial documentation after the nurse read a case scenario that was representative of a real-world patient. This case scenario was representative of only a single interaction between a nurse and a patient, and therefore could not measure nursing documentation across multiple patient interactions. Additionally, measuring the quality of care plans is not comparable to measuring the quality of patient outcomes. More specifically, a high score on the Q-DIO scale does not necessarily lead to improved health status or patient outcomes. The quality of documentation and the quality of patient outcomes may not be related (Urquhart, 2009). In this study, the relationship between clinical practice guideline representations and patient outcomes could not be evaluated as participants did not plan care for actual patient.

Limitations relating to the study design are also worth discussing. Firstly, this study is cross-sectional in design. While the participants were given a brief explanation about how to use the WBI guidelines, they may have been inexperienced in using this type of guideline representation, and this may have affected the outcomes of the study. With continued use and practice of the electronic format, the participants may have produced

higher quality care plans. This limitation was noted in another guideline study by Larrabee et al., (2001). Future research could include providing study participants with specific training about how to use the WBI format guideline. Larrabee et al (2001) included a similar training intervention. The authors concluded that a nursing information system did not improve documentation in the first six weeks. However, following a training intervention, the authors found the documentation system significantly improved. Therefore, it is possible that with a training intervention, a better comparison could be made between the guideline representation formats.

Another limitation surfaced after analyzing the results of the Pretest for Attitudes Toward Computers in Healthcare v.2 (Kaminski, 2006). Five of the eleven participants scored in the highest category. The tool described participants who fell into this category as being very confident and positive in their ability to use a computer. And the remaining six participants scored in the second highest category of pretest attitudes towards computers in healthcare. There were no participants that scored below the top two categories of pretest attitudes towards computers in healthcare. This indicates that the sample did not represent the population of nurses that had negative attitudes towards computer use in healthcare. Prior survey research that attempted to assess nurses' confidence and experience in using information technology showed that fewer than 25% of nurses stated that they were very confident in using any software application (Eley, Fallon, Soar, Buikstra, & Hegney, 2008). It is possible that nurses who are less comfortable with computers were more hesitant to participate in the study, and therefore, the research findings may not fully represent nurses who worked in the organization where the study took place. Additionally, research into the factors affecting acceptance

of technology by nurses indicates that nurses' perceived ease of use and usefulness of a system significantly impacts acceptance (Hsiao, Chang, & Chen, 2011). Based on the results of this research, one could hypothesize that nurses with low confidence in their ability to use computers perceive information systems to be more difficult to use and therefore are less likely to adopt new systems or participate in research involving computer tasks.

The last limitation that will be discussed relates to the methodology. The within-group methodology used in this study may have introduced a limitation. Participants were asked to use the PDF guidelines first, followed by the WBI guidelines. This was done based on prior research suggesting that exposure to an electronic guideline will affect the information gathering and reasoning strategies of participants (Patel, Kushniruk, Yang, & Yale, 2000). Due to this methodology, however, it is possible that some of the differences in nursing documentation may be attributable to the order of the task conditions, and not to the guidelines. For example, it is difficult to rule out the possibility that the nursing documentation quality was reduced when participants used the WBI guidelines because they were fatigued from having already completed a similar task using the PDF guidelines.

## Conclusions

Clinical practice guidelines are used in a variety of healthcare environments with the goal of standardizing care and improving the quality of care. In some circumstances, the nursing profession is the target user group of a clinical practice guideline. It is important to evaluate the effect that the introduction of a clinical practice guideline has on outcomes of interest. This must be done to ensure that guidelines are having the desired effect, and

not having unanticipated negative consequences. While information technology offers an opportunity to develop novel formats of clinical practice guidelines, technology does not eliminate the need for thorough evaluation of their implementation and use. This research study revealed that the modification of a clinical practice guideline to be more interactive had both positive and negative impacts on the user experience. The research also showed that this change did not significantly impact the quality of nursing documentation.

Clinical practice guidelines have the ability to support nurse decision making, but in order to do this, they must be adopted and used by nurses. Factors facilitating the use of guidelines include providing nurses with adequate education, training, communication, time, and staffing support (Abrahamson, Fox, & Doebbeling, 2012). This support and training is particularly important when using technology to disseminate practice guidelines, as nurses confidence in their ability to use computers may be limited. There is great variability in the format and content of clinical practice guidelines and in the healthcare environments where they are deployed. Information technology is a tool that must be used cautiously due to this high degree of variability and uncertainty.

Improving the usability of practice guidelines, ensuring their seamless integration with clinical work-flow, and carefully managing their content, may be strategies to improve adoption of guidelines. The relationship among guideline adoption, nurse performance, and patient outcomes, however, should not be assumed. Until further research provides evidence that supports these relationships, it may be premature to allocate resources towards the introduction of new nursing practice guideline representations.

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# Appendix A – Demographic Questionnaire

Gender (Circle one): Male Female
Age: _____
Years of nursing experience: _____
Years with BC Cancer Agency: _____
Current Position: _____
Highest level of education: _____
Highest level of nursing education:_____

# Appendix B – Computer Attitudes Questionnaire Items

Adapted from: Kaminsky, J. (2006). *PATCH Scale*. Retrieved March 13, 2013, from Canadian Nursing Informatics Association: http://cnia.ca/journal/PATCH_scale.pdf

1. The computer is a powerful enabling tool.

2. In healthcare, computers could save a lot of paperwork.

3. Machines and I don't mix.

4. I feel I am a skilled typist.

5. I feel alarmed when I think of using a computer.

6. I have excellent finger dexterity.

7. I regularly use a computer at home.

8. I would love to be a proficient user of computers.

9. Bedside computers will irritate clients.

10. I will never feel relaxed about using a computer.

11. Computers can help me to be creative.

12. I would enjoy learning course work using a computer program.

13. Computers are frustrating to use.

14. Listening to people using computer jargon intimidates me.

15. Computers will someday put health professionals out of a job.

16. I am in control when I use a computer.

17. I relate well to technology and machines.

18. I feel confident that I can master using a computer.

19. I can let my creativity flow when writing using a computer.

20. Computers in healthcare will create more work for nurses.

21. Computers can be great problem solving tools.

22. Computers are too complicated for me to learn well.

23. Computers are impersonal and dehumanizing.

24. The future promise of computers in healthcare excites me.

25. I feel restless and confused when I think of using a computer.

26. I don't intend to own a home computer.

27. I feel a computer course in nursing is totally unnecessary.

28. People who like computers are introverted and antisocial.

29. I know more about computers than most faculty do.

30. Working with computers is boring and tedious.

31. I can easily master the content of a computer lessons.

32. I feel ambivalent about computers and technology.

# Appendix C – Case Scenarios

Adapted from: (M. Alford, personal communication, April 27, 2010)

Case 1: Celia Brown

Celia Brown is a 46 year old woman with Stage III ovarian cancer. She received her second carboplatin treatment 5 days ago. About a day after this treatment, Celia started feeling nauseous and began vomiting. She has been drinking ginger ale, but all other food will not stay down. She says that she vomits about 4 times per day about one half of a cup in quantity. Her nausea is persistent throughout the day but gets worse when she thinks about eating or when she thinks about her next chemotherapy visit. She also mentioned that the smell of the clinic makes her feel sick. She admits that she is an easily squeamish person, but remembered that she felt fine prior to her chemotherapy treatment. Celia believes that her medications are contributing to her nausea and vomiting, so she stopped taking her decadron as prescribed. Her pulse is rapid and she has lost 5lbs since her last visit. Her skin is dry and her eyes appear sunken. Her urine is concentrated. Her bowel sounds are normal and she states she had a bowel movement last night. She says her nausea is 5/10 in severity at the present moment, but has been as bad as 8/10 at it's peak.

Case 2: Sam Chen

Sam Chen is a 66 year old man with nasopharyngeal cancer. He is on dual modality treatment consisting of Cisplatin chemotherapy and radiation therapy. He's had 3 cycles of chemotherapy and is in his radiation therapy review session. He asks the nurse if the heater is on because he feels very hot. He also says 'he isn't feeling himself'. He wonders if he feels this way due to his small intake of foods over the past few days. He mentions that all he can eat is yoghurt because of how sore it is to swallow other foods. He says

wonders why the Tylenol isn't working and states that he took three doses yesterday and once again in the morning. He admits that he often forgets to brush his teeth. He has not taken his temperature and claims that he does not know how to do that. He thought that he could take Tylenol and try to 'sleep it off', but found sleeping difficult because he was too hot and his heart was beating quickly. His pulse is 100 and his temperature is 38.5 degrees Celsius. His breathing is normal and he has no respiratory symptoms. His throat is red but has no broken lesions. The skin over his radiation therapy site is red and moist. His ANC results are 1.3 and he has lost 4lbs in the last week.

# Appendix D – PDF Symptom Management Guideline Fever and Neutropenia

BCCA Professional Practice Nursing. (2005). *Symptom Management Guidelines*. Retrieved July 24, 2013, from BC Cancer Agency: http://www.bccancer.bc.ca/HPI/Nursing/References/SystemManagementGuidelines/default.htm


## Professional Practice Nursing Standards – Symptom Management Guidelines
## FEVER AND NEUTROPENIA

**The Symptom Management Guidelines Developed by Professional Practice Nursing and Interdisciplinary colleagues at the BCCA are currently being reviewed and will be updated in 2011**

| Definition | |
|---|---|
| • **Febrile neutropenia:** an oral temperature ≥ 38° C **AND** ANC <1.0 X $10^9$/L.<br>• **Fever:** a single temperature reading ≥ 38.3° C (100.9 ° F) **OR** a temperature ≥ 38 ° C (100.4 ° F) which lasts more than one hour.<br>• **Infection:** symptoms caused by the multiplication of microscopic organisms and subsequent invasion of the body's natural barriers. Organisms may have a bacterial, viral, fungal, or parasitic origin.<br>• **Neutrophils:** one of five white blood cells and the most abundant type. They are phagocytes, normally found in the blood stream, but migrate to sites of acute inflammation. The lower the neutrophil count, the greater the risk of infection.<br>• **Neutropenia:** an abnormally low number of neutrophils in the blood. Neutropenia is further described as mild, moderate or severe, based on the absolute neutrophil count (ANC). | |
| **Causative Factors of Neutropenia** | |
| **Cancer Related & Cancer Treatment Related** | • Chemotherapy agents may reduce the number and function of neutrophils<br>• Monoclonal antibodies (e.g. alemtuzumab)<br>• Serum albumin level < 35 g/L<br>• Occurrence of febrile neutropenia in previous course of therapy<br>• Cancers that affect bone marrow (e.g. lymphoma, leukemia or myeloma)<br>• Solid tumors may outgrow blood supply, causing necrotic areas<br>• Extensive radiation to bone marrow containing bones (e.g. pelvis, legs, and sternum)<br>• Stem cell transplants - at risk for severe, prolonged neutropenia |
| **Other** | • Age – patients ≥ 65 years are at a higher risk<br>• Certain ethnic groups (e.g. African-Americans, Yemenite Jews, Ethiopians and certain Arabs) have a normally slightly lower ANC<br>• Co – morbidities; AIDS, hypersplenism, congenital and cyclic neutropenia, chronic diseases (e.g. emphysema, chronic obstructive pulmonary disease (COPD), cerebrovascular disease, congestive heart failure (CHF), diabetes, tuberculosis or other pre-existing infections (e.g. viral, bacterial, fungal, rickettsial, protozoal)<br>• Vitamin deficiencies (e.g. vitamin $B_{12}$ or folic acid)<br>• Aplastic anemia and autoimmune neutropenia<br>• Hemodialysis<br>• Dehydration<br>• Hypotension<br>• Medications including some: antiarrythmics, antibiotics, anticonvulsants, antifungals, antihistamines, antihypertensives, anti-inflammatories, antimalarials, antithyroids, cardiovascular agents, diuretics, gastrointestinal agents, hypoglycemic agents, immunosuppressants, phenothiazines, and psychotropic drugs. |

| Causative Factors of Infection in Patients with Neutropenia | |
|---|---|
| **Factors Related to Infection** | • Immunosuppression<br>• Prior infection and /or antibiotic use in the last 90 days. Herpes Simplex Virus (HSV) reactivation in immunocompromised patients may be as high as 75%.<br>• Chemotherapy induced mucositis may cause endogenous flora in the oral or gastrointestinal tract to enter the bloodstream (sepsis).<br>• Obstruction of the lymphatic system, biliary tract, bronchial, gastrointestinal or urinary systems by tumours or secondary to surgical procedures.<br>• Graft versus host disease - may be at higher risk of developing fungal infections up to 6 months after transplant. |
| **Factors Related to Infection** | • Presence of open wounds, catheters or drains (e.g. bladder catheter, central venous catheters, intravenous lines, feeding tubes, nephrostomy tubes).<br>• Inpatient hospital treatment may contribute to higher risk of febrile neutropenia than treatment in outpatient setting due to potential exposure to pathogens during hospital stay. |
| **Consequences** | |
| • **Febrile neutropenia** is considered an **ONCOLOGICAL EMERGENCY** which if left untreated, can quickly lead to **sepsis, acute respiratory distress syndrome and/or septic shock.** See Appendix A for signs and symptoms of sepsis and septic shock.<br>• Severe or prolonged neutropenia increases patient risk of infection. Neutropenia lasting 7 to 10 days poses a moderate risk and greater than 10 days poses a high risk.<br>• Chemotherapy dose delays, reductions, or discontinuation of treatment. | |

| Focused Health Assessment | | |
|---|---|---|
| **GENERAL ASSESSMENT** | **SYMPTOM ASSESSMENT** | **PHYSICAL ASSESSMENT** |
| **Contact & General Information**<br>• Physician name – oncologist, family physician<br>• Pharmacy<br>• Home health care<br>• Other health care providers<br>• Allergies<br><br>**Consider Causative Factors**<br>• Cancer diagnosis and treatment(s) – note type and date of last treatment<br>• Post BMT<br>• Medical history<br>  – Recent infections, antibiotic therapy<br>  – Recent reports of diarrhea, constipation, vomiting, dysphagia, urinary symptoms<br>• Medication profile<br>• Review recent lab, diagnostic reports | **Normal**<br>• Refer to pretreatment nursing or oncology assessment<br><br>**Onset**<br>• When did symptoms begin?<br><br>**Provoking / Palliating**<br>• What makes it better? Worse?<br><br>**Quality (in last 24 hours)**<br>• Can you describe your symptoms?<br>• What is your temperature? For how long?<br><br>**Region / Radiation**<br>• Where are your symptoms? | **Vital Signs**<br>• Include temperature, pulse, respiratory rate, blood pressure, oxygen saturation<br>• Frequency – as clinically indicated. If severe neutropenia, presence of fever or infection then every 4 hours and prn |

| Focused Health Assessment – Continued... | | |
|---|---|---|
| **GENERAL ASSESSMENT** | **SYMPTOM ASSESSMENT** | **PHYSICAL ASSESSMENT** |
| *** Special Consideration*** <br><br> **High Risk Indicators Requiring Medical Consultation:** <br>• Recent chemotherapy / radiation with regimen of high risk for febrile neutropenia <br>• Post BMT <br>• Fever > 38° C for more than 1 hour <br>• Chills, rigors <br>• Poor performance status – profound weakness, fatigue <br>• Change in mentation / alertness <br>• Diarrhea, cough, dyspnea, chest or abdominal pain, headache, stiff neck, rash <br>• Age > 65 <br>• Potential for infection (Central vascular devices, intravenous lines, prosthetic devices such as cardiac valves) <br>• Recent or current infection <br>• Prior febrile neutropenia | **Severity / Other Symptoms** <br>• Have you been experiencing any other symptoms: <br>– Chills, sweating? <br>– Shortness of breath? <br>– Cough, with sputum? (What colour?) <br>– Fatigue or feeling of unwellness (malaise)? <br>– Mouth sores or sore throat? <br>– Burning/urgency/frequency of urination? <br>– Vaginal discharge? Itching? <br>– Constipation/diarrhea? <br>– Any areas of redness/ swelling/pain? <br>– Recent blood transfusion? <br>– Recent travel or exposure to sick individuals? <br><br> **Treatment** <br>• Using any antipyretics? If so, what type? <br>• Any other medications or treatments? (e.g. anti-diarrheals, anti-emetics, analgesics, granulocyte colony-stimulating factors) <br><br> **Understanding / Impact on You** <br>• How much are you eating or drinking? <br>• What do you believe is causing these symptoms? <br>• How is this affecting you? | **Systems Assessment** <br>• Assess presence of shaking (rigors), chills, diaphoresis <br>• Assess level of consciousness and orientation <br>• Assess skin and oral mucosa for signs of infection <br>– Note any areas of redness, swelling, pain, warmth, impaired skin integrity, exudate <br>• Assess respiratory tract: <br>– Respiration – note ease, presence of adventitious sounds <br>– Cough – note quality of phlegm, duration of cough or phlegm production <br>– Sinuses – assess for sinus congestion, tenderness, unilateral eye tearing or facial swelling, bleeding, periorbital cellulitis <br>– Nares – assess for ulcerations, drainage <br>• Assess any drains and catheters (e.g. central vascular device, bladder catheters) for function and signs of infection <br>• Assess other systems pertinent to patient recent medical history |

| NEUTROPHIL GRADING SCALE (Adapted NCI CTCAE Version 3.0) | | | | |
|---|---|---|---|---|
| GRADE 0 | GRADE 1 (Mild) | GRADE 2 (Moderate) | GRADE 3 (Severe) | GRADE 4 (Life threatening) |
| Normal ANC | <Normal ANC - 1.5 X $10^9$/L | ANC <1.5 – 1.0 X $10^9$/L | ANC <1.0 – 0.5 X $10^9$/L | ANC <0.5 X $10^9$/L |

| Management of Neutropenia |
|---|
| GRADE 0 – GRADE 1 |

↓

| NON – URGENT: Support, teaching & follow-up care as required | |
|---|---|
| Patient Care and Assessment | • Review cancer treatment and potential for neutrophil count to be affected. Advise patients when their nadir is likely to occur.<br>• Not all patients with neutropenia exhibit a fever in the presence of an infection (e.g. elderly, patients on corticosteroids). These patients may have hypothermia, hypotension, confusion or other signs of clinical deterioration.<br>• Maintaining adequate hydration and nutrition incorporating protein, vitamin B and C during treatment assists with maintaining skin integrity. Dehydration and poor nutrition can cause skin dryness and dry desquamation which may lead to possible site for infection and inability for bone marrow to function properly.<br>• If Grade 1 neutropenia, consult with physician if patient on active chemotherapy treatment. An interruption of treatment until neutrophil count returns to ≥1.5 X $10^9$/L (or within specified limits for the protocol) may be required and possible dosage reduction for further cycles. Refer to specific chemotherapy protocols for detailed direction: http://www.bccancer.bc.ca/HPI/ChemotherapyProtocols/default.htm |

## Management of Neutropenia

GRADE 0 – GRADE 1 – Continued...

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### NON – URGENT:

Support, teaching & follow-up care as required

| | |
|---|---|
| **Recommendations for Prevention of Infection** | • Review skin and oral care and hygiene recommendations with patient and family. Reinforce importance of self – care and compliance with recommendations to help prevent the development of infectious complications.<br>– Keep body clean by bathing daily. Practice hand hygiene using soap and warm water or an antiseptic hand sanitizer prior to handling foods, before and after eating, after using the washroom, coughing or sneezing in hands. Ensure hands are properly dried. Avoid touching face and mucous membranes as much as possible.<br>– Keep mouth clean by brushing with a soft toothbrush at least twice daily. For detailed oral hygiene recommendations, see Oral Mucositis SMG http://www.bccancer.bc.ca/HPI/Nursing/References/smgs.htm<br>– Use an electric shaver rather than a razor for shaving.<br>• Safe food handling methods:<br>– Ensure cold foods are kept cold and hot foods<br>– Wash all fresh fruits and vegetables thoroughly<br>– During periods of severe neutropenia, some oncologists may recommend avoiding: raw or rare cooked meats, seafood, eggs; unpasteurized juices or cheese; unwashed raw fruits or vegetables.<br>• Avoid handling pet feces, including fish tanks, bird cages and cat litter boxes. Use caution when playing with pets to avoid injury to skin.<br>• Encourage the patient and family members to have a flu shot in the fall and other immunizations as indicated (for patient who have lymphoma or have had/will have a splenectomy).<br>– Patients should be vaccinated at least 2 weeks before receiving chemotherapy or immunosuppressive therapy, administering on the same day as chemotherapy is not advised.<br>– Patients having chemotherapy or radiation therapy should not receive live attenuated vaccines unless instructed by physician.<br>• Avoid large crowds or anyone with signs of infection (e.g. chicken pox, measles, cold, flu, and shingles) especially during nadir (typically 7 to 14 days).<br>• Advise patients to inform dentist of current treatment (e.g. chemotherapy) prior to any dental treatment and to limit treatment, if possible, to periods when counts will be higher (within a couple of days of chemotherapy treatment).<br>• Avoid constipation and straining to prevent trauma to the rectal tissue. Do not use suppositories and/or enemas when neutrophil count low unless advised by physician.<br>• Advise patients to use a water-soluble lubricant during intercourse. If unsure of partner disease status, use lubricated condoms to protect against sexually transmitted diseases. If severely neutropenic, check with health care team to determine if intercourse should be avoided during this time. |
| **Pharmacological Management** | • Antibiotic prophylaxis may be considered in patients with expected duration of neutropenia (Grade 3 or higher) for more than 7 days or for patients receiving immunosuppressive regimens (e.g. systemic corticosteroids).<br>• Antifungal prophylaxis may be recommended for high risk patients (e.g. those with acute leukemia and stem cell transplantation).<br>• Granulocyte colony stimulating factor (GCSF- e.g. filgrastim, pegfilgrastim) may be prescribed prophylactically following at least 2 episodes of chemotherapy induced neutropenia. |

## Management of Neutropenia

### GRADE 0 – GRADE 1 – Continued...

**NON – URGENT:**
**Support, teaching & follow-up care as required**

| | |
|---|---|
| **Patient Education and Follow-Up** | • Demonstrate to patients how to perform regular temperature checks and to keep a record at home.<br>• Provide contact information and access to resources.<br>• Teach patients signs and symptoms of infections. When a patient is neutropenic, the usual signs of infection may not be present.<br>• Patients to notify doctor and/or nurse immediately if:<br>– Oral temperature ≥ 38.0° C. (Do not take acetaminophen, ibuprofen, or acetylsalicylic acid for fever unless advised by physician).<br>– Cough with or without sputum<br>– Sore throat or sores in mouth<br>– Any areas of redness or swelling<br>– Loose or liquid stools or constipation<br>– Increased frequency or burning with urination<br>– Vaginal drainage or itching<br>– Flu-like symptoms - body aches, general fatigue<br>– Chills, sweating, shortness of breath, changes in mental status<br>• Document assessment, intervention, and follow-up plan<br>• Communicate to health care team as appropriate |
| **Possible Referrals** | • Patient Support Centre<br>• Telephone Care for follow – up |

### GRADE 2 - GRADE 3

**URGENT:**
**Requires medical attention within 24 hours**

| | |
|---|---|
| **Patient Care and Assessment** | • Consult with physician if patient:<br>– On active chemotherapy treatment, may require interruption of treatment until toxicity returns to Grade 0 or 1 and possible dosage reduction for further cycles. Refer to specific chemotherapy protocols for detailed direction: http://www.bccancer.bc.ca/HPI/ChemotherapyProtocols/default.htm<br>– Requires further evaluation and assessment in an ambulatory setting. Follow-up is recommended for any positive cultures, persistent fever lasting 3 to 5 days, subsequent infection, adverse events, or if unable to continue prescribed antibiotic regimen.<br>• Lab and diagnostic testing:<br>– Review most recent lab reports.<br>– Lab or diagnostic tests that may be ordered: complete blood count, blood cultures, creatinine, electrolytes and liver function tests, stool or urine cultures, throat or skin swabs, chest x-ray.<br>• If there is an alteration in skin integrity, a dressing and/or topical agents may be indicated.<br>• Clinical features that may contribute to poorer outcomes are prolonged neutropenia (>7 to 10 days), profound neutropenia (ANC <0.1 X $10^9$/L), age greater than 65 years, uncontrolled primary disease, pneumonia, hypotension, multi-organ failure, invasive fungal infections, mucositis (Grade 3 or 4) or being hospitalized when fever develops. |

**GRADE 2 - GRADE 3 – Continued...**

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| URGENT: Requires medical attention within 24 hours | |
|---|---|
| **Pharmacological Management** | • May require new or change in prescription for anti-infective agents (oral, IV), analgesics, granulocyte colony stimulating factor (GCSF - e.g. filgrastim, pegfilgrastim).<br>• Review prescribed medications with patient.<br>• Avoid use of medications per rectum (e.g. suppositories, enemas).<br>• **See BCCA Antibiotic Guidelines for Febrile Neutropenia:** http://www.bccancer.bc.ca/NR/rdonlyres/C1C1A030-F603-4E33-B375-FF0F35F24BA0/31062/FebrileNeutropeniaGuidelines2008Nov1.pdf |
| **Patient Education and Follow-Up** | • Reinforce with patients how to perform regular temperature checks and to keep a record at home<br>• Provide contact information<br>• Patients to notify doctor or nurse immediately if:<br>– Temperature ≥ 38.0° C. (Do not take acetaminophen, ibuprofen, or acetylsalicylic acid for fever).<br>– Cough with or without sputum<br>– Sore throat or sores in your mouth<br>– Any areas of redness or swelling<br>– Headache, stiff neck or rash<br>– Loose or liquid stools, constipation<br>– Increased frequency or burning with urination<br>– Vaginal drainage or itching<br>– Flu-like symptoms - body aches, general fatigue<br>– Chills, sweating, shortness of breath, changes in mental status<br>• Document assessment, intervention, and follow -up plan<br>• Communicate to health care team as appropriate |
| **Possible Referrals** | • Home Health Nursing<br>• Patient Support Centre<br>• Telephone Care for follow-up<br>• Physician, Oncologist |

**GRADE 4**
**AND/OR**
**Presence of Temperature (T ≥ 38.3 °C OR ≥ 38 °C lasting more than one hour)**

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| **EMERGENT:**<br>**Requires IMMEDIATE medical attention** | |
|---|---|
| **Patient Assessment and Care** | • Have patient go to nearest emergency department or ambulatory setting as soon as possible for further assessment to determine whether a hospital admission is required (Low risk, reliable patients may be able to be treated as an outpatient with close follow-up). Notify oncologist of assessment and facilitate arrangements as necessary.<br>• If on active treatment, will require chemotherapy dosage reductions, delays or discontinuation of treatment. Refer to specific chemotherapy protocols for specific direction: http://www.bccancer.bc.ca/HPI/ChemotherapyProtocols/default.htm<br>• Lab and diagnostic testing:<br>– Review most recent lab reports.<br>– Lab or diagnostic tests that may be ordered: complete blood count, blood cultures, creatinine, electrolytes and liver function tests, stool or urine cultures, throat or skin swabs, chest x-ray.<br>– Assess for drug toxicities from support medications (e.g. antibiotics).<br>• Infectious Disease (ID) consult may be consulted<br>• Frequent nursing assessments including;<br>– Vital signs (every four hours and as clinically indicated)<br>– Asses for of any signs and symptoms of infection. Culture any suspect areas: infected sites, exudate or expectorants.<br>– Assess CVC and/or IV sites as they may need to be removed (e.g. CVC) or site changed (e.g. IV) if felt to be contributing to infective process.<br>– If there is an alteration in skin integrity, a dressing and/or topical agents may be indicated.<br>– Supportive care as required<br>• High efficiency particulate air (HEPA) filtration is recommended for allogeneic stem cell transplant patients and patients with prolonged neutropenia (if available).<br>• Clinical features that may contribute to poorer outcomes are prolonged neutropenia (> 7 to 10 days), profound neutropenia (ANC <0.1 X $10^9$/L), age greater than 65 years, uncontrolled primary disease, pneumonia, hypotension, multi-organ failure (hepatic and/or renal), invasive fungal infections, mucositis (Grade 3 or 4) or being hospitalized when fever develops. |
| **Pharmacological Management** | • May require new or change in prescription for anti-infective agents (oral, IV), analgesics, granulocyte colony stimulating factor (GCSF- e.g. filgrastim, pegfilgrastim). Administer medications as prescribed.<br>• Avoid use of medications per rectum (e.g. suppositories, enemas).<br>• **See BCCA Antibiotic Guidelines for Febrile Neutropenia:** http://www.bccancer.bc.ca/NR/rdonlyres/C1C1A030-F603-4E33-B375-FF0F35F24BA0/31062/FebrileNeutropeniaGuidelines2008Nov1.pdf |
| **Possible Referrals** | • Home Health Nursing<br>• Oncologist<br>• Infectious Disease Physician |

| RESOURCES | |
|---|---|
| **Cancer Management Guidelines** | **Febrile Neutropenia – Solid Tumour/Lymphoma:**<br>• Patient Assessment for Hospital Admission - http://www.bccancer.bc.ca/NR/rdonlyres/C1C1A030-F603-4E33-B375-FF0F35F24BA0/4583/PatientAssessment2.pdf<br>• Antibiotic Guidelines: http://www.bccancer.bc.ca/NR/rdonlyres/C1C1A030-F603-4E33-B375-FF0F35F24BA0/31062/FebrileNeutropeniaGuidelines2008Nov1.pdf<br>• Leukemia and BMT: http://www.bccancer.bc.ca/HPI/CancerManagementGuidelines/SupportiveCare/FebrileNeutropenia/BMT/default.htm<br>• Pain and Symptom Management: http://www.bccancer.bc.ca/HPI/Nursing/References/SupportiveCare/Pain/default.htm |
| **Chemotherapy Protocols** | • http://www.bccancer.bc.ca/HPI/ChemotherapyProtocols/default.htm |
| **Related Nursing Symptom Management Guidelines (SMG)** | • Constipation, Diarrhea, Dyspnea/breathlessness, Oral mucositis/stomatitis, Pain http://www.bccancer.bc.ca/HPI/Nursing/References/smgs.htm |
| **Patient Information** | • http://www.bccancer.bc.ca/NR/rdonlyres/C1C1A030-F603-4E33-B375-FF0F35F24BA0/31062/FebrileNeutropeniaGuidelines2008Nov1.pdf |
| **Additional Resources in BC** | • Fair Pharmacare<br>• Extended Health Plan<br>• BC Palliative Benefits Plan |

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## Appendix A: Septic Shock

| SEPTIC SHOCK<br>**EMERGENT:** Requires IMMEDIATE medical attention | |
|---|---|
| • **Sepsis:** a systemic inflammatory response to infection in the blood.<br>• **Septic Shock:** a condition caused by sepsis that leads to severe hypotension which results inadequate blood flow, impaired tissue perfusion and organ dysfunction. This is a **MEDICAL EMERGENCY** that can have a fatal outcome. | |
| **Early Signs of Septic Shock** | • Dry, warm, flushed skin<br>• Fever, chills<br>• Hypotension<br>• Tachypnea, tachycardia, widening pulse pressure<br>• Anxiety, apprehension<br>• Restlessness, confusion, disorientation, reduced mental alertness<br>• Decreased urinary output<br>• Decreased breath sounds and crackles<br>• Hyperglycemia |
| **Late Signs of Septic Shock** | • Cold, pale, clammy skin<br>• Temperature > 38°C or <36°C<br>• Hypotension<br>• Tachycardia, narrowing pulse pressure<br>• Disorientation<br>• Dyspnea, shortness of breath, cyanosis<br>• Ogliuria, anuria<br>• Lethargy, obtundation<br>• Decreased breath sounds, crackles, wheezes<br>• Hyperglycemia or hypoglycemia |

# Appendix E – PDF Symptom Management Guideline Nausea and Vomiting

BCCA Professional Practice Nursing. (2005). *Symptom Management Guidelines*. Retrieved July 24, 2013, from BC Cancer Agency: http://www.bccancer.bc.ca/HPI/Nursing/References/SystemManagementGuidelines/default.htm


## Professional Practice Nursing Standards – Symptom Management Guidelines: CANCER RELATED NAUSEA AND VOMITING

**The Symptom Management Guidelines Developed by Professional Practice Nursing and Interdisciplinary colleagues at the BCCA are currently being reviewed and will be updated in 2011**

| **Definition** | |
|---|---|
| • **Chemotherapy induced nausea and vomiting can be defined according to its type:**<br>– **Anticipatory nausea and/or vomiting:** is the occurrence of nausea and vomiting prior to a new cycle of chemotherapy. It occurs only after a previous negative experience of chemotherapy and is precipitated by the smells, sights and sounds associated with the chemotherapy administration<br>– **Acute nausea and vomiting:** may occur within the first few minutes to a few hours following chemotherapy and is usually resolved within the 24 hour time period.<br>– **Delayed nausea and vomiting** occurs more than 24 hours following chemotherapy administration.<br>**Comments:**<br>• In general, the greater amount of daily fractional doses, the increased likelihood of radiation induced nausea and vomiting.<br>• Chronic nausea and vomiting in advanced cancer patients is generally due to treatment or disease processes | |
| **Causative Factors** | |
| **Chemotherapy Agents (high risk)** | • Carmustine<br>• Cisplatin<br>• Cyclophosphamide<br>• Dacarbazine<br>• Methotrexate<br>• Procarbazine<br>• Streptozocin<br>• Biotherapy - High dose Interferon or Interleukin-2<br>• For emetogenicity of chemotherapeutic agent, see: http://www.bccancer.bc.ca/HPI/DrugDatabase/default.htm |
| **Radiation Therapy** | • GI tract, liver and the brain |
| **Medication** | • Antibiotics<br>• Opioids<br>• Opioid withdrawal<br>• NSAIDs<br>• SSRI antidepressants<br>• Iron supplements<br>• Anticonvulsants<br>• Digoxin |
| **Cancer Related** | • Gastric cancer<br>• Tumour growth in the GI tract, or CNS<br>• Brain metastases<br>• Bowel obstruction<br>• Reduced GI motility<br>• Gastroparesis, tumour or chemotherapy induced (e.g. vincristine) |

| Causative Factors – Continued... | |
|---|---|
| **Other Causative Factors** | • Vestibular dysfunction<br>• Anxiety, anticipatory nausea<br>• Hypercalcemia, hyperglycemia, hyponatremia<br>• Peptic ulcer disease<br>• Infections of the mouth, pharynx or esophagus<br>• Uremia<br>• More common in women than men<br>• More common in younger patients <50<br>• Less likely in patients with a high chronic alcohol intake<br>• Motion sickness |

| Consequences |
|---|
| • Dehydration<br>• Aspiration pneumonia<br>• Nutrient depletion<br>• Anorexia<br>• Wound dehiscence<br>• Esophageal tears<br>• Chemotherapy dose delays, reductions, discontinuations of treatment<br>• Quality of life – distress, compromised role function, decreased functional status, exacerbation of other symptoms (e.g. pain, fatigue, sleep-wake disturbance) |

| Focused Health Assessment | | |
|---|---|---|
| **GENERAL ASSESSMENT** | **SYMPTOM ASSESSMENT** | **PHYSICAL ASSESSMENT** |
| **Contact Information**<br>• Physician name - oncologist, general practitioner (GP)<br>• Pharmacy (if applicable) - name and contact information<br>• Home health care (if applicable) – name and contact information<br><br>**Consider Causative Factors**<br>• Allergies<br>• Cancer diagnosis and treatment(s) – note type and date of last treatment<br>• Medical history<br>• Medication profile<br>• Recent lab or diagnostic reports | **Normal**<br>• Did you have nausea/vomiting prior to your treatment starting?<br><br>**Onset**<br>• When did the nausea and/or vomiting begin?<br>• How many episodes of vomiting in the last 24 hours?<br><br>**Provoking / Palliating**<br>• What brings on the nausea and/or vomiting?<br>• Is there anything that makes the nausea/vomiting better? Worse?<br><br>**Quality**<br>• Describe the emesis? – Colour (visible blood, coffee ground emesis, bile)? Volume (large or small amounts)? Odour?<br><br>**Region / Radiation - NA**<br><br>**Severity / other Symptoms**<br>• How bothered are you by this symptom? (On a scale of 0 – 10, with 0 being not at all and 10 being the worse imaginable)<br>• What is the daily intake and output?<br>• Do you have nausea with or without vomiting?<br>• Have you had any other symptoms such as:<br>– Abdominal cramping? Stomach pain? Gas pain?<br>– Constipation? - When was your last bowel movement?<br>– Fever? - possible infection<br>– Dry mouth, thirst, dizziness, weakness, dark urine? – possible dehydration<br>– Blood, mucous in stool<br><br>**Treatment**<br>• What medications or treatments have you tried? Has this been effective?<br><br>**Understanding / Impact on You**<br>• Are you able to keep fluids down? What are you drinking? How much?<br>• What do you believe is causing your nausea? | **Vital Signs**<br>• Include temperature, pulse, respiratory rate, blood pressure, oxygen saturation<br>• Frequency – as clinically indicated<br><br>**Weight**<br>• Take current weight and compare to pre – treatment or last recorded weight<br><br>**Hydration Status**<br>• Assess skin turgor, capillary refill, mucous membranes<br>• Amount and character of urine<br><br>**Abdominal Assessment**<br>• Auscultate abdomen - assess presence and quality of bowel sounds<br>• Assess for abdominal pain, tenderness, distention<br><br>**Emesis Examination**<br>• Inspect emesis for colour, consistency, quantity, odour and blood |

| NAUSEA AND VOMITING GRADING SCALE<br>Adapted from NCI CTCAE (Version 3.0) | | | | | |
|---|---|---|---|---|---|
| | GRADE 0 (Normal) | GRADE 1 (Mild) | GRADE 2 (Moderate) | GRADE 3 (Severe) | GRADE 4 (Life Threatening) |
| **Nausea** | Non -symptomatic | Loss of appetite without alteration in eating habits | Oral intake decreased without significant weight loss, dehydration or malnutrition: IV fluids may be indicated <24hrs | Inadequate oral caloric or fluid intake; IV fluids, tube feedings or TPN may be indicated ≥24hrs | Life threatening consequences |
| **Vomiting** | No emesis | 1 episode in 24 hours | 2-5 episodes in 24 hrs; IV fluids may be indicated <24 hrs | ≥ 6 episodes in 24 hrs; IV fluids or TPN may be indicated ≥24hrs | Life threatening consequences |

| GRADE 0 – GRADE 1 | GRADE 2 OR<br>Nausea and Vomiting NOT resolving after 24 hours |
|---|---|

| NON – URGENT<br>Support, teaching, & follow-up as clinically indicated | URGENT:<br>Requires medical attention within 24 hours |
|---|---|
| **Patient Care and Assessment** | • Rule out other causes of nausea and vomiting. Using nursing assessment, collaborate with physician to determine if further investigation warranted.<br>• May need admission to hospital<br>• Assess prior to each chemotherapy, radiation treatment or clinic visit. If an inpatient, assess daily<br>• Lab tests that may be ordered: CBC& electrolyte profile<br>• If anticipatory nausea, consider distraction strategies such as relaxation, music, imagery or hypnosis (referral to patient and family counseling may be helpful for these interventions) |
| **Dietary Management** | • Encourage frequent small meals in a relaxing environment<br>• Eat foods cold or at room temperature. Avoid alcohol and tobacco<br>• Have someone else make the meals<br>• Diet as tolerated, encourage fluids aiming for 8- 12 glasses per day (e.g. sports drinks, broth, popsicles, water)<br>• Avoid foods or fluids that are spicy, acidic, salty, hard or crunchy<br>• Restrict fluids with meals<br>• Eat at least one hour before treatment<br>• Continue dietary recommendations until symptoms resolve<br>• **If patient unable to tolerate adequate daily fluid intake, IV hydration to replace lost fluid and electrolytes may be required**<br>• Refer to BC Cancer Agency, Nutritional Guidelines for Symptom Management: http://www.bccancer.bc.ca/HPI/NutritionalCare/SMG/default.htm<br>• Refer to Food Choices to Help Control Nausea at: http://www.bccancer.bc.ca/NR/rdonlyres/EF4DC248-7B00-4C6F-BD2C-BC271429BD6C/20806/Nausea_handout.pdf<br>• Refer to: Increasing fluid intake: http://www.bccancer.bc.ca/NR/rdonlyres/75D25772-8F87-4C8C-9BA2-8600AB07591C/9321/IncreasingFluidIntake1.pdf |

| GRADE 0 – GRADE 1 – Continued... | GRADE 2 OR<br>Nausea and Vomiting NOT resolving after 24 hours – Continued... |
|---|---|

| NON – URGENT<br>Support, teaching, & follow-up as clinically indicated | URGENT:<br>Requires medical attention within 24 hours |
|---|---|
| **Pharmacological Management** | • Avoid or discontinue any medications that may cause or exacerbate nausea and vomiting (in consultation with physician and pharmacist).<br>• Instruct patient to initiate or continue medications according to instructions given by physician or nurse.<br>• Do not lie down after eating<br>• Allow 30-60 minutes post anti-emetic before eating<br>• Types of Antiemetics that may be prescribed:<br>– Ondansetron, dexamethasone, metoclopramide, prochlorperazine during chemotherapy treatment time<br>– Aprepitant may be used to prevent nausea and vomiting post highly emetogenic chemotherapy<br>– Haloperidol<br>– Nozinan<br>– Dimenhydrinate suppository if unable to take orally<br>– Lorazepam may be prescribed for anticipatory nausea<br>• Refer to BC Cancer Agency Guidelines for Prevention and Treatment of Chemotherapy Induced Nausea and Vomiting in Adults: http://www.bccancer.bc.ca/NR/rdonlyres/8E898B5D-3F12-4623-8E32-5B3C429C58F7/34092/SCNAUSEA_Protocol_1May09.pdf |
| **Patient Education** | • Reinforce importance of accurately reporting nausea and vomiting<br>• Record onset and number of emesis occurrences per 24 hours<br>• Record fluid intake per 24 hours<br>• Review contact numbers and access to resources<br>• Reinforce with patients when to seek immediate medical attention:<br>- Temperature ≥ 38° C<br>- Blood (bright red or black) in emesis, coffee ground emesis<br>- Severe cramping, acute abdominal pain (+/- nausea & vomiting)<br>- Dizziness, weakness, confusion, excessive thirst, dark urine<br>- Projectile vomiting<br>- Nausea and vomiting not improving with recommended strategies |
| **Follow-Up** | • Patients to be re-assessed within 24 hours. If symptoms not resolved at this time, provide further recommended strategies and repeat follow – up assessment within 24 hours.<br>• Follow up options:<br>- Instruct patient/family to call back<br>- Arrange for nurse initiated telephone follow – up<br>- Physician follow – up in ambulatory care setting may be indicated<br>• Document assessment, intervention, and follow – up plan<br>• Communicate to health care team as appropriate |
| **Possible Referrals** | • Oncology Nutrition Services (dietitian)<br>• Home Health Nursing<br>• Patient Support Centre<br>• Telephone Care for follow-up<br>• Pain and Symptom Management/Palliative Care (PSMPC) |

**GRADE 3 - GRADE 4**

↓

| **EMERGENT:** Requires IMMEDIATE medical attention | |
|---|---|
| **Patient Assessment** | • Patients with Grade 3 or 4 nausea and vomiting generally require admission to hospital – notify physician of assessment, facilitate arrangements as necessary<br>• Consult with physician<br>– To rule out other causes or concomitant causes of nausea and vomiting<br>– To hold chemotherapy until symptoms resolved.<br>• Lab tests that may be ordered:<br>– Complete blood count (CBC), electrolyte profile<br>• Nursing Support<br>– Monitor vital signs (as clinically indicated)<br>– Physical assessment<br>– Accurate intake and output record, include daily weight<br>– Pain and symptom assessment and management as appropriate |
| **Dietary Management** | • IV hydration to replace lost fluids and electrolytes<br>• Enteral or parenteral nutrition (TPN) may be indicated for some patients |
| **Pharmacological Management** | • Avoid/discontinue any medications that may cause or exacerbate nausea and vomiting (in consultation with physician and pharmacist).<br>• Medications that may be prescribed intravenously:<br>– Ondansetron (Zofran)<br>– Metoclopromide<br>– Prochlorperazine (Stemetil)<br>– Haloperidol<br>– Nozinan<br>– Dexamethasone |
| **Patient Education** | • Provide support, reinforce to patients/family that nausea and vomiting can be effectively managed with prompt intervention.<br>• Continue to reinforce self care, review medications, lab /diagnostic testing with patients/family as appropriate<br>• Discharge teaching as early as possible with patient/family |
| **Possible Referrals** | • Oncology Nutrition Services (dietitian)<br>• Home Health Nursing<br>• Pain and Symptom Management/Palliative Care (PSMPC) |

| **RESOURCES** | |
|---|---|
| **Cancer Management Guidelines (Health Professional)** | • Chemotherapy Induced Nausea and Vomiting in Adults: http://www.bccancer.bc.ca/NR/rdonlyres/8E898B5D-3F12-4623-8E32-5B3C429C58F7/34092/SCNAUSEA_Protocol_1May09.pdf |
| **Cancer Management Guidelines (Patient /Public Info)** | • Nausea management: http://www.bccancer.bc.ca/PPI/copingwithcancer/symptoms/nausea/default.htm http://www.bccancer.bc.ca/HPI/DrugDatabase/Appendices/Appendix3/ManagingNauseaPtInfo/default.htm |

| RESOURCES – Continued... | |
|---|---|
| **Oncology Nutrition Services**<br>• **Patient Education Materials** | • Refer to Nutritional Guidelines for Symptom Management: http://www.bccancer.bc.ca/NR/rdonlyres/5C9BA6AE-C7EC-40FA-AAEF-2B81AA26BEE5/15439/NauseaSMG1.pdf<br>• Food choice to help control nausea: http://www.bccancer.bc.ca/NR/rdonlyres/EF4DC248-7B00-4C6F-BD2C-BC271429BD6C/20806/Nausea_handout.pdf<br>• Increasing Fluid Intake: http://www.bccancer.bc.ca/NR/rdonlyres/75D25772-8F87-4C8C-9BA2-8600AB07591C/9321/IncreasingFluidIntake1.pdf |
| **Additional Resources in BC** | Fraser Health Authority Palliative Symptom Management Guideline for nausea and vomiting: http://www.fraserhealth.ca/media/14FHSymptomGuidelinesNausea.pdf<br>• Fair pharmacare<br>• Extended health plan<br>• BC palliative benefits plan |

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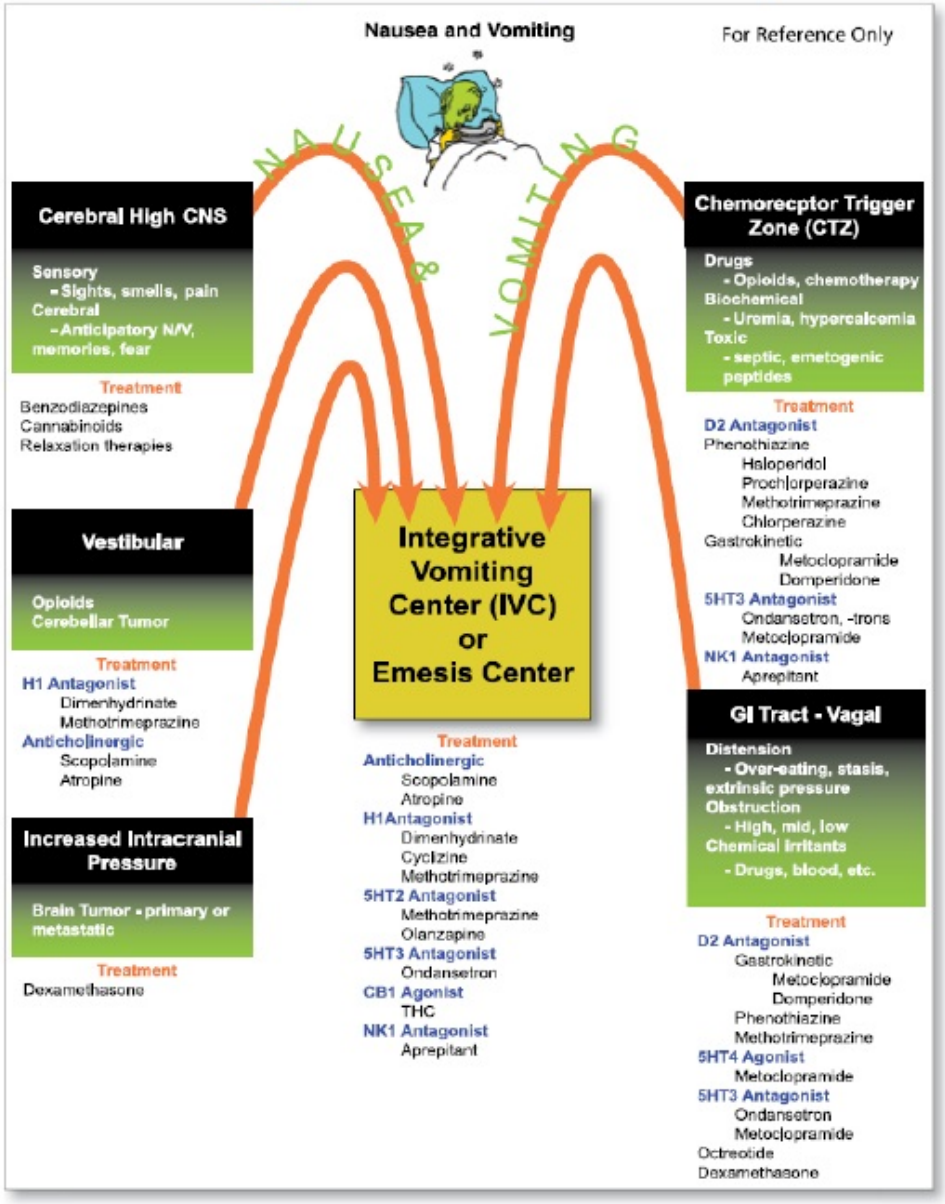
Nausea and Vomiting

Hospice Palliative Care Program • Symptom Guidelines



# Appendix F – Web Based Interactive Guideline

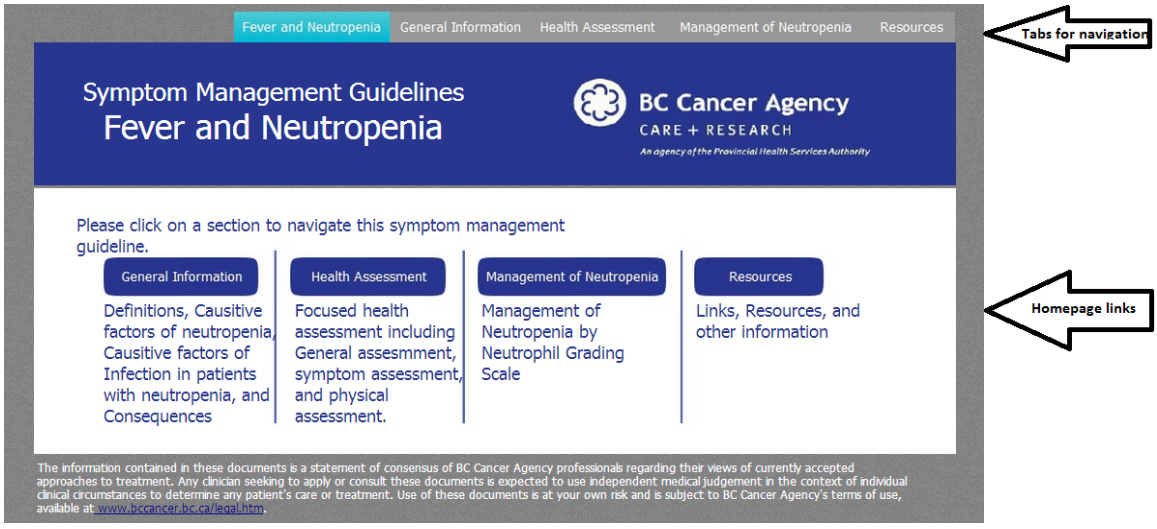



**Illustration 1: Home page**

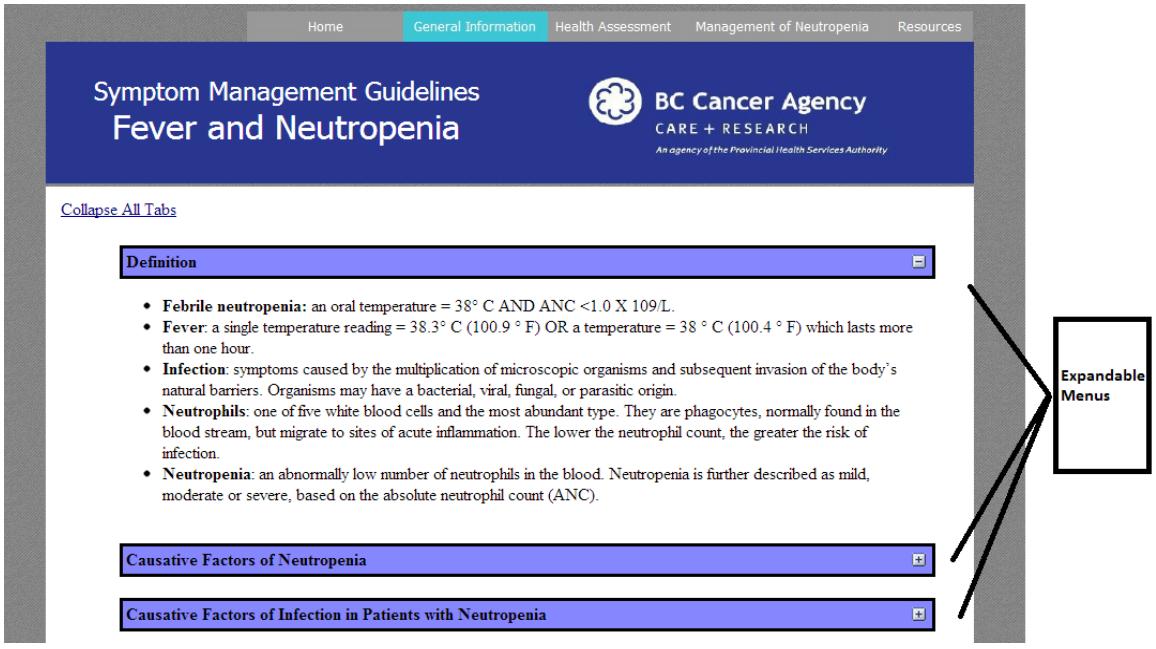



**Illustration 2: General Information**

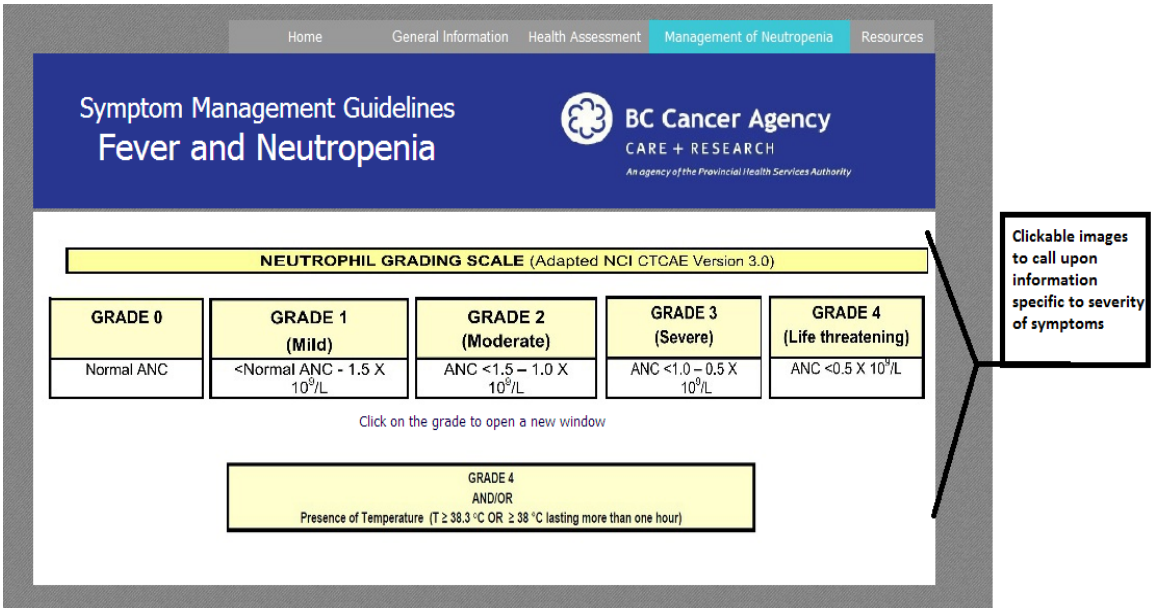



**Illustration 3: Management of Symptom**

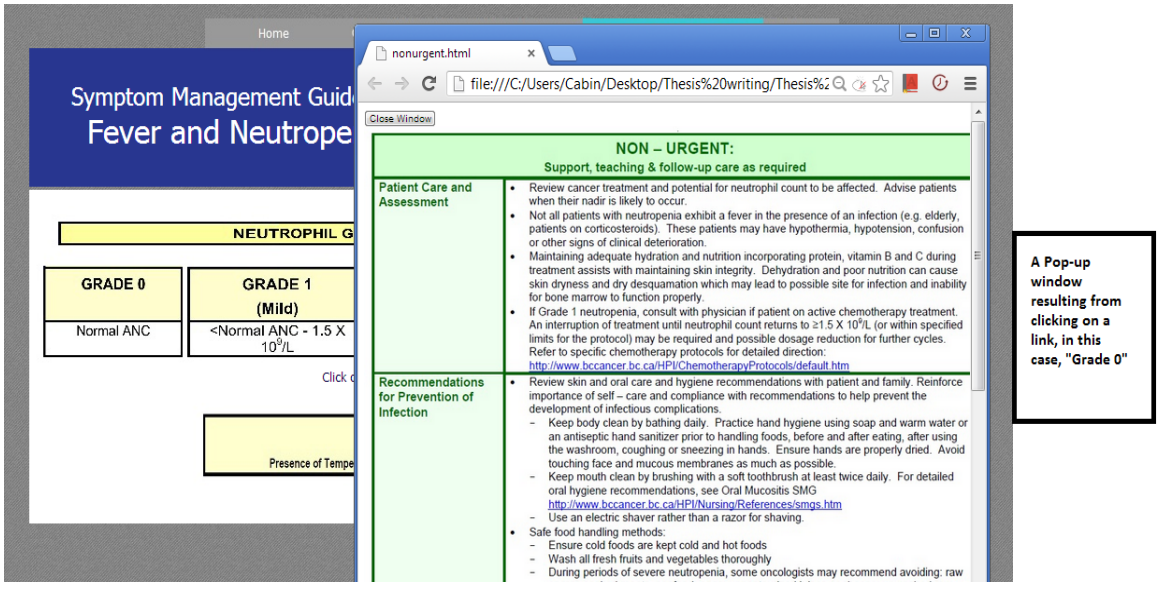



**Illustration 4: Pop-up window**

## Appendix G – Post-task Semi-structured Interview Questions

1. Do you use the Symptom Management Guidelines in practice?
2. Which practice guideline format did you prefer? Why?
3. What improvements could be made to the Dynamic WBI guideline?
4. What improvements could be made to the Portable Document Format guideline?
5. What kind of role do clinical practice guidelines play in the care you give?
6. Would an electronic clinical practice guideline format increase or decrease the role of practice guidelines in your care?
7. Regardless of the guideline format, what feedback do you have about the content of the guidelines?
8. What have been your past experiences with practice guidelines?
9. Do you have any other thoughts or comments?

# Appendix H – Q-DIO Items

Adapted from: Müller-Staub, M., Lunney, M., Lavin, M., Needham, I., Odenbreit, M., & van Achterberg, T. (2008). Testing the Q-DIO as an instrument to measure the documented quality of nursing diagnoses interventions, and outcomes. *International Journal of Nursing Terminologies and Classifications, 19* (1), 20-27

Nursing Diagnoses as Process

01 Actual situation, leading to the hospitalization

02 Anxiety and worries related to hospitalization, expectations and desires about hospitalization

03 Social situation and living environment/circumstances

04 Coping in the actual situation/with the illness

05 Beliefs and attitudes about life (related to the hospitalization)

06 Information of the patient and relatives/significant others about the situation

07 Intimacy, being female/male

08 Hobbies, activities for leisure

09 Significant others (contact persons)

10 Activities of daily living

11 Relevant nursing priorities according to the assessment

Nursing Diagnoses as Product

12 Nursing problem/nursing diagnosis is formulated

13 Nursing diagnosis label is formulated and numbered

14 The aetiology (E) is documented

15 The etiology (E) is correct, related/corresponding to the nursing diagnosis (P)

16 Signs and symptoms are formulated

17 Signs and symptoms (S) are correctly related to the nursing diagnosis (P)

18 The nursing goal relates/corresponds to the nursing diagnosis

19 The nursing goal is achievable through nursing interventions

Nursing Interventions

20 Concrete, clearly named nursing interventions are planned (what will be done, how, how often, who does it)

21 The nursing interventions affect the etiology of the nursing diagnosis

22 Nursing interventions carried out, are documented

Nursing-Sensitive Patient Outcomes

23 Acute, changing diagnoses are assessed daily or form shift to shift/enduring diagnoses are assessed every fourth day

24 The nursing diagnosis is reformulated

25 The nursing outcome is documented

26 The nursing outcome is observably/measurably documented

27 The nursing outcome shows

– improvement in patient's symptoms – improvement of patient's knowledge state – improvement of patient's coping strategies – improved self-care abilities – improved functional status (But what are reliable indicators?)

28 There is a relationship between outcomes and nursing interventions

29 Nursing outcomes and nursing diagnoses are internally related

# Appendix I – Nursing Care Plan Document Template

Client: _____ Date: _____

Progress Notes

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Care Plan

| Assessment/Diagnosis | Goals/Outcomes | Interventions | Evaluation |
|---|---|---|---|
| | | | |

Scrap/Other notes: