

NURSES' KNOWLEDGE DEFICITS IN RELATION TO DIABETES CARE:
PERCEPTIONS OF GENERAL DUTY STAFF NURSES

by

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ABSTRACT

The purpose of this study was to canvas the views of general duty staff nurses to obtain their insights regarding why many nurses have knowledge deficits in relation to diabetes, the factors they believe affect nurses' knowledge and perceptions in connection with this disease, and the strategies they think would be effective in improving nurses' knowledge in this area of care. This study begins to address the gap that is evident in the nursing literature with respect to nurses' diabetes knowledge acquisition, and application within practice.

The study was designed using interpretive descriptive research methods. Nurses, who participated in this study anonymously via the Internet and the WWW, made 849 visits to the study web site, and 2,387 to the electronic bulletin board. However, only 46 submissions to the study web page contained usable data, and 10 comments were made to the electronic bulletin board. Inductive analysis was used to explore data that were obtained.

Nurses indicated that they believe nurses have knowledge deficits about diabetes. Nurses related that several factors contribute to these knowledge deficits including practice area, initial nursing educational preparation, and participation in diabetes continuing educational inservices. Participants stated that they think nurses' knowledge deficits give rise to delays in diagnosis of diabetes; cause patients to misunderstand the disease process, essential diabetes survival skills, and dietary restrictions; bring about the generation of erroneous blood glucose results; and may lead to premature death for persons who live with diabetes. Lastly, participants suggested that nurses' knowledge could be ameliorated by placing more emphasis on diabetes instruction during nurses'

training and by ensuring that nurses take part in continuing education about diabetes on a regular basis.

The discussion of the findings of this study has highlighted many implications for nursing practice and education, and has generated a number of directions for nursing research. Additionally, this researcher's reflections about the process of conducting this study revealed many of the benefits and pitfalls that can occur when computers, the Internet, and the WWW are used as tools for data collection for research.

CHAPTER ONE

Introduction

Background to the Problem

Diabetes is a serious, chronic, systemic disease that profoundly affects life for 7% of the Canadian population (Meltzer et al., 1998). Although much of the daily treatment of diabetes and control of its symptoms rests largely with those affected (Basa & McLeod, 1995; Meltzer et al.; Sacks, 1998; Tildesley, Mair, Sharpe, & Piaseczny, 1996; Sullivan & Hunt-Joseph, 1998), persons living with diabetes must have access to knowledgeable health care professionals to become informed about diabetes and keep abreast of current care modalities (Ash & McSherry, 1997; Basa & McLeod; Baxley, Brown, Porkorny, & Swanson, 1997; Campbell et al., 1990; Carter et al., 1997; Coates & Boore, 1996; Davis, Beckman, Harris, Howe, & Steele, 1992; Drash, 1994; El-Deirawi & Zuraikat, 2001; Lipman & Mahon, 1999; Pritchard, 1996; Reid et al., 1995; Sargant, 2002; Tildesley et al.; Wakefield, Wakefield, & Booth, 1992). While every member of the health care team plays a role in the provision of care to persons with diabetes, nurses play an important role in diabetes education (Basa & McLeod; Tildesley et al.) "as they constitute the largest group of healthcare professionals who have lengthy contact with patient[s] with diabetes" (El-Deirawi & Zuraikat, p. 6). Nurses "provide care to persons across the lifespan, within a wide range of health care settings" (D'Eramo-Melkus & Fain, 1994, p. 314). As a result, nurses knowledgeable in diabetes care are critical to the ability of patients to successfully manage their diabetes and prevent diabetes-related complications (Baxley et al.; Drass, Muir-Nash, Boykin, Turek, & Baker, 1989; Sargant).

While nurses need substantial knowledge about diabetes and its treatment to ensure

that recommended diabetes care standards are met, in the past thirty years, nursing diabetes knowledge deficits pertaining to the areas of diet, medications, disease process, and basic survival skills have been reported regularly by researchers (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Funnell & Herman, 1995; Gossain, Bowman & Rovner, 1993; Hilton, 1982; Leichter et al., 1980; Lenahan, 1993; Lipman & Mahon, 1999; Rosenqvist, 1995; Sargent, 2002; Scheiderich, Freibaum, & Peterson, 1983; Wakefield et al., 1992), and persons living with the disease (Davies et al., 1992; Meltzer et al., 1998; Saudek, Rubin, & Shump, 1997). Nurses' knowledge deficits about diabetes have lead to insufficient or inaccurate information being given to persons living with the disease, and cited as a possible cause of patient non-compliance with diabetes regimes that improve glycemic control (Etzwiler; Gossain et al.; Levatan, Passaro, & Jablonski, 1998; Leichter et al.; Leggett-Frazier, Swanson, Vincent, Pokorny & Engelke, 1997; Lenahan; Lipman & Mahon; Sargent; Scheiderich et al.). Additionally, persons living with diabetes may lose trust in the advice that nurses offer about the disease because of the inaccurate information they have received in the past (Gossain et al.; Lipman & Mahon; Meltzer et al.; Sacks, 1998).

Although there has been substantial bodies of research aimed at investigating factors that affect the knowledge nurses have about diabetes, consensus about causation has not been reached. Factors that appear to affect the knowledge that nurses have about diabetes include the practice area of nursing (Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; Lenahan, 1993), the number of years of nursing service (Drass et al.; Gossain et al.; Leichter et al., 1980; Scheiderich et al., 1983), experience caring for patients with diabetes (Drass et al.; Gossain et al.; Lipman & Mahon; Sargent, 2002), the type of initial basic nursing educational preparation (El-Deirawi & Zuraikat, 2001; Gossain et al.), and the

number of diabetes continuing educational inservices the nurse has attended (Drass et al.; Gossain et al.; Leichter et al.; Sargant; Schneiderich et al). Awareness of knowledge deficits has been named as a factor that affects the knowledge that nurses have about diabetes, although only a few investigators explored this cause (Baxley et al., 1997; Drass et al.; Hilton, 1982; Lenahan).

Solutions to minimize or resolve general duty staff nurses' knowledge deficits have primarily focused on increasing the availability of diabetes information to nurses based on the basic premise that additional information will positively affect practice. One solution has been to determine and publish standards to direct nursing care of patients with diabetes (Baxley et al., 1997; Rosenqvist, 1995), and to initiate implementation in health care agencies (Ahern et al., 2000; Gilman, 2001; Jones, 2002; Walker, Engel, & Zybert, 2001). Another involves reviewing and revising the diabetes content of basic nursing education programs (Carroll et al., 1997; Maldonato, Bloise, Massimo, Fraticelli, & Fallucca, 1995). Continuing educational programs for general duty staff nurses in relation to diabetes have become increasingly accessible to nursing staff in hospitals and community health care agencies (Coles, 1995; Davies et al., 1992; Rath, Boblin, Bauann, Parrot, & Parsons, 1996; Rosenqvist). "Programs of study for advanced practice nurses" (D'Eramo-Melkus & Fain, 1994, p. 313) who wish to specialize in the care of people with diabetes are available in the United States and Canada. Workshops about diabetes are regularly offered to nurses working with specific populations, such as nurses in long term care facilities caring for elderly patients (Funnell & Herman, 1995; Parker, Leggett-Frazier, Vincent & Swanson, 1995; Tonino, 1990). Diabetes care manuals are available to most nurses within their practice settings (Dunning, 1995; O'Grady, 1995; Wyness & Favelle, 1993). A substantial number of

articles with current, relevant, and accurate diabetes-related information have been published in professional journals in the past ten years (Koyama et al., 1996; Linde, 1989; Rath et al.; Waddell, 1991, 1993). Yet, despite the wealth of diabetes educational programs and written materials available to nurses, nurses' diabetes knowledge deficits remain prevalent today (Meltzer et al., 1998).

Purpose Statement and Research Questions

Previous investigators who have examined the knowledge that staff nurses have about diabetes have focused on their own beliefs, and the beliefs of physicians, nursing administrators and educators, or a combination of opinions regarding the causes of this deficit. No research was located in which general duty staff nurses were directly canvassed for their input. In this study, I have solicited the views of general duty staff nurses as to why many nurses have knowledge deficits about diabetes; the factors they believe affect nurses' knowledge acquisition, and perceptions about diabetes; and the strategies they think would be effective in improving the knowledge that nurses have about this disease. Qualitative research methods have been used in this study to examine the phenomenon of nurses' knowledge deficit about diabetes by addressing the following research question: Why do many nurses have knowledge deficits in relation to diabetes, and its management, and what strategies can be implemented to improve nurses' knowledge about this disease? There are several research sub-questions that are generated from the main question. They are as follows:

- What factors affect the knowledge that nurses acquire and perceive about diabetes management?

- Why do many nurses have less actual than self-reported knowledge in relation to diabetes and its management, and what are strategies to resolve this discrepancy?
- What are the clinical implications and outcomes of nurses' knowledge deficits about diabetes management?
- What strategies might be effective in minimizing or resolving nurses' knowledge deficits about diabetes management?

Definitions of Terms

For the purpose of this research, the following term is defined:

General duty staff nurse: a full or part-time staff nurse in a community health care agency or hospital who has not attained diabetes specialty training, such as the training required for a diabetes educator certificate; is not employed in a diabetes specialty care area; and is presently delivering, or within the past year, has delivered patient care for at least 75% of their working time.

Significance of the Study

The practical and scientific significance of this study is that it begins to address the knowledge gap that is evident in the nursing literature with respect to general duty staff nurses' diabetes knowledge acquisition, and determine what influences nurses' application of diabetes knowledge within their practice. This study provides an insider's view of the factors that guide nurses' attainment of diabetes information and affect nurses' perceptions of knowledge about diabetes. This study also examines what nurses perceive are the clinical

implications of their knowledge about diabetes. Additionally, participating in the research has given nurses an opportunity to suggest strategies they believe will be effective in minimizing or resolving the discrepancy between nurses' actual and self-reported knowledge about diabetes management. These strategies will be disseminated to administrators and educators in health care agencies for evaluation and possible implementation. An enhanced understanding about the affects that general duty staff nurses' knowledge and perceptions of diabetes have on care will allow the development of strategies that will begin to rectify the documented knowledge deficits of this population of health care professionals. This is particularly important because while interventions to ameliorate nurses' knowledge deficits have been available for many years, none of interventions have resulted in overall improvements in nurses' diabetes knowledge.

Organization of the Thesis

In Chapter one, the background information to the research question, as well as the purpose and significance of the study have been presented. Chapter two includes a review of the related literature, my assumptions about the phenomenon under study, and a description of the theoretical framework that guides the study. Chapter three incorporates a description of, and rationale for the research design of the study, particularly the sample; the procedures for data generation and analysis; strategies to ensure rigor; ethical considerations; and limitations of the study. Chapter four focuses on the findings of the study. A discussion of how the findings of this study relate to the existing body of knowledge found in the literature, and the contribution this study makes to furthering the understanding of why general duty nurses have knowledge deficits about diabetes, and are frequently unaware of them is the

focus of the final chapter. Additionally, Chapter five includes a discussion of the implications that the findings have for general duty staff nurses, health care administrators, nursing researchers, and nursing educators. A summary of the findings of the study, and presentation of recommendations for nursing practice and research concludes the research report.

CHAPTER TWO

Fore-structure

The purpose of this chapter is to make clear the standpoint from which my research began. The literature that pertains to knowledge deficits of nurses, my professional and personal experience, and the underlying assumptions of the study are reviewed in this chapter. As well, I describe the theoretical and analytical frameworks that have been used to guide the study.

Review of the Literature

A literature search (including Medline, CINAHL, and a manual search) using such phrases as "diabetes and knowledge and nurses"; "nursing knowledge and diabetes"; "nurses' knowledge and diabetes"; "knowledge deficits and diabetes and nurses"; "nurses and knowledge and deficits"; "awareness and knowledge and diabetes"; "awareness and knowledge and nurses"; and "self-assessment and knowledge and diabetes" located several studies proclaiming that a large percentage of general duty staff nurses have knowledge deficits about diabetes (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Gossain et al., 1993; Lawrence, Dowe, Perry, Strong, & Samsa, 1989; Leichter et al., 1980; Lenahan, 1993; Lipman & Mahon, 1999; Meltzer et al., 1998; O'Brien, Michaels & Hardy, 2003; Sargant, 2002; Scheiderich et al., 1983). Several of these researchers suggested that these knowledge deficits are known to be detrimental to the health of persons living with the disease (Etzwiler; Lawrence, et al.; Levetan et al., 1998; Lipman & Mahon; Meltzer et al.; O'Brien et al.; Sargant; Scheiderich et al). Even though the early investigations about this topic are not as relevant as the more current research, an expanded

literature review reveals that general duty staff nurses have had knowledge deficits about diabetes for the past 30 years, despite numerous attempts to rectify the situation.

Nurses' Diabetes Knowledge Deficits

Etzwiler (1967) was one of the first to suggest that professional health care providers, including nurses, dietitians, and physicians, experience knowledge deficits regarding diabetes. Although Etzwiler's total number of study participants and their professions were not reported, the 289 nurses taking part in the study appeared to be drawn from six American schools of nursing. The participating nursing students, each within 2 to 4 weeks of writing their final state board examinations, were given an unspecified diabetes knowledge test. Etzwiler found that these nursing students exhibited "an appalling lack of information concerning basic concepts of diabetes mellitus.... [and Etzwiler concluded that] a great deal of the patients' lack of understanding of diabetes may stem from management by poorly informed professional personnel" (p.116).

Other investigators in this era support Etzwiler's (1967) assessment. A study by Leichter et al. (1980) suggested that many of the health care professionals they studied, including nurses, dietitians, social service personnel, and another unspecified health care provider group, had significant knowledge gaps about diabetes. Their conclusion was based on evaluation of questionnaires about diabetes completed once by 26 university hospital nurses; and administered three times over a 1 year time period to 136 "primary health care workers" (p. 1243) who had attended a symposium about diabetes in Kentucky. Even though the usefulness of the data is limited because only 37 of the health care personnel who participated during the symposium completed all three questionnaires, the scores of the hospital nurses, and the nurses completing the questionnaire at the beginning of the

symposium suggest that the nurses taking part in this study had dismaying knowledge gaps about diabetes.

Scheiderich et al. (1983) administered a Diabetes Basic Knowledge Test (DBKT) to 137 self-volunteered staff nurses from three hospitals in Midwestern United States. Although not noted by Scheiderich et al., the DBKT "was originally developed to assess patients' knowledge of diabetes" (El-Deirawi & Zuraikat, 2001). These investigators observed that a majority of the registered nurses that they evaluated utilizing the DBKT could not correctly answer the questions about diabetic dietary exchanges, side effects of sulfonylureas, the physiological effects of insulin on the body, or identify proper insulin injection sites. Although Scheiderich et al. do not suggest other clinical implications, they do cite nurses' lack of dietary knowledge as one of the primary causes for dietary non-compliance of patients living with diabetes.

The knowledge that nurses have about diabetes monitoring techniques has been assessed during several investigations. Hilton (1982) was one of the first researchers to examine the ability of nurses to perform monitoring techniques required by persons living with diabetes. She tested the capability of 76 registered nurses (5 as part of a pretest group), employed in the inpatient areas of an acute care hospital within the province of British Columbia, to carry out assessments of urine and capillary blood glucose. Hilton found that the 71 nurses involved in the study frequently did not correctly perform the "critical elements" (p. 26, 28) of the procedures used at that time to determine glycosuria or capillary blood glucose. Additionally, a large percentage of the nurses involved made errors interpreting the test results. Hilton suggests that inaccurate self-assessment of knowledge may be part of the problem, concluding that "simply because a nurse believes she is able to

conduct a urine test competently and accurately, or because she has experience in this area of practice, does not necessarily mean that she actually performs the test satisfactorily each time she does it" (p. 31).

Other researchers have indicated that because nurses do not use blood glucose monitoring technology correctly, erroneous results are obtained. In a study by Lawrence et al. (1989), the accuracy of hospital nursing staff performing blood glucose monitoring on patients, using hand-held blood glucose monitors, was assessed. Many of the 199 nurses who participated in the study obtained blood glucose results that differed from laboratory results by more than 20%, the accepted standard for range of accuracy (Meltzer, et al., 1998; Wakefield et al., 1992). Lawrence et al. suggested that because of nurses' inaccuracy in blood glucose monitoring, inappropriate medication adjustments might be made for persons with diabetes.

Improper instruction by nurses has been named as part of the reason that patients do not use self-blood glucose monitoring (SBGM) properly. Wakefield et al. (1992) evaluated the accuracy of registered nurses, patients, and family members in reading bisected and whole visual blood glucose monitoring strips. Although Wakefield et al. did not refer to the knowledge that registered nurses have about diabetes, these investigators found that the 3 nurse participants in the study underestimated the blood glucose results of the bisected strips for 20% of the readings. The nurses were more accurate with whole strips, as only 10% of these readings were underestimated. Wakefield et al. expressed concern regarding future "insulin therapy" (p. 17) adjustments made by health care professionals based on erroneous blood glucose monitoring results. Additionally, these researchers felt that improper variations in each nurse's technique led to incorrect instruction being given to those living with the

disease. The researchers suggested regular evaluation of the proficiency of nursing staff to accurately test blood glucose using visual blood glucose monitoring strips.

Baxley et al. (1997) assert that persons living with diabetes may receive unsatisfactory instruction about other aspects of their disease in addition to SBGM techniques because many nurses have knowledge deficits about diabetes. These researchers administered the DBKT developed by Scheiderich et al. (1983) to a convenience sample of 32 staff nurses who provided direct patient care at least 50% of the time in a 62 bed rural hospital in the southeastern United States. Baxley et al. found that the questions that assessed participating nurses' knowledge about essential diabetes survival skills were "among those most frequently answered incorrectly" (p. 96).

While Levetan et al.'s (1998) investigation did not single out diabetes knowledge deficits of any one professional group, these researchers suggest that the care provided to the patients who lived with diabetes, particularly at discharge, may have been different if nurses in the hospital they studied had better diabetes knowledge. These researchers did retrospective chart studies to evaluate the care rendered to hyperglycemic patients in a 750 beds, inner-city, tertiary care teaching hospital in the Midwestern United States during a one year period in the 1990s. These researchers indicated that 33% of patients with diabetes were not acknowledged as having the disease in their discharge diagnosis. Plans were not made for further diabetes testing, outpatient assistance, or diabetic self-management after discharge, although these patients exhibited obvious signs of diabetes while in hospital, and in some cases, during their hospital stay received "ongoing bedside glucose monitoring and regular insulin coverage" (p. 247).

Lipman and Mahon (1999) conducted one of the few investigations that examined the readiness of student and newly graduated nurses to care for children who live with diabetes. These investigators administered a 20-item Diabetes Knowledge Questionnaire that these researchers had developed to 45 student nurses, 55 pediatric nurses who had less than 1 year of experience, and 55 non-nursing undergraduates. While the scores of the 55 non-nursing students were understandably low, the unsatisfactory scores of both nursing groups were troublesome. These researchers state that "the inadequate knowledge of nursing students as well as nurses practicing 1 year points to a deficit either of diabetes education in nursing school or in the retention of what has been taught" (Lipman & Mahon, p. 94).

El-Deirawi and Zuraikat (2001) assessed the diabetes knowledge of registered nurses employed in a community hospital and home healthcare agency located in Pennsylvania. These investigators sent a diabetes self-report tool (DSRT) that was developed by Drass et al. in 1989, a modified version of Scheiderich et al.'s (1983) DBKT, and a demographic survey to 79 nurses. Although the response rate was low, 35.9%, the data that were analyzed suggested "nurses were not knowledgeable enough about diabetes to be actively involved in diabetes education and to provide patients with the skills needed for survival" (El-Deirawi & Zuraikat, p.10).

Sargant (2002) evaluated nurses' knowledge about dietary recommendations for persons living with diabetes. She sent a previously untested 34-item questionnaire designed to assess nurses' general knowledge about diabetes, as well as dietary management aspects of the disease, to a convenience sample of 135 nurses "attached to GP [general practitioner] surgeries within a large health community health services trust" (p. 616) located in England.

Sargent found that the 90 nurses who returned completed questionnaires "had inadequate knowledge levels to educate patients in diabetes-related issues" (p. 619).

O'Brien et al. (2003) compared the knowledge that general ward nurses and doctors who "were in their pre-registration year after completing their medical degree" (p. 258) have about diabetes. These investigators, using a previously untested 66 question survey that was developed for their study, mailed questionnaires to 143 staff nurses employed in general medical wards in a general hospital in England, and administered the questionnaire in person to a convenience sample of 27 medical staff. These researchers concluded that the knowledge about diabetes that the 105 nurses who returned the questionnaire and 27 doctors who participated in the study was "inadequate [but that].... the combined knowledge of junior doctors and general nurses complements each other" (p. 260).

Setter, Corbett, Campbell, Cook, and Gates (2003) investigated the perceptions, use, and knowledge of hemoglobin A1C values by persons who live with diabetes and home care nurses. They administered a previously untested hemoglobin A1C knowledge questionnaire developed by the investigator to a convenience sample of 26 nurses from a home healthcare agency in the Pacific Northwest; interviewed nurses to determine their perceptions of the use of the blood test; and examined 44 patient charts to gather demographic data, disease and treatment information, and ascertain A1C values. They found that while "... nurses appeared to give adequate attention to FBG [fasting blood glucose], ... A1C values were poorly understood by patients and infrequently used by home care nurses in planning and implementing care" (p. 8).

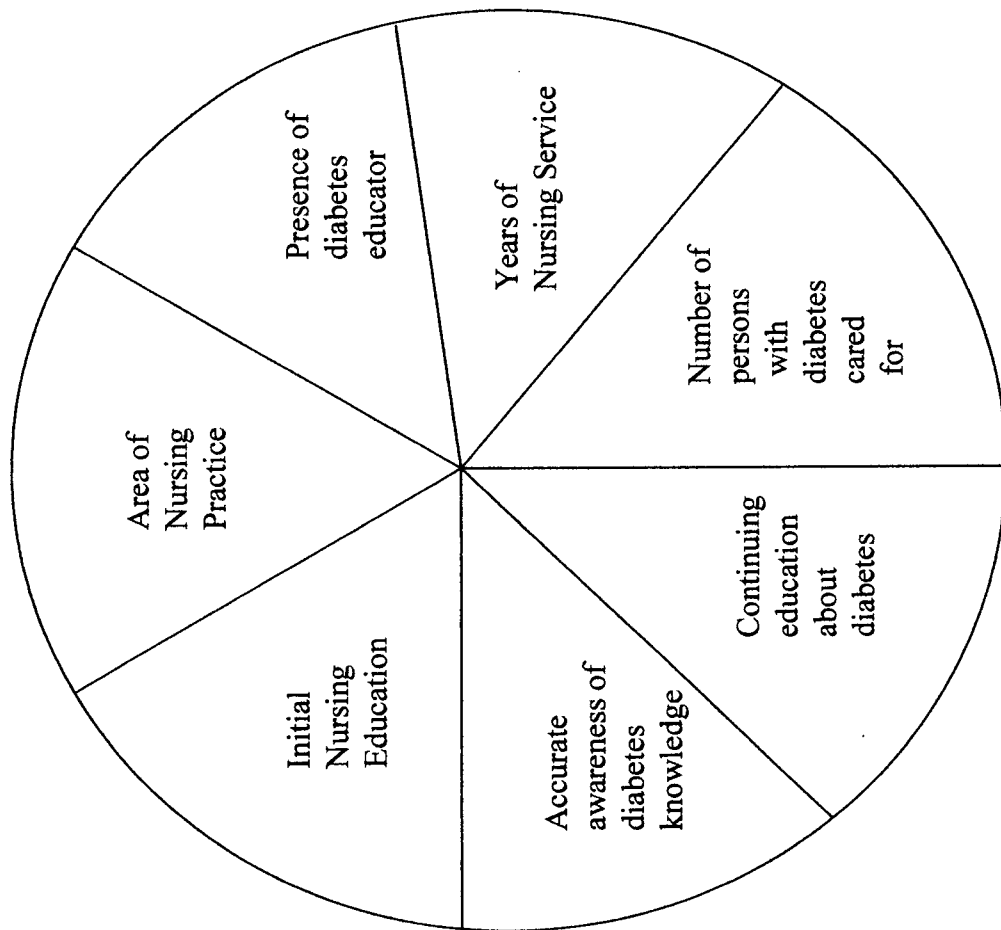
The substantial research of the past three decades indicates that nurses' have knowledge deficits about several aspects of diabetes. While these deficits have been

established, consensus has not been reached about what factors affect the knowledge that nurses have about diabetes, what methods are most effective to ameliorate the situation, or what the clinical implications of nurses' knowledge deficits are. Additionally, the clinical implications and outcomes of the discrepancy between actual and self-reported knowledge about diabetes management have not been fully explored.

Factors Affecting Nurses' Knowledge of Diabetes

Factors that are thought to affect the knowledge that general duty staff nurses have about diabetes are depicted in figure 1. Researchers often suggest their own theories; rely upon the opinions of nursing administrators, nurse educators, physicians, or a combination of administrative and medical personnel; utilize qualitative questionnaires; as well as employ demographic information to explain why nurses have knowledge deficits about this disease. Factors thought to affect nurses' knowledge about diabetes include the nurse's practice area (Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; Lenahan, 1993; Sargant, 2002); the number of years of nursing service (Drass et al.; Gossain et al.; Leichter et al., 1980; Scheiderich et al., 1983); the number of patients with diabetes that a nurse has cared for (Drass et al.; Gossain et al.; Lipman & Mahon, 1999; Sargant); the type of initial nursing educational preparation (El-Deirawi & Zuraikat; Gossain et al.); the presence of a certified diabetes educator within a health care institution (Adams & Cook, 1994; El-Deirawi & Zuraikat; Gossain et al.; Lipman & Mahon; Scheiderich et al.); and the number of diabetes continuing educational inservices the nurse has attended (Baxley et al., 1997; Drass et al.; El-Deirawi & Zuraikat; Gossain et al.; Leichter et al.; Sargant; Schneiderich et al.). Although only evaluated in a few studies, lack of awareness has been named as a factor that contributes

Figure 1: Factors that Affect the Knowledge that a Staff Nurse Has About Diabetes



to the knowledge deficits of nurses related to diabetes (Baxley et al.; Drass et al.; Hilton, 1982; Lenahan).

Gossain et al. (1993), and Baxley et al. (1997) found no difference on the diabetes knowledge test scores between nurses practicing in different areas of health care, but Drass et al. (1989), Lenahan (1993), El-Deirawi and Zuraikat, (2001) and Sargant (2002) declared the area of practice made a significant difference. Drass et al. observed that nurses working in outpatient settings had significantly higher diabetes knowledge scores than nurses who worked in inpatient areas. Lenahan determined that hospital nurses as a group had higher scores than the community health nurses she studied but that the areas of nursing practice within hospital were not significant. Gossain et al. found no difference between the knowledge scores of nurses employed in either the outpatient or inpatient departments, or in any of the various hospital departments, although they did find that staff nurses' diabetes knowledge "may vary widely depending on the setting in which they practice" (p. 219). El-Deirawi and Zuraikat found that "home health nurses achieved higher scores than hospital nurses" (p. 9). Yet, Sargant suggested that nurses working in the community had "several gaps" (p. 616) in their knowledge about diabetes.

The number of years in nursing service has been identified as having an inverse relationship to nurses' diabetes knowledge (Drass et al., 1989; Gossain et al., 1993; Leichter et al., 1980), but this finding has been disputed in other studies (Etzwiler, 1967; El-Deirawi & Zuraikat, 2001; Hilton, 1982; Lenahan, 1993; Lipman & Mahon, 1999; Sargant, 2002). Scheiderich et al. (1983) did not analyze the effect that the number of years a nurse had been employed in nursing had on diabetes knowledge but suggested "misinformation may also

arise during the 3-6-mo [month] orientation period when new nurses are paired with older nurses who may be improperly informed or not current in knowledge" (p. 60).

A slightly positive correlation was found by some researchers between the number of patients living with diabetes that a nurse had cared for and the nurse's knowledge of diabetes (Drass et al., 1989; Sargant, 2002). Others, however, found no relationship (Gossain et al., 1993). Baxley et al. (1997) suggested that while nurses caring for more than 4 patients with diabetes per month perceived themselves as having a high diabetes knowledge, their diabetes knowledge test scores were the same as nurses caring for fewer patients with diabetes. Sargant found that "participants who had diabetes themselves or were closely related to someone with diabetes were identified as having achieved higher scores overall" (618).

Initial basic nursing educational preparation has been thought to affect the knowledge a nurse has about diabetes. Prior to the mid-1980s, the basic educational preparation of nurses was not referred to in published research because the majority of nurses were diploma prepared. Although some researchers have observed that nurses with higher education perform better on a DBKT, other investigators assert that initial basic educational preparation is not correlated significantly to diabetes knowledge. Gossain et al. (1993) administered an updated version of Scheiderich et al.'s (1983) DBKT, and diabetes self-report tool to a "representative sample" (Gossain et al., p. 218) of staff nurses working at three university-affiliated, community hospitals in the Lansing, Michigan area. Fifty-five percent of the 127 nurses involved in their study had associate degrees in nursing, 22% had diplomas, 19% had a bachelor's degree, and 4% had a master's degree. Even though this study was not initially designed to determine the effect of nursing education on knowledge related to diabetes, and the sample may not be a true representation of the nursing staff because participation in the

study was voluntarily, Gossain et al. observed "that baccalaureate and masters level education may prepare nurses better regarding diabetes education" (p. 216). El-Deirawi and Zuraikat (2002) findings also suggested, "that nurses' level of education was positively correlated with their level of knowledge about diabetes" (p. 10). Yet Baxley et al.'s (1997) findings contradict these conclusions. Baxley et al. asserted that the type of initial basic educational preparation was not correlated significantly to diabetes knowledge.

In several studies, the majority of nurses who scored lower on the diabetes knowledge tests had, for the most part, not participated in diabetes continuing education in the preceding six months (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2002; Gossain et al., 1993; Leichter et al., 1980; Sargant, 2002; Scheiderich et al., 1983). In fact, the number of continuing educational inservices attended is the factor most often credited as having the greatest positive impact on the knowledge that a nurse has about diabetes. Nevertheless, Leichter et al. suggest that the improvements seen with attendance at diabetes continuing educational inservices seems to deteriorate with time. As few studies evaluate what long term impact continuing educational programs have on the knowledge of participants (Waddell, 1991), it is uncertain if a single nursing diabetes continuing educational program has any immediate, or lasting effect on subsequent nursing care of persons with diabetes.

The presence of a certified diabetes educator within a health care institution has been found to positively affect the knowledge that nurses have about diabetes by some researchers (Adams & Cook, 1994; Gossain et al., 1993), but disputed by others (El-Deirawi & Zuraikat, 2002; Lipman & Mahon, 1999; Scheiderich et al., 1983). Investigators suggest that general duty staff nurses' knowledge about diabetes is higher in institutions employing diabetes educators because diabetes educators customarily make formal and informal diabetes

inservice education available to general duty staff nurses. These researchers declare that nurses who work at health care institutions that do not employ a diabetes educator have less knowledge about the disease because they are "individually responsible for their diabetes-related education" (Gossain et al., p. 216). Other researchers dispute this conclusion. Several investigators found that the presence of a diabetes educator within an institution appeared to have a negative effect on the knowledge of nurses employed in that institution. Lipman and Mahon suggested because "diabetes questions were fielded by the diabetes educator...the staff nurses were less motivated or perceived less of a need to learn about diabetes" (p. 94). El-Deirawi and Zuraikat declared staff nurses have knowledge deficits about diabetes when an institution employs a diabetic educator because nurses "rely on the educators for teaching and care of patients with diabetes without attempting to enhance their own level of knowledge of diabetes" (p. 11).

Although only a few researchers have assessed this factor, nurses' inaccurate self-evaluation of their own diabetes knowledge has been suggested as one reason that the knowledge deficits that nurses have about diabetes continue to exist. Hilton (1982) indicated that nurses must frequently reevaluate their knowledge of diabetes monitoring techniques to ensure they are performing these procedures correctly. Drass et al. (1989) suggested from the findings of their research that not only did many nurses have significant knowledge deficits about diabetes, but also for the most part, nurses were unaware of these deficits. A convenience sample of 184 nurses, drawn from an American hospital, completed a diabetes knowledge self-assessment questionnaire and a version of Scheiderich et al.'s (1983) DBKT that Drass et al. had updated. Although participants self-assessed themselves as having high diabetic knowledge, their DBKT scores often times revealed otherwise. For example,

although 90% of the subjects stated they knew how to treat hypoglycemia, 93.5% of subjects were unable to correctly answer questions about what treatment a person living would require during a hypoglycemic episode.

Lenahan (1993) studied 159 nurses employed in public health departments and hospitals within British Columbia and similarly revealed that the nurses she studied had inaccurate self-perceptions about their knowledge about diabetes. Three hundred nurses within the province were mailed a revised version of Scheiderich et al.'s (1983) DBKT and a diabetes self-assessment questionnaire. One hundred and fifty-nine of the nurses responding had a score that ranged from 7 to 37 on a possible 45-point questionnaire. Yet, self-assessment scores demonstrated that the nurses perceived their knowledge to be higher.

Gossain et al. (1993) disagree with the findings of the investigations conducted by Drass et al. (1989) and Lenahan (1993). Although Gossain et al.'s observations may be based on biased data because of the voluntary nature of the nurses' participation in the study, Gossain et al. found that although there were "significant deficits in diabetes knowledge among registered nurses, [nurses'] were generally aware of the content areas in which they were competent and the areas in which they were somewhat deficient" (p. 219). El-Deirawi and Zuraikat (2002) investigation support Gossain's findings. They found that participants who "scored higher on the DSRT maintained higher scores on the DBKT" (p. 9).

Although nurses in O'Brien et al.'s (2003) study were eager to receive their test scores, Drass et al. (1989) were the only investigators to indicate that revealing nurses' diabetes knowledge deficits motivated them to seek information about the disease. The staff nurses who completed a DBKT and self-assessment tool "expressed their concern over a knowledge deficit to investigators, displayed dismay over their lack of knowledge, and

requested answers to specific questions.... [and] generated an interest in acquiring current diabetes knowledge that was sustained despite a 4-mo [month] delay in posting the individual scores" (p. 355).

The research of the past indicates that nurses' knowledge about diabetes has been thought to be affected by a nurse's practice area; the number of years of nursing service; experience caring for patients living with diabetes; initial basic nursing preparation, and continuing educational participation; the employment of a diabetic educator; and accuracy of self-assessment of diabetes knowledge. However, although there have been numerous investigations into the topic, the findings of the majority of the studies are inconclusive, and no agreement has been reached as to why nurses have knowledge deficits about diabetes.

Strategies to Improve Knowledge Deficits

Many diabetes educational nursing programs that incorporate up-to-date diabetes care recommendations have been developed to improve the knowledge that nurses have about diabetes. Curricula include didactic inservices about the disease (Davies et al., 1992); traditional nursing care manuals that outline standards of care, and procedures to be followed (Dunning, 1995; O'Grady, 1997); pocket guides (Sargant, 2002); mini-residencies in diabetes care (Berkowitz, Anderson, Panayiotou, Zeimer & Gallina, 1998); workplace change agents (Davies et al.); staff quality circles (MacGuire, 1990); or a combination of strategies. Formal academic study consists of distance course work, or independent study programs about diabetes through universities or community colleges (Kersaiteis, 1997). Less formal methods involve use of professional journals widely read by general duty staff nurses (Vaz, 1988). The *Registered Nurse*, *American Journal of Nursing*, *Nursing Standard*, and in Canada, the *Canadian Nurse*, as well as non-research, clinical journals with a home health care,

administrative, medical, or clinical nurse specialty focus have published many articles with relevant, accurate, diabetes-related information in the past decade.

While the literature contains a plethora of ways to alleviate nurses' diabetes knowledge deficits, little is known about the long-term efficacy of each method to reduce knowledge deficits. Frequently, program evaluations are completed soon after implementation of a strategy, and consequently, only the short-term effects of each method are known. Waddell (1991) conducted a meta-analysis to assess the effectiveness of nursing continuing education programs in a diverse number of practice areas, including general nursing; chronic diseases such as diabetes; specialty nursing; advanced nursing practice; medication administration, and pharmacology; and new graduate orientation. Although Waddell indicates that "CNE [continuing nursing education] activity contributes to a positive change in practice" (p. 118), she admits that nursing practice changes after attending a continuing educational program may not be a forgone conclusion for all nurses. Calculations of the effect size of each of the studies indicated that almost one quarter of staff nurses participating in each of the continuing education programs did not improve or change their nursing practice after attendance. Additionally, although Waddell originally located 95 studies, she was only able to analyze 34. Waddell did not include 61 of the investigations in her analysis because the reports of these investigations did not reveal the methods of measurement that were used to determine the outcomes that the nursing continuing educational programs were thought to have had on practice.

Parker et al. (1995) also analyzed the impact that diabetic educational programs have on nursing practice. These investigators found that the nursing care offered to persons living with diabetes by nurses attending continuing educational programs about diabetes was not

improved. Reviews of the charts of nursing home residents indicated that although staff attending programs about diabetes scored higher on DBKT, the nursing home staff did not appear to utilize the diabetes-related information gained during continuing educational programs and had "no significant increases in specific behaviors related to diabetes care" (p. 544).

A myriad of strategies have been devised over the past 30 years to minimize or resolve knowledge deficits that general duty staff nurses have about diabetes. Yet, despite the wealth of information that has been readily available in a variety of forms, particularly during the past decade, general duty staff nurses continue to have knowledge deficits about diabetes.

Summary of Literature Review

There is a convincing body of literature that suggests that general duty staff nurses have knowledge deficits about diabetes. However, literature pertaining to factors that influence these knowledge deficits, and methods that can be employed to alleviate them is inconclusive. Investigations of the factors that affect the knowledge that nurses have about diabetes frequently have had contradictory findings and consequently, have not provided clear direction for remedial action. Additionally, it is uncertain if the suggested solutions have had any beneficial short or long-term effects on clinical practice. Moreover, while numerous strategies have been proposed to provide nurses with diabetes-related information, nurses' knowledge deficits about diabetes have existed for at least the past thirty years.

Available literature regarding the reasons why general duty staff nurses have diabetes knowledge deficits include theories and suggestions offered by the investigators conducting the research, nurse administrators, nursing educators, or a combination of all three. Lacking in the material are general duty staff nurses' assessment of the reasons for their knowledge

deficits, their estimation of clinical consequences that result from nurses' diabetes knowledge deficits, and their recommendations for corrective action.

The gaps in the literature relating to the factors contributing to nurses' knowledge deficits about diabetes warranted further investigation. The study I have conducted canvassed general duty staff nurses within the province of British Columbia about the existence of knowledge deficits about diabetes among nurses; for their insights into the factors they believe are contributing to the diabetes knowledge deficits that nurses have, and the clinical implications they think occur because of these knowledge deficits; and for input into methods that will alleviate general duty staff nurses' knowledge deficits about diabetes.

The Researcher's Personal Experience

My interests in the knowledge nurses have about diabetes started to develop during my professional life, after I learned about my own lack of knowledge about diabetes. In 1995, I assumed the role of chair of the clinical practice sub-committee formed to review diabetes care within the Vancouver Richmond regional health department. To prepare for my duties, I reviewed the literature that outlines the principles of diabetes management. I was dismayed to discover how little I knew about the disease, and its management, although I considered myself to be reasonably well informed about diabetes. My interest in learning about the disease was heightened when my child was diagnosed with Type 1 diabetes in 1996. I sought to correct my own knowledge deficits, and increase my ability to care for my child by preparing for the examination to become a certified diabetes educator (CDE). I first obtained my CDE designation 1998, and recertified in the spring of 2003.

My review of the literature, and personal observations that I have made persuaded me to believe that nurses are frequently not aware of their own knowledge deficits about diabetes. During my course work for my CDE, and my Master's degree in nursing, I became familiar with the literature that suggested that many general duty staff nurses have knowledge deficits about diabetes. I discovered that unawareness of the problem may be a factor. During my 28-year career as a nurse, and as a consumer of diabetes care for the past seven years, I have found that many nurses with whom I had contact had knowledge deficits about diabetes. Yet the nurses who I felt had insufficient knowledge about diabetes generally appeared to believe, as I did about my own knowledge, that they possessed sufficient knowledge about the disease.

I have found that the clinical care offered by general nurses who have insufficient knowledge about diabetes is persistently not adequate to meet the nursing care needs of patients, or those of my son. For example, after I updated my own knowledge about diabetes I noted that nursing care plans which other nurses had written suggested that glucose monitoring need only be performed weekly, contrary to the care recommended by the Diabetes Control and Complications Trial group (DCCT) and the United Kingdom Prospective Diabetes Study (UKPDS), and outlined in the standards of diabetes care (Expert Committee, 1993; Meltzer et al., 1998; Sacks, 1998; UKPDS Study Group, 1998). Additionally, I found that the strategies that many nurses had proposed for foot care, urine testing, exercise, hypo- and hyperglycemic episodes, and diet frequently were incomplete, erroneous, or both. As a mother, I have often disregarded the advice that general duty staff nurses have provided to my son or to me about diabetes, as repeatedly, the information they

offered was outdated, incomplete, inappropriate for the type of diabetes my son has, or simply incorrect.

Assumptions

The following assumptions, in addition to those that are traditionally associated with qualitative research, have been derived from the related literature and my personal experience, and are incorporated in the proposed study:

- The care offered by general duty staff nurses affects the outcomes of persons living with diabetes.
- The knowledge that most general duty staff nurses have about diabetes can be improved.
- The views that general duty staff nurses have about diabetes knowledge deficits of nurses will reveal significant findings about why these deficits exist.

Framework

Theoretical Framework

The nursing study I have conducted does not fit neatly into any of the traditional qualitative research approaches such as ethnography, grounded theory, or phenomenology. However, interpretive description, a “‘generic’ nursing approach,” (Thorne, Reimer-Kirkham & MacDonald, 1997, p. 172) is an appropriate theoretical framework for my investigation for many reasons. Firstly, interpretive research suggests that those that who live with the experience are the best data sources. Admittedly, although general duty staff nurses may not be experiencing their knowledge deficits about diabetes in the traditional sense, as they may not be cognizant of their own knowledge deficits related to diabetes; may

not be aware of the effects that their knowledge deficits have on clinical care; or both, general duty staff nurses are the individuals with the knowledge deficits, and as a result, experience their knowledge deficits on some level. Secondly, interpretive research utilizes sampling methods that make it possible to capture maximal variation of data. As the scope and magnitude of the data were unknown until after data collection was underway, the broader approach to collection that interpretive research employs assisted me to ensure that I capture, and analyze a maximal variation of pertinent information. Furthermore, interpretive research analysis procedures direct the researcher to comprehend the "overall picture" (Thorne et al., p. 174), as a technique to ensure the volume of individual data does not become overwhelming. Gaining a sense of the problem in its entirety was essential to ensuring the volume of the data did not defeat the investigative process. Finally, the beginning point of analysis for those employing interpretive research is a critical examination of the work of past researchers. The more than 30 years of literature that examines the diabetes knowledge deficits of nurses was utilized to create an analytical framework for my present research. I did not need to reexamine if general duty staff nurses have diabetes knowledge deficits, but could move to examining why this occurs, and determining what methods are most effective in improving the knowledge that nurses have about diabetes.

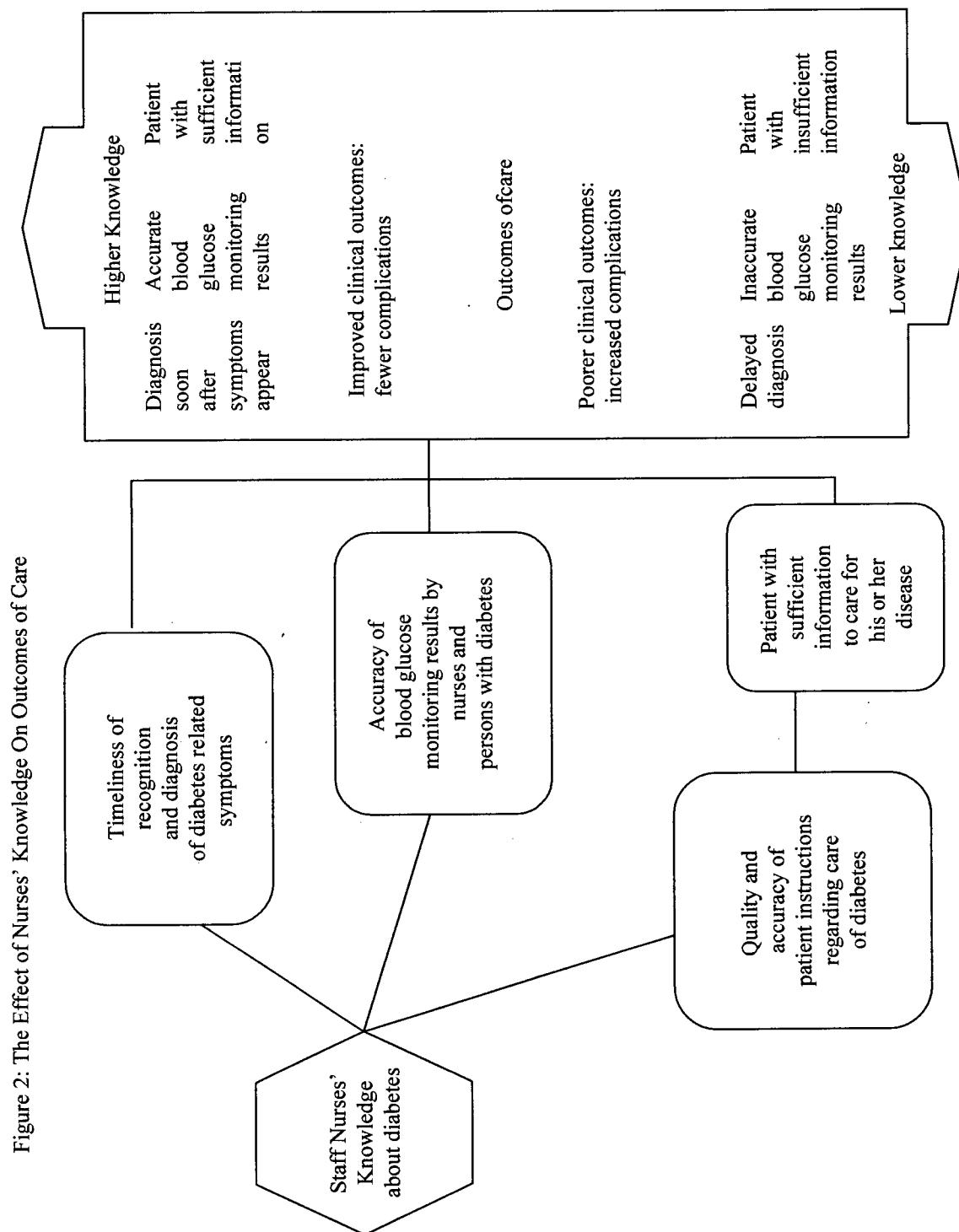
Analytical Framework

Four themes emerged from a critical examination of the existing literature, and my personal experience. These themes were the presence of diabetes knowledge deficits of general duty staff nurses, the precipitating factors that affect nurses' knowledge, the clinical implications of diabetes knowledge deficits, and strategies that are thought to be effective in minimizing knowledge deficits. The analytical framework I used as a guide at the beginning

of my study is depicted in figure 2. This framework identifies each of the factors that was named within the literature as having an affect upon the knowledge that a nurse has about diabetes, identifies the clinical areas of care that appear to be most influenced, and suggests the effect that nurses' knowledge about diabetes has on clinical care.

Chapter Summary

In this chapter, I have examined pertinent literature, outlined my professional and personal experience in the area of diabetes, acknowledged the underlying assumptions, and outlined the theoretical framework that has been used to guide the study. The analytical framework for this study is schematically diagrammed, and identifies the initial framework that was used for data collection and analysis.



CHAPTER THREE

Methods

In this chapter, descriptions of the research design; the setting and sample; the processes of data generation, collection, and analysis; and ethical issues that the study encountered are described. A discussion of the limitations of the study is also included.

Research Design

As noted previously, an interpretive descriptive design was used as a framework for this research because of the suitability of this methodology for the research question. Interpretive description design “involves the description of and interpretation about a shared health or illness phenomenon from the perspective of those who live it” (Thorne et al., 1997, p. 171). Although knowledge deficits in regard to diabetes are not specifically health or illness phenomenon, these deficits are common among general duty staff nurses, and consequently, can be thought of as shared phenomenon. Thus, a research design that can be used to describe and interpret diabetes knowledge deficits from the perspective of general duty staff nurses is appropriate.

Setting

At the beginning of the study, I assumed that few general duty staff nurses would be willing to admit publicly that they had little diabetes knowledge and that this lack of knowledge had a detrimental effect on the health care that a person living with diabetes received because of possible reprisals from employers, nursing professional regulating agencies, patients, or a combination of all parties. Consequently, I believed that nurses were

unlikely to be candid in their responses if I gathered data during face-to-face interviews or if I was otherwise aware of, or had the possibility of determining, their identities. To promote nurses' participation in the study, and to enhance the frankness of their responses, I chose to gather information from nurses utilising a milieu that provided anonymity, namely computers and the Internet via the World Wide Web (WWW).

The Internet and the WWW

The Internet is the linked network of independent computer systems that joins computers of different types and operating systems together to create a worldwide communication system (Nicoll & Ouellette, 1994; Howe, 1998). Each independent computer system connected to the Internet has the capability of becoming an Internet site. Communication routing systems transmit and receive data from one site to another error free in the original form (Gee, 1995). The routing system for the Internet is referred to as the Internet Protocol (IP). The WWW is one of the IPs that allows users to gain access to a wide range of Internet sites. Whereas the IPs of the past had limited capabilities in that only text-based information could be sent from a finite number of transmission sites to an equally limited number of destinations through a complicated process known to only a few United States military personnel, the IP known as the WWW allows the general public to transmit and receive "information of any type, from any source ... in a simple and consistent way" (Nicoll & Ouellette, p. 27).

In addition to the enhanced data capacity offered by the WWW, persons using this IP have the added advantage of remaining almost nameless, if they so desire, while gathering or exchanging information. Absolute anonymity is never guaranteed because of the public nature of the Internet. The possibility of being identified is of limited concern for most users

of the WWW, however, as affirmation of a WWW user's name is a formidable task, requiring a sophisticated knowledge of computers, and the Internet. Furthermore, in Canada, tracing an individual user of the WWW or the Internet can only lawfully be initiated through a court order.

The basic WWW unit is a web page (Howe, 1998). Visitors to a web site are able to move from one page to the next by scrolling down, or by pointing and clicking the cursor on the web button that indicates next page. A WWW page can accommodate direct connections (referred to as hyperlinks) to other WWW pages, Internet sites, or IPs. Hyperlinks are visible in web page text through the use of contrasting colour, altered font, underlining, or a combination of techniques. Clicking on a computer mouse, or pressing the enter key of the computer keyboard when a computer cursor is on a WWW hyperlink text immediately connects a WWW user to that hyperlink site.

History of Computers, and the Internet in Research Data Collection

Although computers have been used to gather raw data for medical research since 1966 (Locke et al., 1992), the use of computers and the Internet as data gathering tools and collection settings have only recently become practical (Fawcett & Buhle, 1995; Rosenfeld et al., 1991; Rosenfeld, Booth-Kewley, & Edwards, 1993). Even though some survey and research participants "feel intimidated by computers or ... [fear] that 'Big Brother' is monitoring their answers" (Rosenfeld et al., 1993, p. 487) when a computer, or the Internet is used instead of a face-to-face interview, many health care workers and research investigators have found these technologies effective methods to obtain information.

Researchers comparing methods to collect information from patients have found that patients are less inhibited in their responses when a computer instead of a healthcare provider

is used to ask questions because of the non-judgmental milieu that computers provide. For example, patients reported that they experienced a higher comfort level when computers, rather than physicians or other healthcare personnel, were used to gather information about daily amount of alcohol ingested (Hays et al., 1992); HIV status or personal HIV risk factors (Locke et al., 1992); and the effects of ulcerative colitis on their quality of life (Soetikno, Mrad, Pao, & Lenert, 1997).

Investigators, who studied the effect that a computer has on collection of data, make similar observations. Rosenfeld et al. (1991) reviewed the written reports of studies that utilised computers rather than paper and pencil, or face-to-face interviews to collect data. They stated that when computerised methods were used, research subjects appeared to respond with "greater candour [particularly if] ... the questions were of a personal sensitive nature" (p. 25). The benefits in data collection gained through the use of computers appear to be further enhanced when the WWW, or another IP, is also employed. Researchers, who reviewed the journal reports of studies that investigated alcohol consumption (Duffy & Waterson, 1984; Hays et al., 1992; Lucas, Mullin, Luna, & McInroy, 1997); personal use of illicit substances (Coomber, 1997; Nicholson, White & Duncan, 1998); or the opinions that employees had about workplace supervisors (Rosenfeld et al.), believed that when the WWW or another IP was used, subjects were more "forthright" (Rosenfeld et al., p. 26); "honest" (Locke et al., 1992, p. 1305); and "disclosing and direct" (Houston & Fiore, 1998, p. 117). Furthermore, Fawcett & Buhle (1995) suggest that because of the anonymous nature of electronic data collection methods on the Internet, research subjects were more "liberated" (p. 277). Rosenfeld et al. stated that narratives obtained through the WWW appeared to contain "a lower proportion of socially desirable responses" (p. 25).

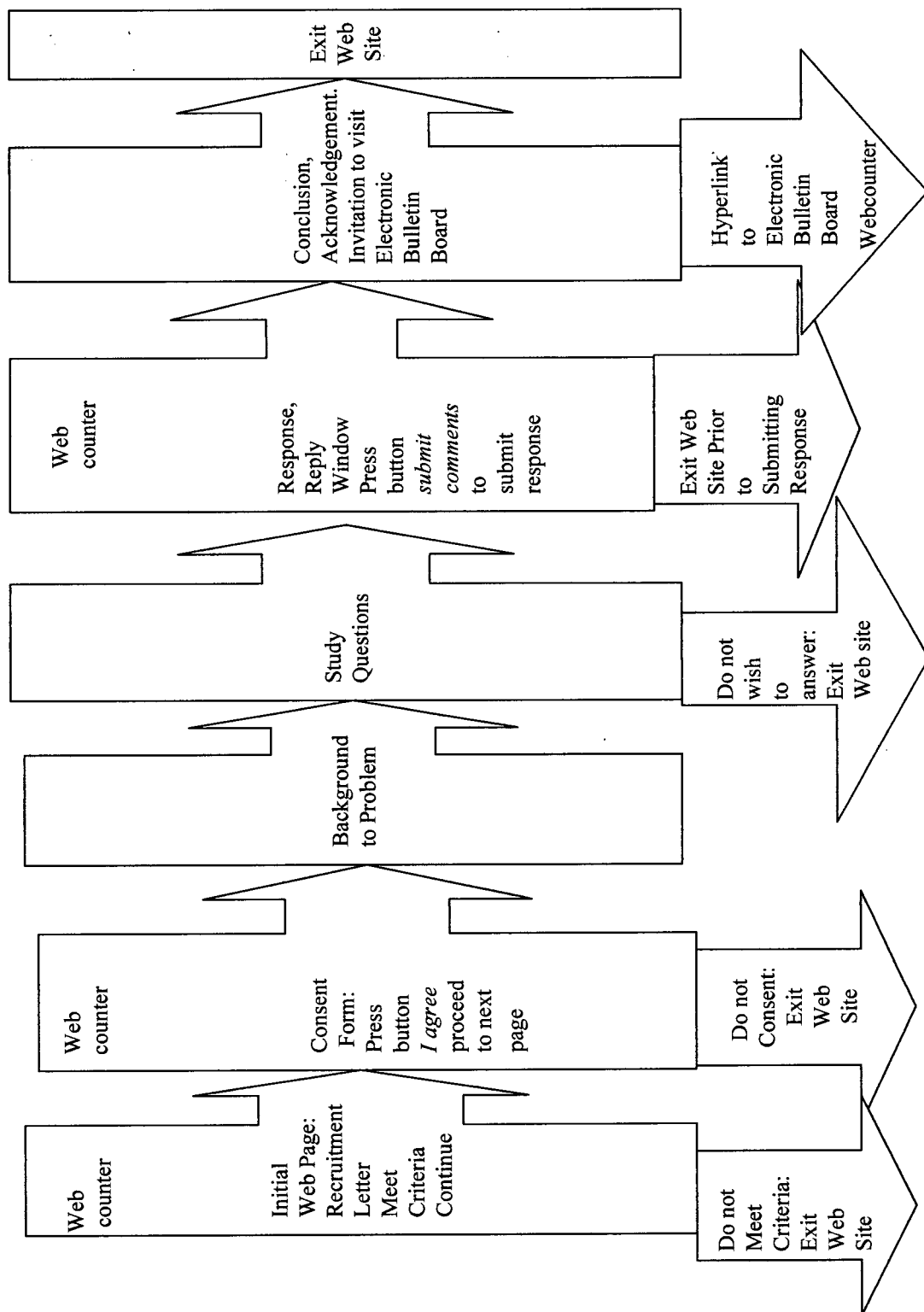
Use of the Internet and WWW for This Study

The content of the WWW site that was used for this study is exhibited in figure 3.

The study web page *www.nursingdiabetes.com* and the bulletin board *www.nursingdiabetes.com/bulletin_board* appeared on the Internet for a period of a year, from April 17th 2001 to April 4th, 2002. The study web page *www.nursingdiabetes.com* and electronic bulletin board *www.nursingdiabetes.com/bulletin_board*, using hypertext mark-up language (HTML) 3.2, were linked to the Internet through Blaze Telecommunications. A program called Web Broadcasting Company, Palo Alto, California (WEBFM), was used to transfer participant responses from the study web page and the electronic bulletin board to the research database. The information that was submitted to the study web page was downloaded to a computer disc via the Internet. Information was not stored on the hard drive of the investigator's computer, or on the computers of the web page company. The computer discs remained in the possession of the investigator, and were locked in a filing cabinet located in the investigator's home when not being used by the investigator. Data obtained from the electronic bulletin board were stored on the computers of the web page company, Blaze Telecommunications, and were displayed on the electronic bulletin board for the duration of the study. At the completion of the study, the electronic bulletin board responses were downloaded to a computer disc via the Internet, and removed from the computers of the web page company and the WWW. Discs containing electronic bulletin board data remained in the possession of the investigator, and were locked in a filing cabinet in the investigator's home when not being used by the investigator.

The participant information letter for this study that was sent out to health care agencies within the province of British Columbia (see Participant Information Letter,

Figure 3: Web Page Organization



Appendix A) directed nurses wishing to participate in this study to log on to the WWW and proceed to the address www.nursingdiabetes.com. The study web page began with a copy of this original advertisement, as it was the form that was most likely to be recognized by the nurses visiting the web site. Additionally, this letter highlighted the criteria for participation in the study. General duty staff nurses, with active registration with the Registered Nurses' Association of British Columbia (RNABC); who were employed full or part-time, or had been employed within the past year; and who devoted more than 75% of their work life in the delivery of nursing care were asked to participate in answering the study questions. Any nurse who did not have an active registration with the RNABC; who had not worked as a nurse in the past year; or who devoted more than 25% of his or her employed nursing time to administration, staff education, or other types of non-patient centred work were asked not to respond to the questions posed on the study web page or to visit the electronic bulletin board used for the study. Those who were not eligible to participate were asked to close the WWW window, thereby exiting the study web page.

The web site consent for participation in this study followed the information letter (see Consent for Participation, Appendix B). A similar consent form appeared at the beginning of the electronic bulletin board (see Consent for Participation in Electronic Bulletin Board Discussion, Appendix C). Research consent forms traditionally obtain signatures to indicate participants' agreement to take part in a research study. However, as consent for this study was gathered electronically, signatures could not be obtained. Additionally, because the participants of this study were to remain anonymous, no space was provided for nurses to give their names or otherwise reveal themselves. For the study web page consent, nurses were notified that by pointing and clicking their cursor on a web

highlighted statement labeled *I agree* they had consented to participate in the web page portion of the study, and the information they provided would be incorporated into the study findings. Nurses were also informed that consent could be withdrawn by exiting the study web page prior to beginning the study, or by not submitting their responses to the study web page (see below for procedure to submit responses to the study web page).

Both the study web page and electronic bulletin board consent forms contained a statement about confidentiality of information. Nurses were notified that the information they submitted to the study web page would not be directly accessible at any time to other participants who were also visiting the study web page. However, submissions to the study web page would be summarized by me and posted on the electronic bulletin board for other nurses participating in this study to read and discuss in written form.

The third page of the study web page contained space for data collection (see Demographic Information and Study Questions, Appendix D). Demographic data were gathered at the top of the page and the study questions followed. Participants responded to questions gathering demographic data by filling in a blank space with one or two words. Nurses were asked for the type of initial nursing education they received and date of graduation, highest level of nursing education attained, number of years employed in nursing, area or areas of nursing practice and specialties, approximate date of the last educational offering about diabetes they had attended, an estimate of the number of patients known to be living with diabetes that he or she has cared for in the past year, age, and gender. A participant made corrections, changes, or otherwise varied his or her response by using the computer cursor and delete key.

The study questions appeared directly following the demographic questions. Space

was provided for participants to respond after each study question was posed. No restrictions were placed on the length that each response could be or on the time in which it must be completed. Corrections, changes, or other variations could be made at any time prior to submission of a response with the point and click of the computer cursor and use of the computer delete key. Demographic data and responses to the study questions were tendered to the database by pointing and clicking the computer cursor on the web button labeled *submit*. If a participant did not wish to participate after completing any portion of the demographic data or the study questions, he or she could exit the study web page prior to clicking on the web button *submit*, or by clicking on the web button *reset* at the top of their computer screen, thereby deleting the data instead of forwarding it to the database.

Visitors who did not click on the web button *submit* did not proceed to the final web section of the study. However, visitors were not required to fill in any information if they simply wished to view the entire study web site prior to participating in the study. Guests could proceed to the final section of the study web page and the electronic bulletin board by tendering a blank submission to the study database.

The final section of the study web page expressed gratitude to nurses for participating (see Web Page Participant Thank You, Appendix E). This section informed nurses of the electronic bulletin board that had been set up for discussion of the research topic. Nurses who wished to add information to their web page responses, make comments about the study, enter into an electronic written discussion with other nurses or myself about the topic, respond to the further study questions that I posed as data were analyzed, or simply to follow the process of my research were directed to the electronic bulletin board. A hyperlink to the electronic bulletin board was contained in the final section of the study web page. Although

it was possible to proceed to the electronic bulletin board through the study web page, participants were instructed to physically note the address of the electronic bulletin board or to electronically bookmark it so they could visit on more than one occasion. Additionally, nurses were asked to respond to the questions posed on the study web page before visiting the electronic bulletin board used for the study and to complete the web page sections of the study only once.

Nurses who visited the electronic bulletin board first viewed the consent form. Participants were advised that when they made a submission to the electronic bulletin board by pointing and clicking their cursor on the web button labelled *submit comments*, they were agreeing to the participate in the electronic bulletin board discussion, and they understood that their comments would be displayed on the electronic bulletin board for the duration of the study. In contrast to the study web page, remarks submitted to the electronic bulletin board were directly and immediately accessible to all visitors of the electronic bulletin board. Statements made by prior participants appeared after the consent, and a space to add comments was available at the bottom of the electric bulletin board page.

Sample

Interpretive descriptive methodology encourages the use of theoretical sampling both as a method to select research subjects and to analyze data. Utilizing theoretical sampling, researchers seek individuals who will provide predicable variation within the theme of interest to begin data collection (Morse & Field 1995). As data are gathered and analyzed, later research participants are conscripted "on the notion of obtaining maximal variation on the themes that emerge from the inductive analysis itself" (Thorne et al., 1997, p. 173).

The study I formulated did not allow me to know the individual identities of nurses responding to my inquiries, and therefore, I could not directly approach nurses who I felt would provide predictable responses, nor could I select those nurses I believed would offer maximal variation of information about the topic. As well, I was unable to target a particular demographic group of general duty staff nurses to ensure that general duty staff nurses in every area of practice were represented in my study. However, to increase the likelihood that general duty staff nurses in every area of nursing care had input, and that I would gather both predictable, as well as maximal variation of information, I *cast a wide net*. I invited as many general duty staff nurses in the province of British Columbia as possible to participate. Three hundred and fourteen introductory letters about the study were sent via electronic mail, telephone fax, or both, to administrators, nursing supervisors, and clinical educators in hospitals, nursing homes, and public health units in regional health districts throughout British Columbia during the period of April 18th to May 1, 2001. The telephone fax numbers and e-mail addresses, which are available at public libraries and health board offices in British Columbia, were obtained through the Vancouver Richmond Health Board. I asked that a copy of the introductory letter be included in nursing newsletters, posted on physical and electronic bulletin boards accessible to general duty staff nurses, and placed near agency and institution computers that were linked to the WWW, and available for use by general duty staff nurses.

Information about the study was not listed with any Internet search engines nor was it posted on Internet directories accessible to the general public. Search engines and directories allow users of the Internet to find a web site without knowing the address of that site simply by using a word or phrase to describe what they are looking for (Search engines, 2002;

Internet directories, 2002.). However, as I wanted only persons who met certain criteria to respond, I did not make the study web site readily discoverable by every user of the Internet. Although information about the study was on one Internet directory, the directory connected to the RNABC web site, only persons with an active RNABC registration number and correct personal password had access to that directory.

Unfortunately, I was unable to contact every health care agency in every regional district in British Columbia because of the reaction that several nurses, nursing supervisors, hospital administrators, and other unidentified persons had to my request to distribute the introductory letter. Nursing job action was taking place in the province of British Columbia during the spring and summer of 2001, and many nurses were participating in a *work-to-rule* campaign and rotating strikes. Twenty persons telephoned me to gain information or express displeasure. Sixteen revealed that they were nursing supervisory personnel. Several called my thesis advisor as well. Some callers asked for more details about the study. Other inquired about my background. Still others wished to determine my link with the administration department in their facility. Personnel from one facility phoned Dr. Paterson to ask if approval from the ethical review board in that facility had been obtained.

Many of the telephone callers voiced anger. One person asked if "her nursing management was conducting the research?" An extremely irate person stated she would not distribute my Invitation to Participate, or to otherwise respond to my request. This caller added that she felt "it was extremely inappropriate [of me] to conduct research of this nature at this time." While I received several telephone calls from persons identifying themselves as general duty staff nurses, the majority of telephone (16/20) calls were from persons describing themselves as nursing supervisory or administrative personnel. Fourteen of these

nursing supervisors telephoned to state that nurses employed in their facilities, on their units, or in their clinics did have sufficient knowledge about diabetes, and therefore would not be given the information about the study. One nursing supervisor admonished me for not obtaining permission from the administration of her facility prior to sending my request, indicating that I should not have bothered sending the introductory letter to that facility as the nurses employed there were, in her view, "highly informed" about diabetes.

As I was unable to continue contacting nurses through their places of employment, I posted the introductory letter on physical bulletin boards and beside computers with Internet access in the Helen Randall library at the RNABC building. The RNABC web site manager publicized the study on the RNABC electronic bulletin board on the professional practice group page, which is accessible to general duty nurses with an active registration number, and a valid personal password. As president of the Diabetes Nurses Professional Practice Group (DNPPG) I attached the introductory letter to the DNPPG fall newsletter. Additionally, I requested that other professional practice group presidents include the information about the study to their newsletters. Information about the study was sent via e-mail to Master's in nursing students at the University of British Columbia. An advertisement about the study was placed in the December 2001 issue of *Nursing BC* (see Advertisement, Appendix F). Lastly, I employed a chain link (also known as snowballing) method of recruiting participants. I requested that my nursing colleagues give the introductory letter about the study to other nurses. Additionally, nurses completing the survey questions were asked to give information about the study to other general duty staff nurses who they felt might also be interested in participating.

Researchers have only begun to use the Internet and the WWW as data collection

tools. However, the optimal length of time to pose research questions on these environments has not been determined (Miller, King, Luri & Choiz, 1997). Published reports of research suggest that investigators have maintained their Internet or WWW milieus from as short a time period as 2 weeks (Nicholson et al., 1998) to as long a time as 4 months (Soetikno et al., 1997). Initially, I planned to open the study web page for a period of one month and to continue the electronic bulletin board for at least a month after the study web page was terminated to discuss the information received in the final web page responses. However, as other researchers utilizing the web for data collection have similarly experienced (Foster, 1994; Lakeman, 1997; Rosenfeld et al., 1991), I had difficulty attracting subjects. Data collection took a year, and therefore the web page and bulletin board were removed from the Internet on the same date, April 4th, 2002.

Current literature does not give a clear indication of what sample size was appropriate for this study. Additionally, studies that canvass the views of general duty staff nurses about knowledge deficits that nurses experience have not been published. However, utilizing principles of theoretical sampling, I decided that the sample should consist of between 25 to 30 nurses, the numbers being divided as evenly as possible between nursing educational levels and areas of nursing practice. At the conclusion of the data collection, 317 responses were submitted to the study web page, 48 of which contained data. Two hundred and sixty-nine were blank transmissions. Additionally, 10 comments from participants were added to the bulletin board. I did not include two of the data submissions that were made to the study web page in the analysis. One consisted of demographic data only, and wording in two of the study web page responses were so similar that I felt both were from the same participant. As a result, I only included the first of the two responses in the analysis.

I did not close the study web page when 30 responses with data had been received, as many of the entries were less detailed than hoped for, and I felt I needed the information that a larger sample would provide. As well, traffic to the study web page and electronic bulletin board had increased during February and March 2002, and I anticipated that more responses might be forthcoming. The increased visits at that time may have been partly because more nurses saw the introductory letter on the RNABC web site or in the library at the RNABC building. The annual deadline for RNABC registration is in March. Frequently, nurses visit the RNABC web site during this time frame to electronically order application forms for registration. Participants may have learned of the study while they were viewing the RNABC web page. Additionally, many nurses drop off their registration in person during the first 3 months of the year (personnel communication receptionist, Maxine Munro, March 7th, 2002), and this year several nurses also stopped to visit library at the RNABC (personal communication librarian, Joan Andrews, March 7th, 2002). Subjects may have learned of the study when they attended at the RNABC building. I continued the study web page until April 2002 to inform this potential sample about the study.

I had planned to continue to display the study electronic bulletin board on the WWW after the web page was dismantled to promote discussion of the final web page responses. However, I closed both the web page and the electronic bulletin board on the same day. As stated above, the web page was maintained for a period of 12 months because I had difficulty acquiring a sufficient number of participants. Since ethical approval for this study from the University of British Columbia was for a year, I was unable to continue the electronic bulletin board after the study web page was closed. I did not request an extension for ethical approval of the study so as to maintain my electronic bulletin board as discussion on the

electronic bulletin board was not active, and information beneficial to the analysis was not being discussed, nor was it anticipated.

Since I could not re-interview participants of this study in the traditional sense, I attempted to utilize the electronic bulletin board to confirm my interpretation of the information obtained through the study web page and to explore the issues that had been raised. I posted summaries of the information that had been obtained from the study web page on the electronic bulletin board in an effort to initiate discussion about the themes that had been identified during my analysis. However, nurses did not respond when I posted the following entries on the electronic bulletin board.

Nursing literature suggests that every nurse has contact with a person who lives with diabetes every day of her/his practice. As well, in Canada for every person we know has diabetes, another who actually has the disease has not been diagnosed. Any comments?

Many nurses have indicated that more educational sessions are needed to teach nurses about diabetes. Although the nursing literature is full of educational strategies that have been suggested by doctors and administrators to assist general duty staff nurses improve their knowledge about diabetes, I'd like to hear from general duty staff nurses. What type of educational sessions would you find most helpful in improving your knowledge about diabetes?

The majority of nurses who submitted comments on the electronic bulletin board requested information about nursing care of persons who lived with diabetes. Many of my electronic bulletin board replies (see Investigator's Replies on the Electronic Bulletin Board, Appendix G) included directions on how to obtain basic information about the disease and library citations for nursing articles relating to the care of persons living with diabetes.

To determine the rate of participation in the study, counters were connected to the study web page and electronic bulletin board. The first counter recorded the number of nurses who logged onto the study web page, and the time zones from which they were

connected. Another counter was set up to record the number of study web page visitors who proceeded to the consent form after reading the criteria for participation. An additional counter tallied the number of submissions to the study web page. By subtracting the number of web page visitors who do not meet the participation criteria from the number of nurses who visited the study web page consent form and dividing the remainder into the number of nurses who submitted data to the study web page, I was able to calculate the actual percentage of participation by multiplying by 100 (Duffy, 2000; Harris & Dersch, 1997). A final counter was connected to the electronic bulletin board to determine the number of visits that were made, and the time zones from which they were connected.

A total of 849 visits were made to the study web page and 2,387 visits to the electronic bulletin board. As many of the visitors to the electronic bulletin board were presumed to be repeat visitors, participation rates were determined using data obtained from counters linked to the study web page. Thirty-two persons did not continue past the introductory letter on the study web page, and therefore were presumed not to have met the criteria for the study. Although 317 persons transmitted to the study data bank from the study web page, many transmissions did not contain data. As stated above, it was possible to view the entire study web page and the electronic bulletin board prior to making a response. As only 48 persons made submissions with questions answered to the study web page, participation was calculated to be 5.88%.

The low rate of participation may not be a true reflection of actual participation rates however. Although the counter indicates that 849 visits were made to the study web page, and 817 persons proceeded past the introductory letter, these numbers may be an inflated total of *new* visitors. Analysis of the data submitted to the study web page revealed that at

least one participant may have been a repeat visitor. Nevertheless, as I was not unable to unequivocally determine how many participants were visiting the study web page on more than one occasion, nor could I state how often visitors were returning to the study web page, I took a conservative approach.

To determine the rate of attrition, the number of responses with data tendered to the study web page was first subtracted from the number of nurses who progressed to the section displaying the study questions. The remainder was then divided into total number of nurses who had progressed past the section displaying the consent form and multiplied by 100. Seven hundred and sixty-nine persons met the criteria for participation, consented to participate in this study, but did not submit data (500 persons proceeded past the introductory letter, but exited the study web page prior to making a submission; and 269 made blank submissions to the study data base). I have calculated the attrition rate at 94.12%.

All of the visitors to the electronic bulletin board were from time zones found within British Columbia. Six of the 849 visitors to the study web page were from time zones in Asia or Europe. Three persons visiting were from time zones outside of British Columbia, but within Canada. I was unable to determine if any of the submissions to the study web page or the electronic bulletin board were from these nine visitors. Additionally, I could not ascertain if persons who lived in the same time zone as that found in British Columbia, but who actually lived outside of the province of British Columbia made submissions. Nevertheless, the majority of guests to the study web page, 840, were from time zones found within British Columbia.

Although the study web page and electronic bulletin board addresses were not listed with any Internet search engines, or posted on an Internet directory available to the general

public, it was possible to utilize an Internet search engine or an Internet directory, open to the public to find the addresses for the study web page, electronic bulletin board, or both.

However, information obtained from Blaze Telecommunications indicated that only two visitors found www.nursingdiabetes.com via an Internet search engine, namely *Google*, and no one found www.nursingdiabetes.com/bulletin_board by this method. Although I am unable to determine if guests to the study web page or electronic bulletin board were persons who were not nurses but simply used an Internet directory open to the public to locate the electronic addresses for this study, I believe nurses provided the information for a number of reasons. First, information about the study was only posted on one Internet directory connected to the RNABC web site, a site that is restricted from the general public but accessible to nurses with an active RNABC registration number, and a valid personal password. Nurses with an active RNABC registration number and valid password must have been working in the profession within the past 5 years. As well, the majority of visitors were from time zones within British Columbia. Persons using Internet directories to find study web page address are located in every time zone in the world. If the addresses for the study web page or electronic bulletin board were available on an Internet directory that I was unaware of there would have been more visits from time zones outside of British Columbia.

Other reasons lead me to believe that nurses within the province were the persons making submissions to the study web page and electronic bulletin board. Visits to the study web page increased, and several responses were received from the study web page at the same time as the RNABC annual registration. As noted above, during this period, nurses were attending at the RNABC building where the introductory letter was available. Nurses may have seen the letter while they were in the RNABC building. Lastly, the introductory

letter was just sent to health care institutions within British Columbia, or given to nurses who I knew were registered with RNABC; and advertising for the study was only placed in a nursing publication. It would seem that as persons viewing the study web page had little opportunity to find the study web page address in a place other than the introductory letter, the visitors to the study web page were utilizing the address that was provided in the introductory letter. As few persons other than nurses had access to the introductory letter, I believe nurses within the province of British Columbia made the submissions to the study web page.

The rate of attrition provided me with information that assisted me to determine the effectiveness of the web page design (Duffy, 2000). A poorly designed web page has been cited as one of the reasons participants of web research exit web pages prior to completing the study that they are involved in (Duffy). A significant number of nurses exited the study web page after reading the criteria for participation and consenting to participate, but prior to making a submission. While a nurse may have chosen to exit the study web page after he or she had agreed to participate but prior to submitting his or her information for reasons other than flawed web page design, because the percentage of visitors who exited the study web page before submitting a response was significantly higher than the percent of web page visitors who volunteered data for the duration of the study, I considered changing the design of the web page. However, as I had difficulty distributing the introductory letter about the study, and the study web page began with a copy of that letter, I did not make any substantial changes to the study web page design.

Description of Participants

Forty-eight visitors submitted demographic information to the study web page.

However, as one respondent volunteered only demographic information, and two of the replies seemed so similar that just the first was included in the data analysis, the following description of the participants is based on information contained in the remaining 46 responses.

Other investigators who have utilized the Internet as a means of gathering data have found that research participants often do not answer questions about demographic facts (Coomber, 1998; Miller et al., 1997; Nicholson et al., 1998; Rosenfeld et al., 1991; Soetikno, et al., 1997). However, very little demographic data were missing from the transmissions to the web page data bank used for this study. All of the participants filled in information to questions posed about gender, age, number of years employed, level of education and year of graduation, and area of nursing practice. One nurse did not identify the number patients who lived with diabetes that she had cared for during the past year. Two respondents did not submit data about the last educational offering about diabetes they had attended.

Researchers in the past have concluded that several demographic factors affect the knowledge that nurses have about diabetes. To determine if demographic factors could be used to predict the views that nurses participating in this study have about general duty staff nurses' knowledge about diabetes, demographic data were reviewed for indications that responses to the four research questions were gender, age, or practice area specific. However, analysis indicated that no viewpoint could be associated with an identifiable group of participants. Male and female nurses; nurses with less than 1 year, and more than 20 years experience; diploma, degree, and postgraduate nurses; nurses from different practice areas; nurses who stated they never cared for patients with diabetes, and those who had cared for "more than 100," or "++++" patients with diabetes annually; nurses who revealed they live

with diabetes, and nurses who did not divulge if they, or anyone in their household, has the disease; and nurses who had differing rates of participation in educational offerings about diabetes held similar views about the presence, cause, and effects of knowledge deficits, and suggested many of the same methods to improve nurses' knowledge about diabetes.

The sample consisted of 13 male and 33 female nurses. The average age of the respondents was 40 years, ranging from 21 years old to 70 years. Forty-three percent ($20/46 = 43\%$) stated that they were between the ages of 26 and 35 years old. Participants reported that they had been employed in nursing from ".45" to 42 years, with an average of 14 years. Twenty-two ($22/46 = 48\%$) participants had worked less than 10 years, while 18 ($18/46 = 39\%$) had 20 or more years in the profession.

Twenty-two of the respondents advised that they were initially diploma prepared in nursing. Twenty-four stated they had originally graduated from a degree program. Graduation dates range from 1960 to 2001. Almost half ($22/46 = 48\%$) of the participants indicated that they had completed their initial education in nursing within the past 10 years.

Fifteen nurses acknowledged that they had a diploma as their highest level of nursing education, while 26 revealed that they had attained a university degree in either nursing or science. One participant indicated that she had obtained a degree as her highest level of nursing education, and was presently enrolled in a Masters in nursing program. Two had completed Master's degrees in nursing. Two other respondents put "RN" as their highest level of education.

All of the nurses participating in this study designated at least one area of nursing practice. Twenty participants stated they practiced in one area of nursing, while others listed as many as eight areas. More than half ($26/46 = 57\%$) selected "medical" as an area of

nursing in which they practice. Fourteen ($14/46 = 30\%$) stated they nursed in "surgical" areas. Eleven respondents ($11/46 = 24\%$) designated "geriatrics." Eight nurses ($8/46 = 17\%$) indicated that they worked in critical care ("CCU," "ICU," or an unspecified area of critical care). Another 8 participants recorded they were working in "home care." One nurse stated she worked in "public health," and another in a "community care outpatient clinic." Specialty areas included "community mental health," "psychiatry," "oncology," "PACU [paediatric ambulatory care unit]," "hospital," "at home program," "neuro [neurology]," "paediatric," "emergency," "maternal/new-born [*sic*]," "labour and delivery," and "geriatric rehab [rehabilitation]."

Of the 44 participants who answered this question, 15 indicated they had only attended educational offerings about diabetes during nursing school. Only one nurse had diabetes education in the preceding year. Seven ($7/44 = 16\%$) had participated in some form of continuing education, during nursing training, or after graduation during the past 2 years. Ten ($10/44 = 25\%$) had attended an educational offering about diabetes in the year 2000. Nine respondents ($9/44 = 20\%$) declared that they had not attended an educational offering about diabetes for between 6 to 10 years. Two nurses indicated that they had not been to an educational offering about diabetes since the mid 1980s and 5 other nurses stated that they had not attended since the 1970s. Nine participants ($9/44 = 20\%$) admitted that they had never been to a diabetes educational offering, although every one of these respondents also stated that annually, each had cared for 10 or more persons who lived with diabetes. One person marked "n/a [not applicable]" to the question, although she also submitted that she practiced on a medical unit and declared that in the past year, she had cared for 10+ patients who lived with diabetes.

The majority of participants to this study were able to give an exact number, between zero to 100, when specifying the number patients who lived with diabetes that they cared for during the past year. Some of the nurses responding to this survey suggested that they had cared for "30+," "at least 30," "between 40-50," "100+," "++++," or "many" persons with diabetes. One participant answered "unknown" when asked how many patients with diabetes she had cared for in the past year. Another gave an exact number, "12" but put a question mark after the number. Only one respondent did not provide any answer to this question. Based on the submissions that furnished an exact number, I calculated that annually, each of the nurses responding to the survey cared for an average of 20 patients who lived with diabetes.

Generation of Data

As stated above, raw data were generated through the use of a WWW web page and an electronic bulletin board. On the study web page site, demographic data were first gathered and, after supplying a short introduction to the problem, the following questions were posed:

- Do you think general duty staff nurses have knowledge deficits about diabetes?
- Why would nurses have knowledge deficits about diabetes?
- How is the care that persons living with diabetes receive affected by nurses' knowledge about diabetes?
- How can the knowledge that nurses have about diabetes be improved?

Although I had hoped to use the electronic bulletin board to re-interview the study web page participants, only one participant responded to another's comment, and nurses did

not respond to the queries that I posted on the electronic bulletin board. As stated previously the majority of the submissions to the electronic bulletin board (8/10) either requested information about the disease, or asked questions about the care of persons living with diabetes.

Thorne et al. (1997) support the employment of "collateral data sources" (p. 174) in interpretive descriptive research as a means of expanding the range of data available and a method for providing support for the research. In addition to the data supplied by participants, I have incorporated relevant material from my clinical and personal experience, and information from professional nursing journals, and other types of healthcare literature into my database. I have utilized the aforementioned collateral sources to substantiate individual participant information; as a method of corroborating my insights and theories about why general duty staff nurses frequently have knowledge deficits about diabetes; and as a "testing ground" (Thorne et al., p. 174) for the strategies that participants have suggested to ameliorate the situation.

Data Analysis

I have relied on the principles of analysis of qualitative data that Miles and Huberman outlined in 1984 to analyze the data. From the beginning of this study, I have employed inductive rather than deductive analysis. Prior to determining the exact analytic strategy; the number and types of codes to be used; and the size of each data unit, I first obtained a sense of the material. Lastly, I avoided overly relying on a single data source. Data from individual participants have been substantiated by other sources.

Inductive analysis is the process of bringing “knowledge into view” (Morse & Field, 1995, p. 8). Researchers employing this type of analysis examine examples of phenomena of interest, describe and name essential variables, and identify relationships and determine commonalities between variables. Concepts emerge as analysis continues and theory is developed. Although analysis, for the most part, proceeds from the concrete to the abstract, the process is not linear. During the process of analysis, I went back and forth between the steps as necessary to re-examine specific participant information, revise definitions, modify concepts, and amend my emerging theories.

So as to “avoid premature analytic closure.... [qualitative researchers are advised to first] *look at* their data – in order to discern what to *look for* [emphasis in text] ” (Sandelowski, 1995, p. 371). Before I began to analyze the data by coding, memoing, or otherwise deconstructing the data into parts, I ensured that I had a sense of “gestalt” (Sandelowski, 1993, p. 3) about the information that I had received. I repeatedly immersed myself in the data from the participants, reading, and rereading the study web page and electronic bulletin board responses until I was wholly familiar with the information, and able to begin to answer questions as “ ‘what is happening here?’ and ‘what am I learning about this?’ ” (Thorne et al., 1997, p. 174).

Nursing researchers, utilizing an interpretive descriptive design, are challenged in “two equally compelling directions” (Thorne et al., 1997, p. 170). They must discover the commonalities of the group while concurrently deciding what is unique to a particular individual. Infrequently discussed variables may be fundamental to the phenomenon, or only pertinent to a few individuals. To avoid affirming that a variable was essential when it was not common among general duty staff nurses, but so as to not overlook the importance of

each individual's contribution, I summarized and posted the study web page responses of general duty staff nurses on the electronic bulletin board requesting that other nurses comment and discuss the information. However, as visitors to the electronic bulletin board did not express their views about the replies that I posted, I discussed study web page responses with nurses with whom I had contact and kept journal notes documenting these conversations. As stated previously, I also utilized my clinical and personal experience, professional nursing journals, and other types of healthcare literature to substantiate individual participant information.

Rigor

Even though "rigor is less about adherence to the letter of rules and procedures than it is about fidelity to the spirit of qualitative work" (Sandelowski, 1993) all qualitative research must meet the criteria of credibility, fittingness, auditability, and confirmability (Guba & Lincoln, 1989). A study is credible if it presents a trustworthy account of the human experience. Nurses participating in this study must be able to discern their interpretations from the research report. Furthermore, nurses who have not had a particular experience must have a deeper understanding and the ability to recognize the identified situation after reading my report. A strategy that I employed to increase the credibility of my findings was to post summaries of participants' study web page comments on the electronic bulletin board, requesting that electronic bulletin board participants remark on the extent to which the opinions were shared themselves and perhaps by other nurses. Although many of the participants did not engage electronic discussion, the narratives that nurses submitted about experiences caring for persons who live with diabetes on the study web page were consistent.

Additionally, I confirmed my analysis through literature corroboration, and by having face-to-face conversations with nursing colleagues, and my thesis advisors.

Sandelowski (1986) and Thorne et al. (1997) warn that a researcher's personal biases will have an effect on the credibility of the findings of a study. Sandelowski further suggests that credibility is influenced by the proximity an investigator has to the subject under investigation. Maintaining a personal reflective journal during the research process is one method Sandelowski and Thorne et al. propose to lessen the influence that personal biases have on the outcome of a study, although Thorne et al. advise that it would be naïve to suggest that personal bias can be completely eliminated. Thorne et al. further assert that reflective journaling can be a method to communicate the process of the research, a procedure they state is "critical to an interpretive description" (p. 175). I am both personally and professionally involved in the care of persons living with diabetes. Throughout the research process I have used reflective journaling to record the process of my research as well as a method to ameliorate the effect that my personal and professional biases had on the outcome of this study.

Fittingness (Guba & Lincoln, 1989), or transferability (Streubert & Carpenter, 1995), refers to the ease with which persons not involved in a study can employ the findings of that study. The consumer of research findings, not the researcher determines the degree to which a study meets the criteria of fittingness (Guba & Lincoln). Although it is difficult at the onset of a study to predict how consumers will view the findings of the proposed research, the degree to which the study questions are expected to generate relevant data can provide a measure of the fittingness of a particular study. The questions posed by this study pertain to the knowledge deficits that general duty staff nurses have about diabetes and I believe that

information about why this is so has been generated. General duty staff nurses' were asked for their opinions about methods to ameliorate the situation and nurses' suggestions about what they believe would improve their knowledge about diabetes were obtained. The findings of this study are applicable outside of this study setting as the information that has been received is from nurses who are directly involved, namely general duty staff nurses. Additionally, as all of the abstract concepts and emerging theories have been related back to the data that have been received from participants during the course of the study, I believe that I am correct in my analysis. Lastly, I have asked nurses who are "interested [in my topic] and rigorous [in their analysis]" (Huberman & Miles, 1998, p. 200) to assist me to determine if my findings do indeed fit the data, and are applicable to situations outside of this research setting. As stated above, I have discussed my emerging theories at length with colleagues, as well as consulted frequently with my thesis advisors about my findings.

No qualitative researcher can be absolutely certain before commencing data collection that the information he or she is seeking will be produced by the questions that he or she originally ask. Although Huberman & Miles (1998) suggest that "errors in the field can be undone the next time out; there is always a second chance" (p. 186), the use of the Internet to gather data from anonymous sources makes it more difficult. My fall back plan of clarifying the questions and posting them to the electronic bulletin board was not effective. However, the nature of the questions that participants did submit to the electronic bulletin board and the comments they made supported my analysis of the study web page data.

Auditability, the ease with which external examiners can systematically review all of the materials that have been used to arrive at research study conclusions, has been frequently overlooked by qualitative researchers in the past because, until recently, the canons and

conventions for reporting qualitative methodology did not exist (Huberman & Miles, 1998). Nevertheless, agreement has been reached regarding the minimum amount of information that should be available about a completed qualitative study. Qualitative researchers should document sampling decisions, instrumentation and data collection, size and production of database, software used, employed analytic strategies, and any pictorial depictions of data that have been made to support the qualitative researcher's conclusions (Huberman & Miles). Accounts of the entire qualitative research process must be kept in easily retrievable written forms such as in a reflective journal, field notes, and in ongoing records documenting both the successive methods of coding collected data and the reasons that methods were accepted or discarded. I have documented the criteria for participation in the study, the size of the sample that I obtained, and detailed reasons for not including two submissions in the analysis. I have outlined the procedures for collecting data and identified both the computer communication systems and software that was used for data collection. I have specified analytic strategies and retained the pictorial depictions that I have made of the data. Throughout data analysis, I have a written reflective journal to record the successive methods of coding collected data and the reasons that various methods were either adopted or discontinued.

The criterion of confirmability requires that two rules be followed (Hodder, 1998). First, the various research findings from a single study must be internally consistent. Typically, a researcher will make more than one assertion based on the data from a single study. A study that is internally confirmable will produce findings that are in agreement with each other. Secondly, the interpretation of data must support theories pertaining to, and outside of the investigated discipline. External confirmation can be accessed by the level of

acceptance that the conclusions of a study have within other disciplines. Interpretations that require "too much special pleading" (Hodder, p. 125) prior to acceptance by members of another discipline are not as externally confirmable as study conclusions that do not need explanatory interpretation or defence. To meet the criteria of internal consistency, I have scrutinized the various findings that I have made to ensure that my interpretations do not contradict one another. Likewise, I have compared my findings to those of researchers in other disciplines and have found that the findings of this are consistent with the findings of studies from other disciplines.

Ethical Considerations

Typically, ethical concerns surrounding the conduct of research focus on the topics of informed consent, privacy, and protection from harm (Fontana & Frey, 1998). Informed consent was not an issue as the nurses participating in the study were informed about every aspect of the study; no covert procedures to collect data were used. Privacy was maintained, as participants to the study were anonymous. Data from the study web page and the electronic bulletin board (after being deleted from the Internet) were kept in locked location when not in use.

Participants could have encountered harm as a result of disclosure of prejudicial information. Nurses who admitted that they do not know about diabetes or who furthermore stated that their lack of knowledge had been detrimental to persons living with diabetes risked disciplinary measures from employers, as well as from the regulatory body for nurses (in British Columbia the RNABC); legal action from patients; or both. I protected the nurses who disclosed prejudicial information on the study web page by ensuring that their

submissions remained anonymous. Additionally, although I collected information about the visitors from web site counters, I ensured that the web site counter tracking system did not gather information with which an individual could be identified.

The anonymity of the participants created an ethical predicament during the course of the study. I learned about situations where a nurse's lack of knowledge about diabetes had the potential to have a detrimental effect on the health of a person living with diabetes, and although I offered information via the electronic bulletin board to rectify the situations, because I did not know who was providing the information, I could not ensure the safety of those patients. However, I believe that the only way to access the thoughts and feelings that general duty staff nurses have regarding this issue was to offer anonymity. Although I am not able to verify that the information I provided via the electronic bulletin board did improve the care of a particular patient, because of the information that I have obtained by conducting this study, the future care that a person living with diabetes receives from general duty staff nurses will be improved.

I made a request for ethical approval of the study from the Behavioural and Research Review Board, University of British Columbia January 15th, 2001. On March 5, 2001 I responded to the concerns that members of the board had expressed regarding use of the electronic consent forms to be used for the web page portion of study and the electronic bulletin board, and supplied the list of the demographic questions that I asked on the study web page. Additionally, I detailed the reasons that signatures could not be collected, and outlined the steps that I had taken to ensure that consent was obtained. The Behavioural and Research Review Board, University of British Columbia granted ethical approval of the study on April 6th, 2001 for a period of one year (see Ethical Approval, Appendix H).

Chapter Summary

In chapter three, an outline of the research design; a description of the setting and sample; details about the processes of data collection, generation, and analysis; and information on the framework that was utilized to ensure rigor are provided.

CHAPTER FOUR

Preamble

Many of the submissions made to the study data base contained spelling, grammatical, and typographical errors, lacked punctuation, utilized abbreviations, and required additional wording to clarify meaning. I have not changed spelling, or grammatical mistakes found in the submissions as amending these errors in square brackets decreases the clarity of the data. Errors to spelling appear as submitted and then are followed by the term sic in italic and square brackets. Typographical and punctuation errors such as spacing between words have been corrected, but do not appear in square brackets. Apostrophes, commas, and periods have been added, and type case has been changed when required to promote clarity without the addition of square brackets. Any words that were not part of a submission, but that I have included, are displayed in square brackets. Abbreviations that participants have used are first displayed as received, and then are spelled out in square brackets.

Presentation of Findings

In this chapter, I will present an interpretive summary of the responses received from the study web page www.nursingdiabetes.com and the electronic bulletin board www.nursingdiabetes.com/bulletin_board. Four themes have emerged from analysis of the data obtained. These themes include the perception that general duty staff nurses have knowledge deficits about diabetes, the factors that affect the knowledge that nurses have about the disease, the effects of knowledge deficits about diabetes on the care of persons who live with the disease, and strategies to improve general duty staff nurses' knowledge about diabetes.

Perceptions of Knowledge of General Duty Staff Nurses

Nurses visiting the study web page, www.nursingdiabetes.com, were asked to respond to the question, *Do you think general duty staff nurses have knowledge deficits about diabetes?* While the majority of the participants (38/46 = 80%) who submitted information to the database answered in the affirmative, indicating that they believe general duty nurses have knowledge deficits about diabetes, approximately 20% (8/46) either disagreed, or only conditionally agreed, with this statement.

Several participants volunteered comments, as well as indicating their agreement or disagreement. One nurse, who believes general duty staff nurses do have knowledge deficits, claimed "few general duty nurses have anything more than a rudimentary knowledge of symptoms, and treatment of the disease." Another suggested, "There is little understanding of issues related to monitoring and appropriate treatment [*sic*]". Yet another, who agreed that general duty staff nurses do have knowledge deficits about diabetes, declared she felt "overwhelmed" when caring for persons who lived with the disease. Two nurses, who answered the question in the affirmative, reported living with diabetes. One testified that she had received inadequate care from general duty staff nurses because of their lack of knowledge about the disease.

Eight of the participants who submitted responses to the database did not agree with the statement that general duty staff nurses have knowledge deficits about diabetes. Five of the nurses answered "no." One participant added "the level of knowledge is sufficient to provide appropriate care to patients." Others, who also replied "no" to this question, stated, "most have a general knowledge," "most seem knowledgeable [*sic*] in the basic care and treatment of patients with diabetes;" or "most have adequate knowledge to care for their

patients.” One nurse declared she did not agree with the statement but felt this group of health care workers could know more. She explained, “...most gen. [general] duty nursed [sic] have a basic understanding of the disease process. To my way of thinking 'basic' [quotation marks included in submission] isn't good enough. There is too much at risk.”

Others did not include a yes or no answer in their submission, but their remarks revealed they did not concur with the statement. One participant alleged that a nurse's knowledge about diabetes might be contingent upon his or her area of practice. He wrote, “It depends on the ward. On the geriatric wards, the level of knowledge is probably higher because of the high number of patients with type 2 diabetes.” One nurse admitted that she has knowledge deficits about diabetes, but stated she “could not comment upon other nurses' knowledge.” Another, who also indicated she did not know enough about diabetes to care for patients who live with the disease, declared she believed the other nurses she worked with had “a fairly good understanding of diabetes itself.”

In summary, the majority of participants who responded to this question felt general duty staff nurses do have knowledge deficits about the diabetes. Participants who did not believe general duty staff nurses have knowledge deficits about diabetes suggested that most general duty staff nurses have sufficient knowledge about diabetes to care for patients who live with the disease.

Factors Affecting the Knowledge of General Duty Staff Nurses

Participants responding to the question, *Why would nurses have knowledge deficits about diabetes?* named several different reasons why knowledge deficits occur. While the majority, 26 participants, suggested a single causative factor, others named as many as 7

factors. Participants stated nurses have knowledge deficits about diabetes because of nurses' assessment of the complexity of the disease; nurses do not receive adequate education about diabetes during nurses' training, or through continuing education after graduation; nurses, and other health care workers are unaware of the knowledge deficits about diabetes that exist; nurses fail to recognize their role in the care of persons with diabetes; and nurses rely on other health care personnel, or the patient to have knowledge about diabetes. Despite the fact that some participants refuted the notion that general duty staff nurses have knowledge deficits about diabetes, every participant who submitted more than demographic information to my database expressed an opinion about why these knowledge deficits may occur.

Complexity of the Disease

Overestimation of complexity.

Several of the nurses responding to this question suggested that a nurse's assessment of the "overwhelming" complexity of the disease is one of the reasons general duty staff nurses have knowledge deficits about diabetes. One participant asserted that general duty staff nurses have knowledge deficits because diabetes is a "such a complex, systemic disease... [ellipsis points contained in submission] perhaps it's hard to grasp all aspects." Another stated diabetes is a "very complicated disease. Not cut and dry."

Other participants argued that because diabetes care is so complicated, care of persons who live with this disease is a separate area of health care outside the realm of general duty nursing. One nurse suggested diabetes is a "highly specialized, and personal disease." Yet another explained general duty nurses may have knowledge deficits about the disease because "diabetes is a complex disease with volumes of information regarding its cause, treatment, and management. The fact that there are specialty areas in the health care

system for this disease alone atests [*sic*] to its complexity.” Another respondent stated the nurses she had contact with have knowledge deficits about the disease because nurses have “a false perception that they do not require specialized training in the treatment of patients with diabetes.”

Underestimation of complexity.

In contrast to the participants who indicated general duty nurses have knowledge deficits about diabetes because the disease is complex, others suggested nurses have knowledge deficits because nurses minimize the importance of the disease. Several participants indicated nurses have knowledge deficits about diabetes because nurses do not understand the effect that diabetes has on the health of the person living with the disease. One respondent, who felt nurses underestimate the implications of diabetes, suggested, “Nurses do not seem to understand the importance of this disease or how widespread it is.” Another commented, “We don’t see it as life threatening as it is.” Yet another stated, nurses’ “lack of acknowledgement of the seriousness, and implications of diabetes” contributes to their knowledge deficits about the disease.

Many participants commented that general duty staff nurses have knowledge deficits about diabetes because their nursing care is focused on other, more pressing, priorities. One wrote, “Diabetes is often a secondary condition to other more urgent illnesses, and I think becomes a secondary consideration in our practice and in education.” Another suggested that the nurses on her floor “do not work with clients/patients [*sic*] outside of medication dispensation [*sic*], in many cases, and do not think about complications, etc. [and so forth] associated with the disease.”

*Inadequate Education**Nursing programs fail to adequately teach students.*

Several nurses responding suggested general duty staff nurses have knowledge deficits about diabetes because nursing schools fail to adequately educate students about diabetes during their nursing training. Even though every participant who proclaimed nursing schools do not properly teach student nurses about the disease named other contributing factors as well, many participants echoed the opinion of one nurse who claimed general duty staff nurses have knowledge deficits about diabetes because "little is learned in nursing programs."

Nurses lack education about diabetes after leaving nursing school.

More than half of the participants in this study stated that general duty staff nurses have knowledge deficits about diabetes because as a rule, nurses do not receive education about diabetes after leaving nursing school. Several participants named this as the only cause of the knowledge deficits that nurses experience. While many indicated nurses lack education about diabetes because they do not engage in education offerings that are available after they graduate from nursing school, others implied nurses cannot participate because there are few diabetes-related educational offerings for nurses.

Several participants held that general duty staff nurses have knowledge deficits about diabetes because they do not access existing educational offerings about the disease. Although some simply wrote, "lack of ongoing education," or "noe [sic] inservices," others suggested nurses just have "no time available" to seek out, and participate in educational offerings about diabetes. Still other participants observed nurses do not pursue educational opportunities about diabetes because nurses are not interested in the topic. Another suggested

she does not attend inservices about the care of persons living with diabetes because "this is not an area of expertise, and is not expected to be so in our area." Two participants asserted nurses do not participate in education about diabetes after graduation because of a combination of factors. One implied that the lack of time, and scarcity of diabetes-related educational programs were factors. She wrote that nurses do not have "enough time to attend inservices if they were provided." Another stated nurses do not seek information about diabetes due to a "lack of interest. Too many other more pressing topics that they need to learn about when caring for their very busy patients."

Although none of the participants expressed the view that general duty nurses have knowledge deficits in any other area of nursing, several warned that the reluctance of general duty staff nurses to attend continuing education programs may not be limited to the topic of diabetes care. These participants advised that many nurses are not committed to ongoing education in any area of practice, and therefore, do not seek out any type of educational offering after graduation. One expressed that "most nurses go to work, and do little else to continue their education." Yet another declared the nurses she had contact with, as a rule, had knowledge deficits because of "non-participation in post-registration education sessions; [and a] lack of commitment to self-directed learning."

Many participants made particular mention of written materials, generalizing that, often, nurses do not access nursing literature. Again, while some implied nurses just do not read literature pertaining to diabetes, others indicated nurses do not access written material for any area of practice. One participant, who appeared to believe nurses do make use of literature when necessary, commented that nurses had "little interest in articles, or education offered as not seen as relevant [*sic*] to practice setting." Another stated she believed general

duty staff nurses “don’t read nursing magazines, and other literature.” One participant asserted even literature that is mailed to every nurse registered with the RNABC, and therefore, readily available to nurses within the province, may not be read. She declared her fellow nurses “may also not read the articles that are available in nursing magazines sent to BC [British Columbia] nurses.”

A few of the participants who maintained many nurses have knowledge deficits about diabetes because they have not engaged in educational offerings about the disease since graduation from nursing school also expressed the view that nurses would become involved in continuing education programs if they could. One participant captured the sentiments of others when she stated nurses are “overworked,” and do not have enough time to attend inservices. Another suggested in order to correct nurses’ knowledge deficits about diabetes Canada must first “solve the nursing shortage!! So we have the opportunity to attend more inservices.... [exclamation points contained in submission].”

Many participants claimed general duty staff nurses have knowledge deficits about diabetes because diabetes-related ongoing education for nurses is difficult to locate. These participants wrote because of a “lack of continuing education,” or “there is not enough info [information],” general duty staff nurses have knowledge deficits about diabetes. Others suggested employing agencies are deficient in providing inservices about the disease. One participant declared, “No one can stay current without annual seminars, and hospitals are deficit in upgrading programs.” Another explained,

Staff who have not receive adequate educational inservice about DM [diabetes mellitus], and the care from employers. Employers rarely provide educational inservice to staff nurses to update their knowledge. Many nurses including me have recieved [sic] basic education years ago. I [and] we have not recieved [sic] information about nes [meaning unknown] knowledge about DM [diabetes mellitus], either from

employers or taking initiative to do so, there will be a deficits [*sic*] in knowledge.

Other participants stipulated there is a lack of educational offerings taking place in the specific areas which nurses work. One nurse declared there are "not enough education in-services [*sic*], and learning opportunities provided directly on nursing units." Another commented when inservices do take place on her unit or in her area of practice, the sessions do not usually include information about diabetes. She wrote,

As inservices in specific departments tend to focus on issues specific to your specialty area you would have to make an effort to update yourself on these issues on your own time. Many nurses do not feel they have the time for this.

A few participants stated inservices about diabetes were not provided at workplaces because supervisory personnel do not put sufficient value on the knowledge nursing staff have about diabetes. One participant declared, "Inservices have been given on wound care, IVs [intravenous], response to violence, disaster plans, lifting, but in 15 years I have never been offered an inservice in diabetes." Another participant stated more inservices about diabetes would be available within her place of employment if there were "more emphasis on this condition by nursing staff co-ordinator [*sic*]."

Nurses do not receive education about advances in diabetes care.

Many participants taking part in this study believe general duty staff nurses have knowledge deficits about diabetes because nurses have not learned about advances in diabetes care through continuing educational offerings. Several reiterated the sentiments expressed by one who simply stated that nurses have knowledge deficits about diabetes because nurses are "not keeping up with the latest treatments." Others asserted that nurses have not learned about advances in diabetes care because of a lack of time, a dearth of

educational offerings, or both. Although she only commented on her own knowledge base, one nurse declared she had knowledge deficits about the disease because she lacks the time to learn about what is new in diabetes care. She stated, "Changes in treatment, and no time to follow up, and learn about these changes." Another, who did refer to her colleagues, also indicated that finding the time to learn about advances in care was a problem. She stated many nurses have knowledge deficits about diabetes because of their "lack of opportunity to keep up with newest treatments."

A few claimed nurses have knowledge deficits about diabetes because of the paucity of educational updates to inform nurses about diabetes-related advances. Several nurses echoed the opinion of one participant who stated knowledge deficits about diabetes occur because nurses have a "lack of current information." Yet another asserted that "information is constantly changing, and nurses are not kept current," implying that the onus is on some unnamed entity to provide nurses with information about discoveries in diabetes care.

While many participants talked about advancements in diabetes care, only a few specifically indicated the breakthroughs that they feel are creating these knowledge deficits. Several stated the introduction of new medications used in treatment of the disease make it difficult to maintain an adequate knowledge base. One participant, who revealed why she has knowledge deficits about diabetes, explained, "Changes in medication - I only learn about new diabetic medication when a patient is admitted to PACU [the pediatric ambulatory care unit] on the medication." Another, who generalized about why many nurses have knowledge deficits, declared, "The medications, particularly oral hypoglycemic agents are changing." Another suggested, "The information re diabetes changes frequently including the name of the types, new meds [medications], and combinations being used." Others referred to

advances in technology. One nurse revealed she has “no time to keep up with new technology in bs [blood sugar] testing, or education on diabetes.”

Nurses Are Unaware of Their Own Knowledge Deficits About Diabetes

Although not identified as the sole reason by any participant, a nurse's unawareness of personal knowledge deficits about the disease was named as a factor contributing to the knowledge deficits that general duty staff nurses have about diabetes. One participant wrote, “Many nurses doubt they have deficits.” Another speculated about why nurses are unaware of their own knowledge deficits about diabetes. She submitted, “Most nurses probably think they have sufficient knowledge and never give it another thought. They never give it another thought, when there is so much more to it than taking a BS [blood sugar] reading, giving insulin, or oral meds [medications].”

Unawareness of Physicians, and Nursing Educators and Supervisor Personnel

Several participants alleged the unawareness that physicians, nursing educators, nursing supervisory personnel or a combination of all three groups have about diabetes has a direct bearing on the general duty staff nurses' lack of knowledge about the disease. One nurse, who lives with diabetes, wrote,

The level of awareness by nursing professors, head nurses, health administrators, and even physicians about diabetes is appalling. That is what leads to the serious deficiency [*sic*], and lack of awareness as to the nature of the disease, it's [*sic*] health consequences, and it's [*sic*] treatment.

Another participant suggested knowledge deficits about diabetes that general duty staff nurses will not be rectified until nursing supervisors' and physicians' knowledge about the disease are ameliorated. She wrote, “Improvement should start with increased knowledge by nursing supervisors, and treating physicians. The process must be top down. Until then,

general duty nurses will continue to place insufficient importance on this pervasive disease.”

Yet another nurse advised in order to correct the knowledge deficits that general duty staff nurses have there must be “more awareness by nurses in administrative, and management positions.”

Nurses Fail to Recognize Their Role In the Care of Persons With Diabetes

Participants who submitted responses to the database frequently indicated they believe general duty staff nurses have knowledge deficits about diabetes because general duty staff nurses do not often care for patients who live with diabetes, or if they do, diabetes management is rarely the focal point of care. While some participants only commented about themselves, others generalized their observations to their colleagues as well.

One participant stated she has knowledge deficits about diabetes, as she does “not work with clients with diabetes.” Another discussed her own knowledge about diabetes, and the knowledge of her fellow nurses, and indicated, “It is infrequent that we care for a child who has diabetes.” One participant asserted general duty staff nurses, “if they are not actively involved with a diabetic patient, they let a lot of knowledge slip.” Still others responded that diabetes is “not something that nurses deal with on a daily bases,” and nurses lack “opportunities to care for people with diabetes.”

A few participants did not make clear what exposure they believed nurses have to patients with diabetes. These participants did suggest, however, that nurses have knowledge deficits about diabetes because nurses do not use the knowledge about the disease that they, presumably, once had. Participants stated the problem of knowledge deficits about diabetes has occurred because nurses “lack of use of knowledge,” or are “not using it enough.” Another succinctly noted, ““If you don't use it, you loose it.” Although participants who

stated that nurses do not use knowledge about diabetes may have been insinuating that knowledge deficits about the disease have occurred because nurses have little contact with persons who live with diabetes, they may have also been claiming although nurses do care for persons with diabetes, it is not the focal point of their nursing care. Other participants, who do make this distinction, suggested nurses become involved in diabetes care only when this disease is within their specialty area. One summarized, "There are so many issues of concern in nursing and depending on your specialty, you may not be directly involved in treating patients with diabetes [sic] as their primary issue."

In contrast, several nurses suggested that even though general duty staff nurses are involved in the care of persons with the disease, nursing care is restricted to the performance of a limited number of diabetes-related tasks. One nurse submitted, "Most general duty nurses only deal with diabetic patients when they are hospitalized and deal mostly with monitoring blood sugars, [and] administering antihyperglycemic [sic] agents." Another explained that nurses have limited responsibility when caring for patients who live with diabetes and only perform "assessments of symptoms [sic] of abnormal BS [blood sugar], and teaching hygiene [sic]. They have very little to do with meal planning, adjusting insulins [sic], balancing diet, and exercise, or a host of other concerns in the daily life of the patient." Another participant expressed a similar opinion, and stated nurses "do not work with clients/patients [sic] outside of medication dispensation [sic] in many cases, and do not think about complications, etc [and so forth] associated with the disease."

Reliance On Other Health Care Personnel, and the Patient

Many participants suggested general duty staff nurses have knowledge deficits about diabetes because nurses rely on other health care personnel, or the individual who lives with

diabetes to have sufficient knowledge about the disease to manage symptoms. Several declared physicians have an obligation to provide nurses with directions for diabetes care. Others argued the responsibility for diabetes care rests with health care professionals who have specialized training in the disease. Still others indicated because persons who live with diabetes are knowledgeable, they are able to provide their own care.

One nurse, who admitted both she, and her colleagues had knowledge deficits about diabetes, indicated that the physicians on her unit have sufficient knowledge about the disease, and therefore, can direct the nurses in the provision of care to patients living with diabetes. She wrote, "The staff will look meds [medications] up in the CPS [Compendium of Pharmaceuticals and Specialties], or we will ask the physician or anaesthesiologist [*sic*] about it." Another declared when she, and her colleagues care for persons who live with diabetes, "We wing it. Hoping that the doctor has ordered the appropriate diet, med [medication], and dosages."

Other participants indicated nurses have knowledge deficits about diabetes because health care personnel who have specialized training in the field perform the bulk of the care. One nurse claimed nurses' "reliance on diabetic educators to actt [*sic*] as a resource, and to provide patient teaching decreases motivation to participate in self-directed learning" about the disease. Another suggested she did not often seek out information about diabetes because "in my area, if a person is newly diagnosed or is having any difficulty [*sic*] with their disease, they are sent to the only local diabetic nurse." One remarked that nurses have enough knowledge about diabetes to provide care to persons living with the disease during hospitalization. She reasoned, "The general duty nurse concentrates mostly [*sic*] on stabilizeing [*sic*] the patient while in hospital, and counts on dieticians, doctors, home care

nurses, and specialty clinics to do the rest.” Another participant declared that although the nurses on her unit have knowledge deficits about diabetes, patient care is not adversely affected because patients receive assistance from specialists in the field of diabetes. She explained that when aid is provided to patients with diabetes by the nurses on her unit, “We rely on others as resource people.” Still another declared, “Since most patients with diabetes have other professionals treating them for diabetes, their treatment for other problems would not be impacted.” One participant stated,

We just follow the Drs [doctors] orders and check the blood sugars as ordered, and suggest they go to the clinic for followup [*sic*]. We do have a teaching sheet to follow if the clinic appt. [appointment] is to be a few weeks hence. I don't think their care is hampered, but sometimes think their stay is longer due to trying to regulate the insulin requirements in an articial [*sic*] environment.

Several participants mentioned that they relied on the person who lives with the disease to have the necessary knowledge to manage the symptoms of the disease. One explained that despite her personal knowledge deficits about diabetes, patient care is not affected because patients can manage the disease on their own. She rationalized that “usually patients learn about their desease [*sic*].” Another suggested she had little knowledge about diabetes but could care for a patient with the disease because she was able to recall information about diabetes from nursing training, and the patient would be familiar with his or her disease. She stated,

Initially, before I research it on my own, I would rely on my memory from my basic training eg. [for example] indications of hyper & [and] hypoglycemia, Blood Sugar levels & [and] interventions, I would rely on the patient's expertise living with the illness...[ellipse points contained in submission], and what has worked before for them.

In summary, participants who submitted information to the data base suggested that general duty staff nurses have knowledge deficits about diabetes because nurses believe that

the disease is difficult to comprehend; nurses underestimate the complexity of the disease; nursing training programs fail to adequately teach students about diabetes and, as a rule, nurses do not partake in education about diabetes after leaving nursing school; nurses are unaware of the knowledge deficits about diabetes that exist; the level of awareness about diabetes that nursing educators, nursing administrators, and physicians have affects the knowledge that nurses have about the disease; nurses fail to recognize their role in the care of persons with diabetes; and nurses rely on other health care personnel, or the patient to have the knowledge required to manage the disease.

Implications for Care of Persons With Diabetes

Nurses responding to the question, *How is the care that persons living with diabetes receive affected by nurses' knowledge about diabetes?* answered from one of three perspectives. Many discussed how care is adversely affected when nurses lack knowledge about diabetes. Others declared the knowledge deficits that nurses have about diabetes have no effect, or are only minimally deleterious to the care that is received by persons living with the disease. Still others concentrated on the improvements to care which would be realized if general duty staff nurses knew more about diabetes.

Deleterious Effect on Care

Nurses who indicated knowledge deficits about diabetes have a deleterious effect on care discussed the complications that arise when general duty staff nurses lack knowledge about the disease. Several simply asserted that persons with diabetes receive inadequate health care as a result of nurses' knowledge deficits. Others declared that persons with diabetes suffer increased complications, and that diagnosis is delayed as a direct result of

nurses' knowledge deficits. Still others believed patients, other healthcare personnel, or both are given inaccurate information about diabetes when nurses are not knowledgeable about the disease.

Inadequate care.

Several participants wrote that unsatisfactory care is delivered to persons living with diabetes when general duty staff nurses have knowledge deficits about the disease. Although a few did not indicate the areas of care they believed are most affected, or to what extent care is compromised by knowledge deficits, other participants were detailed in their descriptions. Some nurses specified that relatively minor consequences occur because of poor care. Others predicted dire outcomes.

One participant merely wrote that the care of persons who live with diabetes is "not the best" when nurses have knowledge deficits about this disease. Another expressed a similar opinion and declared, "If a nurse fails to recognize the needs of diabetic patients, care will suffer." One believed that when nurses have knowledge deficits about diabetes, they "fail to identify patients' symptoms as attributable to diabetes." Still another asserted that "important aspects of diabetic care might be missed altogether, or not fully addressed" as a result of the knowledge deficit that nurses have about the disease.

Several participants described the areas of nursing care they believe are most affected by knowledge deficits about diabetes. One charged that patients who live with the disease "don't get the care they need, and the proper, immediate care in an emergency [*sic*]. They will also no [*sic*] be educated properly upon discharge" because nurses lack knowledge about diabetes. Another nurse suggested that because she has knowledge deficits about diabetes, she "may not be able to meet my clients needs initially, or offer them the resources they

need.” Others, who generalized about their colleagues’ knowledge and practice, indicated that because nurses are not knowledgeable about the disease, the “impact of diabetes is not taken into account when assessing patient needs, or change in status, [and] management of diabetes in relation to treatment regimes may be unclear, and not effective;” and persons who live with diabetes “may not be treated properly, and may also cause risk to the patient.” One nurse warned, “Many nurses may respond with anger to patients with uncontrolled diabetes who may be irritable. There could be a number of other symptoms that may be misunderstood or not recognized.”

Several participants suggested that persons with diabetes might not properly monitor their blood glucose when they are provided care by nurses who have knowledge deficits about diabetes. One wrote that when nurses are not knowledgeable about diabetes,

Nurses fail to encourage diabetic patients to monitor their blood-glucose levels, or to monitor levels for the patient. If monitoring is not done, neither the nurse, nor the patient can tell what the patient should eat, or how much insuline [*sic*] should be injected.

Another lamented, “Nurses have little knowledge of appropriate monitoring techniques, monitoring frequency, and treatment for hypo- or hyperglycemia.” Yet another stated, “Lack of knowledge leads to poor control of blood sugars through failure to test blood glucose, and modify diet appropriately.”

A few participants declared persons who live with diabetes experience dire outcomes because nurses have knowledge deficits about the disease, including premature death. One respondent wrote that knowledge deficits of general duty nurses about diabetes

puts there [*sic*] life in danger. Nurses being unaware of hypo and hyper glycemia signs, and symptoms [*sic*]. Not knowing what a normal sugar is. Not knowing how the different insulins [*sic*] work, and how quick, and for how long. Not understanding how medications, and illnesses can effect diabetics.

Another, who indicated she believed patients with diabetes die because of nurses' lack of knowledge, wrote that the knowledge that other health care professionals have about the disease is also a factor. She submitted, "Many people are dying from this disease because not only nurses not keeping up with current knowledge."

While the majority of participants who made submissions to my database limited their comments to diabetes care, a few suggested that when nurses lack knowledge in any area, care is detrimentally affected in all aspects. One participant wrote, "Lack of knowledge would lead to substandard care." Another nurse declared that although the care of persons living with diabetes is adversely affected by nurses' lack of knowledge about the disease, knowledge deficits about diabetes are no more deleterious than are knowledge deficits about other diseases. He submitted the effects that knowledge deficits about diabetes have on patient care are "pretty much the same as someone with any other disease...[ellipsis points contained in submission] it is potentially detrimental." Other participants voiced similar opinions, and stated, "lack of knowledge leads to less effective care;" "poor knowledge in any area will be harmful to patient care;" and there is a "direct correlation between knowledge, and care received."

Increased complications.

Several participants indicated that they believe increased morbidity and complications result when nurses lack knowledge about a patient's disease. Although only one nurse specifically referred to diabetes care, the comments of other participants are applicable to diabetes care. One nurse held that immediate complications would arise if the nurses working in her area have knowledge deficits about a disease, and stated, "A knowledge of any disease process is necessary to be aware of possible complications, especially post

surgical or post anaesthesia." Another participant made specific, detailed reference to the types of complications that persons who live with diabetes would endure because of nurses' lack of knowledge about the disease. She declared,

If a nurse has a knowledge deficit about diabetes, they are less likely to understand the underlying complications that arise from the disease, eg. [for example] circulation, and wound care, compliance issues, cardiac symptoms in a age group not characteristically thought of having cardiac problems (miss interpreting symptoms, or not weighting symptoms of diabetic patients appropriately)[round brackets contained in submission].

Delayed diagnosis.

Several participants alleged that persons with the disease are not diagnosed, or suffer misdiagnosis because nurses have knowledge deficits about diabetes. Two asserted that the only implication for care is delayed diagnosis of the disease. One participant suggested that physicians are also to blame, and stated, "Many diabetic patients probably go undiagnosed because the medical, and nursing staff are unfamiliar with the disease." Others limited their comments to nurses. One asserted, "Nurses are not spotting the symptoms of diabetes. As a result the patient's disease goes untreated." Another declared, "Nurses should be aware of symptoms, and appropriate treatment. Otherwise, patients will be improperly diagnosed." One participant did not refer to nurses' knowledge about diabetes, but detailed a situation where recognition of symptoms of diabetes by general duty staff nurses could have resulted in a more timely diagnosis.

There are many Aboriginal people who have not yet been diagnosed, yet show the symptoms of diabetes. The only time care is provided is when Aboriginal people present themselves to the ER [emergency room], or Hospital with a heart attack, or complications of diabetes, ie: [that is], blindness, kidney damage, etc [and so forth]. Many of the physicians who care for aboriginal people in remote, or not even remote areas, do not know much about diabetes. Is it they don't care about their Aboriginal clients with diabetes or clients with symptoms? Aboriginal people are over represented in dialysis, eye disease, obesity, die sooner, and are

diagnosed later, even though the aboriginal people develop diabetes type II as early as age 2 years of age.

Inaccurate information.

Many participants suggested that nurses relay inaccurate information about diabetes to patients, other health care personnel, or both because nurses have knowledge deficits about the disease. A few participants did not elaborate further, and merely stated that patients with diabetes do "not get the most appropriate information;" "may receive incorrect, or outdated information;" and "they may get conflicting [*sic*], or incomplete care/advise [*sic*] from the bedside nurse." Others detailed the information that is lacking. One participant revealed, "Nurses with inadequate knowledge of diabetes are unable to give patients appropriate advice on diet, excersize, and regular monitoring of their blood sugar levels." Another, who indicated she worked in a long term care facility, stated, "Patient, and family education about diet, excerice [*sic*], personal care, foot care, medical management, etc [and so forth] will be negatively affected if the staff failed [*sic*] to give the appropriate, and correct information to residents." Still another claimed, "The patient may not have proper teaching about management of diabetes at home. The pateint [*sic*] may be running into difficulties with blood sugar management, and the nurse may not recognize it."

A few nurses suggested the inaccurate information about diabetes that nurses communicate to other health care personnel has a harmful effect on patient care. One participant stated that persons with diabetes might experience poor care because "staff may also failed [*sic*] to give correct, and adequate information to unregulated staff." This participant also suggested that nurses might not communicate appropriate information to medical staff. She declared, "Staff nurses may failed [*sic*] to relate essentail [*sic*] information, and concerns to physicians in dealing with complications." Another also

indicated that nurses may not relate important diabetes-related patient data to physicians because nurses lack of knowledge about the disease. She wrote, "With a lack of knowledge a nurse may be unsure as to when to contact a physician or not."

No Impact

A few of the participants who responded to the query "How is the care that persons with diabetes receive affected by nurses' knowledge about diabetes?" indicated that they believe patient care is not, or is only minimally affected when nurses have knowledge deficits about diabetes. One explained, "Since most patients with diabetes have other professionals treating them for diabetes, their treatment for other problems would not be impacted." Another declared,

I believe that care while in hospital is adequate but could be improved upon. I believe that patients are receiveing [sic] safe, and competent care but could benefit from further support in teaching about the disease, and how to better live with it.

Another reasoned that care is only minimally affected because "the basics, eg [for example] testing blood sugars, and administering medications is not usually an area of deficit. The more detailed knowledge is what is missing."

Improved Care With Increased Knowledge

Several participants advised that persons who live with diabetes receive better care when nurses are more knowledge about diabetes. All of these participants focused on how increased knowledge about diabetes improves care, and did not comment on how lack of knowledge may be deleterious. While some did not indicate the areas of care which would be changed for the better when nurses' knowledge about diabetes is improved, others were specific about the aspects of care they felt would be affected.

A few participants indicated that care improves generally when nurses are

knowledgeable. One participant commented, "If nurses knew more about diabetes, they would be able to provide both advice, and treatment for the conditions that the disease gives rise to." Another suggested, "Naturally, the more a nurse knows about a patient's condition, the better the care for that patient is likely to be."

Several participants specified the areas of diabetes care they feel are positively affected when general duty staff nurses are knowledgeable about diabetes. One participant asserted earlier detection of the disease might result. "Knowledge of diabetes is important as a diagnostic tool to confirm, or refute diabetes as a cause of a patient's symptoms." Two participants detailed several aspects of care they believed are affected by the knowledge that general duty staff nurses have about diabetes. One wrote,

Emergency care when persons with diabetes have a hypoglycemic episode is essential. Family members need current knowledge regarding the care of their loved one with diabetes. Persons with diabetes need to know preventative care, foot care, eye care, nutritional care, and updates on medications including insulin action, and use.

Another submitted the following comment.

A nurses level of knowledge impacts upon the care because increased knowledge facilitates better assessment of patient's diabetes self-management; more critical assessment of the impact of medical interventions upon the patient's health; quicker, and more accurate identification [*sic*] of problems, and potential problems; anticipation of issues before they arise, and the implementation of interventions before problems escalate; efficient use of specialty diabetic resources; instills a sense of patient/nurse trust because the nurse conveys confidence, and knowledge when interacting with [*sic*] the patient; [and the] patient will be more likely to actively participate in their own health care.

In summary, while the majority of the participants who responded to this query declared that the care of persons who live with diabetes is detrimentally affected when nurses have knowledge deficits about diabetes, a few stated that knowledge deficits have no, or only inconsequential, effect on care. Several participants did not mention what they believe is the

effect of knowledge deficits, but suggested that care would be improved if nurses had more knowledge about diabetes.

A few of the participants who asserted that knowledge deficits about diabetes have a detrimental effect on care stated that only minimal difficulties arise. Others, however, announced dire consequences. Participants suggested that because nurses have knowledge deficits about diabetes, patients with the disease receive inadequate health care, suffer increased complications, experience delayed diagnosis, and may die prematurely. Participants also advised because nurses relay inaccurate information about diabetes, nurses cause patients, other health care personnel, or both to improperly manage the disease.

A few respondents concluded that nurses' knowledge deficits about diabetes have little, or no impact on the care of persons living with the disease. These participants stated that the care offered by nurses meets the needs of persons with diabetes because nurses are knowledgeable about the basics of diabetes; other more skilled health care professionals, with specialty training in diabetes, are able to provide care, or both.

Many participants, who did not indicate how care is affected when nurses have knowledge deficits about diabetes, asserted that patients with diabetes receive better care when general duty staff nurses increase their knowledge about the disease. The areas that participants named would be improved mirrored the areas participants stated are affected by knowledge deficits. Participant suggested when nurses increase their knowledge about diabetes persons with the disease receive better care, suffer fewer complications, and are diagnosed in a more timely manner. Participants also indicated that when nurses know more about diabetes, persons living with the disease acquire accurate information about management of symptoms, and diabetes-related resources are more effectively utilized.

Methods to Improve General Duty Staff Nurses' Knowledge About Diabetes

Nurses who responded to the question, *How can the knowledge that nurses have about diabetes be improved?* made several suggestions that focused, for the most part, on providing information about diabetes to general duty staff nurses. Many participants advised that other health care personnel, namely physicians, and supervisory personnel, must also become informed about diabetes before the problem of nurses' knowledge deficits about the disease can be rectified.

Education of Nurses

The majority of participants suggested that the way to ameliorate nurses' knowledge deficits about diabetes is to provide more diabetes education to nurses. While a few indicated that student nurses should receive increased diabetes education during training, others advised that practicing nurses must routinely engage in continuing education about diabetes.

Improve training.

Several participants proposed that the way to improve general duty nurses' knowledge about diabetes is to increase diabetes-related instruction during nursing training. They echoed the sentiments of those who suggested that there must be "better emphasis while in training," "greater emphasis while in university on importance of knowledge of diabetes," and that "more emphasis on the magnitude of this condition should be given in nursing schools." One participant suggested that knowledge about diabetes was so important for nurses that during training "there should be full courses on diabetes."

Continue education about diabetes after graduation from nursing school.

Most of the participants who made submissions to the database asserted that nurses must continue their education about diabetes after graduation from nursing school to ensure they do not have knowledge deficits about diabetes. While a few participants echoed the opinion of one who recommended “inservices, inservices...inservices!! [ellipses, and exclamation points contained in submission],” others offered more detailed recommendations for continuing education programs. Several participants pointed out that more significance must be placed on self-study. Many declared that courses on the Internet would improve nurses' knowledge about diabetes. Others asserted that formal, and informal continuing education programs must be provided at places of employment. A few suggested that exposure to health care personnel who have specialized training in the area of diabetes care could assist nurses improve their knowledge about the disease. Although every participant did not mention this issue, many of the nurses suggested that it is the duty of employers to provide continuing education programs about diabetes during work hours. Others indicated that nurses themselves must arrange, fund, and dedicate their time to participate in diabetes-related continuing educational programs.

Many participants suggested that nurses should engage in self-study programs to maintain their knowledge base about diabetes. These participants wrote that nurses could improve knowledge about diabetes by taking “some sort of course that could be taken over the Internet, or by correspondance [*sic*];” engaging in “self study [*sic*], workshop, inservices, teleconference, case review, etc [and so forth];” “on a regular basis, get [or] obtain information on the newest technology, and information that relate [*sic*] to diabetes;” and by reading “more articles, cases studies for nurses to keep up on diabetes.” One nurse stated,

"...If I was given a child with Diabetes, I would need to research it from my texts...." Yet another did not make any recommendation about what types of educational activities she believed nurses should engage in, but stated that nurses' knowledge deficits about diabetes are ameliorated when "Staff nurses take the initiative [*sic*] to seek relevant information." One participant declared that before nurses can partake in continuing education to improve their knowledge about the disease Canada must first take steps to employ more nurses.

A few participants announced that nurses would have to be taught about the necessity of continuing education before they will partake in educational offerings about diabetes. One nurse suggested there must be a "campaign to inform nurses that they need to stay really up to date." Another stated that there ought to be "more emphasis on need to keep up with current developments in nursing magazines and other literature." One nurse, who stated that general duty staff nurses did not have knowledge deficits about diabetes suggested, "There is no major need for improvement, but general emphasis on continuing education would probably help." One participant asserted that more significance should be placed on continuing education after graduation when nurses are students. She wrote the method to improve general duty nurses' knowledge about diabetes is to have "greater emphasis on ongoing education while nurses are in university." One declared the only way to improve the knowledge that nurses, and physicians have about diabetes is to "make continuing education for nurses (and physicians) mandatory [round brackets contained in submission]."

A few participants mentioned the Internet as a means of acquiring continuing education about diabetes. One advised that nurses could gain information about diabetes through "Internet access to new treatments." Another recommended that "info [information] on the Internet" be made available as a method for improving knowledge about diabetes.

One participant suggested nurses could find a "course that could be taken over the Internet" to improve their knowledge about diabetes.

The majority of nurses who made submissions declared that nurses' knowledge about diabetes would be improved if more information about diabetes were presented to nurses within hospitals. Many suggested that continuing education be in the form of inservices. Others proposed that print materials should be offered. Still others recommended that employers make specialists in the field of diabetes care accessible to nurses. Although several did not indicate who they believed should shoulder the cost of providing continuing education for nurses, many advised that employers must contribute both time for nurses to attend continuing education sessions, and money to fund programs. One participant simply wrote there should be "more inservices and info [information] given to ward clinicians." Two more recommended "yearly inservices." One respondent stated that annual inservices would "keep nurses knowledge fresh." Another suggested inservices have to be scheduled more often to make a difference in the knowledge that nurses have about diabetes. She wrote, "In-house education sessions for nurses available on a regular basis – eg [for example] twice a year."

A few participants suggested formal inservices were not necessary. One nurse proposed, "Education packages sent out to facilities so the nurses could review, re-educate, and update on diabetes (brief as possible) [round brackets contained in submission]." Another declared that nurses' knowledge about diabetes would be improved if "books, and current periodicals available where nurse work." One asserted that the care provided to persons with diabetes could be improved if the hospitals, and other health care agencies provided nurses with "some care paths to refer to for the common challenges." Another

wrote, "Clinical pathways, or care maps would be valuable." One participant declared that nurses' knowledge about diabetes would be improved if "individual patients came with detailed nursing care plans with instructions as to their diabetes management regime that would be valuable." She did not state, however, whom she felt should be responsible for providing these materials.

Several participants claimed that nurses' knowledge about diabetes would be ameliorated if nurses had increased access to specialists in the field of diabetes. They suggested there be "better communication from professionals who are versed in this area," "more exposure to specialists in this field," and "diabetes educators being available to the staff." Another claimed, "There needs to be a network established either on-line, or inter-hospital/clinic by Diabetes Educators to help share the knowledge." A few participants pointed out that general duty staff nurses with an interest in diabetes care could be selected to inform themselves about the disease, so that they could act as an educational resource for their colleagues. One suggested that nurses' knowledge about diabetes would be improved if "at least one person as a contact at each facility for updates on new info [information] and evaluation of ED [educational] packages (probably the diabetes nurse if a place has one) [round brackets contained in submission]." Another recommended that health care agencies "incorporate responsibility for some patient teaching to the ward nurse who has completed the certification course (decreases demands on the diabetic resource nurse, acknowledges the ward nurse's education level, and provides the patient with immediate access to information that is responsive to his/her [*sic*] needs) [round brackets contained in submission]." One more suggested that nurses' knowledge about diabetes would improve

by having greater exposure to the many facets of diabetic care, and learning from the various disciplines [*sic*]. For example in services by home

care, or diabetes [*sic*] nurses would help general duty nurses understand the many patients needs outside of the hospital. Consequently, nurses could then give support to teaching done in those areas.

Other participants suggested that specialists in the field of diabetes care provide formal inservices to general duty staff nurses. One stated that in her health care institution, "Diabetic educators could provide ongoing annual inservices to nurses in other specialty areas, noting the recent changes about diabetes, and the connection of symptoms to those seen in other specialty areas." Another declared, "Perhaps the Diabetes Association could offer in-services on nursing units over a period of time to better inform nurses."

Several participants asserted that employers have a duty to provide time, programs, or both so nurses can engage in continuing education about diabetes. Many participants stated that until nurses have educational sessions provided by employers, and staff are granted time to attend, general duty staff nurses will have knowledge deficits about diabetes. One nurse suggested the way to improve general duty staff nurses' knowledge about diabetes is to have "paid education, and more often." Others submitted employers must "provide inservice, and education to staff nurse regularly;" "provide more inservice programs on diabetes for nurses in hospitals;" "in house [*sic*] inservice during work hours;" "more education [*sic*] sessions in hospital;" "and "on-going in-services in work places that focus on diabetes in relation to the specific settings."

Other participants indicated that employing agencies do not necessarily have to provide the inservices about diabetes but must "provide more opportunities to attend educational sessions." One respondent, who seemed to feel that nurses might need some coaxing to be present at continuing educational programs, declared there must be "more aid for compulsory [*sic*] seminars by hospitals." One participant suggested that employers could

provide nurses with motivation to partake in continuing education. She wrote, "Offer self-directed/professional [*sic*] development courses that are provided by the employer, and give recognition of the completion of training with certification."

Many of the participants who asserted that general duty staff nurses need to have more education about diabetes also declared that awareness of the disease by nurses must be improved. One participant suggested continuing education programs for nurses have an "emphasis of complexity." Another declared that nurses must place "more emphasis on the magnitude of this problem, and the need for patients to have attentive, and knowledgeable [*sic*] treatment for their diabetic condition." Yet another claimed that nurses, as well as the general public, need a greater awareness of the disease. She recommended "National awareness of DM [Diabetes Mellitus], eg. [for example] National DM [Diabetes Mellitus] Awareness Week." One nurse indicated that she now plans to partake in educational offerings about diabetes because of her increased awareness of her own knowledge about diabetes. She wrote "...[ellipsis points contained in submission] Now even filling in this questionnaire, I am more apt to look for Cont Ed [Continuing Educational] opportunities ie [that is] in Canadian Nurse & [and] RNABC magazine."

Several nurses who submitted responses to the web page indicated that they would be interested in reading nursing articles about diabetes. While many did not comment on the number of articles about diabetes they believed have been available in nursing magazines, and other media, a few suggested that nurses have not improved their knowledge about diabetes because there is a shortage of information about diabetes in nursing publications. These participants commented that to improve nurses' knowledge about diabetes there must be "more articles, cases studies for nurses to keep up on diabetes;" "educational flyers;"

“more articles on this, and other topics of day to day [sic] concern to nurses who provide direct care to patients;” “accessible information form [sic] different avenues, eg. [for example] Internet, journals;” and “there could also be more regular articles submitted to Canadian Nurse, or other nursing journals.” One participant indicated that information must be readily available. She wrote,

Inservices, information brochures... the thing is to deliver the information in a setting where the nurse will not have to go out of there [sic] way... if an effort or an inconvenience is anticipated then you've lost a large proportion of those nurses who most need the information [ellipsis points contained in submission].

Educate Nursing Teachers, Supervisors, and Physicians

Many of the participants making submissions to the database declared that nursing teachers, supervisors, physicians, or all of these personnel must first be educated about diabetes before general duty staff nurses' knowledge about the disease will improve. For some, this was the only method they suggested to ameliorate the knowledge deficits that general duty staff nurses have about diabetes. Participants submitted that to improve the knowledge that general duty nurses have about diabetes, there must be “greater awareness by treating physicians;” “more emphasis with nursing teachers, nursing supervisors, health administrators, and family physicians” and “increased knowledge by nursing supervisors, and treating physicians.” One nurse, who replied to a comment submitted to the electronic bulletin board about Aboriginal health, suggested that nurses must educate other health care professional about the disease.

As well, nurses need to work towards ensuring that all members of the health care team are up-to-date on the precursors of, and signs and symptoms of, diabetes, particularly the family physician and emergency room staff, who are often the first medical personnel [sic] people will encounter and a provide a great opportunity to pick up on diabetes.

In summary, participants who made submissions to the data base suggested that to ameliorate general duty staff nurses about diabetes there must be more focus on diabetes during nursing training; nurses must partake in continuing education about diabetes after graduation from nursing school; written educational offerings about diabetes must be more available and accessible; and nursing teachers, supervisors, and physicians must become more aware and better educated about the disease.

Chapter Summary

In chapter four, an interpretive summary of the responses received from the web site www.nursingdiabetes.com and the electronic bulletin board www.nursingdiabetes.com/bulletin_board has been presented. Analysis of the data has revealed that many participants believe that general duty staff nurses have knowledge deficits about diabetes, the care that persons who live with diabetes receives is deleteriously affected by the knowledge deficits of general duty staff nurses, nurses' knowledge deficits about diabetes have several causative factors, and there are a variety of strategies to improve the knowledge about diabetes that nurses have. In the following chapter, I will discuss the research findings in light of relevant literature and directives for nursing education, practice, and research.

CHAPTER FIVE

Discussion, Limitations, and Implications

In the beginning of this chapter, I will discuss the findings generated in this research, and compare the findings of this study to the published reports of previous studies.

Following, I will outline the implications that these findings have for nursing practice, education, and future investigations. Chapter five will close with a review of the limitations of this study, my reflections about the use of computers, the WWW, and the Internet as data collection tools in nursing research, and a synopsis of this study.

Discussion

In the past, investigators have derived conclusions about the existence and cause of nurses' knowledge deficits from analysis of the responses that nurses gave to questions about diabetes knowledge, and demographic information obtained from study participants. It is not always clear from the published reports how the effects of the identified knowledge deficits have been ascertained. Other researchers have captured the opinions of investigators, physicians, nursing educators, and nursing supervisory personnel to formulate strategies to ameliorate nurses' knowledge deficits. In this study, general duty staff nurses have provided thoughts and insights into the existence, causes, and effects of nurses' knowledge deficits, as well as strategies to correct these knowledge deficits. I have used relevant literature and personal experience to support participants' submissions, and to substantiate my insights regarding the factors that contribute to nurses' knowledge deficits about diabetes and the strategies to rectify the situation. The pertinent thoughts expressed by nursing supervisory personnel at the beginning of this study are included in the following discussion.

The central themes that were identified during analysis of data obtained while conducting this study also emerge in the published reports of past investigations. An extensive literature review indicates that many researchers (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Gossain et al., 1993; Lawrence et al., 1989; Leichter et al., 1980; Lenahan, 1993; Lipman & Mahon, 1999; Meltzer et al., 1998; O'Brien et al., 2002; Sargent, 2002; Scheiderich et al., 1983) believe that (1) nurses lack knowledge about diabetes, (2) a number of factors affect the knowledge that nurses have about the disease, (3) patients who live with diabetes suffer because nurses have knowledge deficits in this area of care, and (4) there are methods to improve nurses' knowledge about the disease.

Nurses Have Knowledge Deficits About Diabetes

Data from this research study support the conclusions of several previous investigators who stated that nurses lack knowledge in several areas related to diabetes, such as diabetic survival skills (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Lipman & Mahon, 1999; Scheiderich et al., 1983), insulin administration and timing (Baxley et al.; El-Deirawi & Zuraikat; Etzwiler; Lipman & Mahon; O'Brien et al., 2002; Scheiderich et al.), diet (Baxley et al.; Drass et al.; El-Deirawi & Zuraikat; Lipman & Mahon; Sargent, 2002; Scheiderich et al.), and etiology of diabetes (El-Deirawi & Zuraikat; Etzwiler; Lipman & Mahon; O'Brien et al.). Even participants who did not agree that nurses have knowledge deficits about diabetes indicated that it is possible for nurses to lack knowledge in this area of care. Every participant who denied the existence of knowledge deficits submitted reasons why knowledge deficits may occur.

Factors that Affect Nurses' Knowledge

Data from this research support the conclusions of previous research that suggest that a number of factors contribute to nurses' knowledge deficits including the practice area (Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; Lenahan, 1993; Sargant, 2002; Walker et al., 2001), the initial nursing educational preparation (El-Deirawi & Zuraikat; Gossain et al.), the number of diabetes continuing educational inservices the nurse has attended (Baxley et al., 1997; Drass et al.; El-Deirawi & Zuraikat; Gossain et al.; Leichter et al., 1980; Sargant; Scheiderich et al., 1983), and awareness of knowledge deficits (Baxley et al.; Drass et al.; Hilton, 1982; Lenahan). Participants in this study added data that nurses' inaccurate assessment of the complexity of the disease, nurses' failure to recognize their role in the care of persons with diabetes, and nurses' reliance on other health care personnel or the patient to have knowledge about diabetes are factors that contribute to the lack of knowledge that nurses have about diabetes. These submissions may reveal evidence about knowledge deficits, rather than provide clues to what causes knowledge deficits.

Practice area.

Although many researchers have suggested that there is a relationship between the knowledge that nurses have about diabetes and their specific area of practice (Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; Lenahan, 1993; Sargant, 2002; Walker et al., 2001), the nature of this relationship has not been explored in the published reports of investigations on this topic. Data from this research indicate that in many practice areas, diabetes is designated as a disease secondary to the main foci of the clinical setting. Several participants in this study declared that because diabetes is not a primary focus of care in some practice areas, nurses in those areas place less concern on their knowledge about diabetes. Additionally, participants declared that nursing supervisors and nursing educators in

the areas of practice that designate diabetes as a secondary diagnosis have fewer expectations of knowledge about diabetes for nurses, and direct fewer resources towards providing nurses with continuing education for this area of care.

Participants' identification of diabetes as a secondary diagnosis may also present other problems. Some nurses have been found to have less actual than self-reported knowledge about diabetes (Baxley et al., 1997; Drass et al., 1989; Hilton, 1982; Lenahan, 1993). It may be that identifying diabetes as secondary to the primary foci of care leads nurses to place less importance on accurately accessing their knowledge. Nurses may be overestimating their knowledge about diabetes because they do not believe that it is necessary for them to accurately review their knowledge in this area of care.

Nurses, who view diabetes as a secondary, and possibly a less important diagnosis, may not be taking the effects of diabetes into account when performing nursing assessments, or administering care. Comments about the secondary nature of this diagnosis may also imply that participants lack knowledge about the effect that diabetes can have on the health of patients who live with the disease. Diabetes can lead to many other disease processes such as cardiac and kidney disease, retinopathy and blindness, neuropathy, and dementia (Haire-Joshu, 1996). Suggestions that diabetes is a secondary diagnosis, when the primary diagnosis is one of these disease processes, may indicate that participants do not recognize the complications of diabetes as such.

Initial basic training.

Some researchers have found that nurses who receive initial basic training in a university program scored higher on tests designed to assess knowledge of diabetes (El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; Lenahan, 1993). While participants in this study make no mention of the differences between preparatory nursing programs, comments submitted to the study web page indicated that nurses who took part in this study do not feel that students are adequately instructed about diabetes during initial nursing training. Participants did not however reveal what they believe is the nature of the deficiency.

Some researchers state that the basis of instruction for every initial health care training program could be diabetes care (Haire-Joshu, 1996). Student nurses in diploma and university preparatory programs in the province of British Columbia attend as few as two, and usually no more than four, lectures dedicated to diabetes instruction during their initial basic training (personal communication, Leslie Stuart, University of British Columbia, August 26th, 1998; personal communication, Fran Johnson, Douglas College, August 27th, 1998; personal communication, Anne Wyness, University of British Columbia, August 4th, 1999). Each lecture is approximately 2 hours in length, and the exact number and content are dependent upon the interest of the students, and the individual nursing instructor (personal communication, Leslie Stuart, University of British Columbia, August 26th, 1998; personal communication, Fran Johnson, Douglas College, August 27th, 1998; personal communication, Anne Wyness, University of British Columbia, August 4th, 1999). A few students may receive additional diabetes education during lectures concerning maternity or paediatric subjects. A student nurse's clinical experience during his or her basic nursing program may not include care of a person living with diabetes (personal communication,

Leslie Stuart, University of British Columbia, August 26th, 1998; personal communication, Fran Johnson, Douglas College, August 27th, 1998; personal communication, Anne Wyness, University of British Columbia, August 4th, 1999). Most student nurses trained in British Columbia have an opportunity to care for a person with diabetes, but this is not a prerequisite to graduate from any of the basic nursing preparatory programs in British Columbia (personal communication, Leslie Stuart, University of British Columbia, August 26th, 1998; personal communication, Fran Johnston, Douglas College, August 27th, 1998; personal communication, Anne Wyness, University of British Columbia, August 4th, 1999).

Licensure examinations are used to assess the adequacy of students' knowledge to begin practice as registered nurses. Samples of registered nurses' licensure examinations are available in the study guides published by the Canadian Nurses' Association. The questions can give an indication of the number and type of questions that are asked on these examinations. The guide offered by the Canadian Nurses' Association (2000) includes samples of licensure examinations. One examination includes seven case-based questions about diabetes, approximately 5% of the examination. The second examination has two questions, less than 2% of the examination, about related to diabetes care. Previous guides devote approximately 7% of the questions to diabetes care (Canadian Nurses' Association, 1992; 1995). The queries in each of the sample examinations assess factual knowledge of diabetes, and do not examine the effect that diabetes has on other aspects of nursing care. Although the American preparatory nursing examination manual published by Mosby (Saxton, Nugent, & Pelikan, 1996) is not directly representative of Canadian nursing examinations, as the American system of educating, and ensuring knowledge through examination is similar to the Canadian method, this guide can be reviewed to assess the type

and number of diabetes questions that may appear on nursing licensure examinations in Canada. Twenty-six questions directly related to diabetes, 10% of the test, are included in the Mosby guide. Many are similar to those found in the guide published by the Canadian Nurses' Association. Nurses who are able to correctly respond to the questions about diabetes on a licensure examination are considered to have sufficient knowledge to provide care that meets minimum standards for persons with this disease.

Even though the majority of persons writing Canadian licensure examinations pass on their first attempt, and the diabetes-related questions are apparently not answered incorrectly an inordinate number of times, nurses in Canada have been found to lack knowledge about the disease (Hernandez, 1995; Lenahan, 1993; Meltzer et al., 1998). It can be argued that initial nursing education about specific topics has diminishing importance as time passes. Nurses who have practiced for several years experience probably do not presently have knowledge deficits about diabetes because they received inadequate education about diabetes while they were students. However, as researchers have found that even nurses with less than a year of experience have knowledge deficits about diabetes (Lipman & Mahon, 1999; O'Brien et al., 2003), the conclusion that initial instruction about diabetes is at times inadequate requires further investigation. Educators would benefit from expanding the relationship between quantity, and type of questions asked on licensure examinations, and the nature of diabetes outcomes and practice outcomes related to diabetes care.

Continuing education.

Nurses have long been urged to attend continuing educational offerings about diabetes based on the premise that continuing educational programs positively affect practice (Koyama et al., 1996; Linde, 1989; Rath et al., 1996). In several prior investigations about

the knowledge that nurses have about diabetes, it was found that nurses who scored lower on the diabetes knowledge tests had not participated in diabetes inservice training during the preceding 6 months (Baxley et al., 1997; Drass et al., 1989; Gossain et al., 1993; Scheiderich et al., 1983), to 2 years (El-Deirawi & Zuraikat, 2001; Sargant, 2002). Participants in this study suggested that non-participation in continuing education about this condition after completion of initial training is the principal reason that nurses have knowledge deficits about diabetes. While many believe that attending continuing educational inservices is a positive mitigating factor on nurses' diabetic knowledge, the findings of others (Leichter et al., 1980; Waddell et al., 1991, 1993) suggest that the improvements seen with diabetes inservices deteriorate with time. As few studies have re-evaluated the long term impact that continuing educational programs have on the knowledge of the participants (Waddell et al., 1991), it is uncertain if a single nursing diabetes continuing educational program has any immediate or lasting effect on subsequent nursing care.

While it was not the original intent of this study to determine what factors influence nurses' participation in continuing education about diabetes, data submitted to the study web page indicate that nurses believe that factors associated with the individual, work environment, and program content affect nurses' participation in continuing education about diabetes. Past researchers, however, suggest that nurses' individual characteristics have the most effect on nurses' "motivation to participate in CNE [continuing nursing education]," while the type and content of programs are "responsible for the effects of continuing education on nursing practice" (Waddell, 1991, p. 116-117).

Data submitted to the study web page suggested that nurses have knowledge deficits about diabetes because nurses do not receive education about advances in diabetes care.

While many participants declared that this factor is one of the causes of the knowledge deficits about diabetes that nurses have, these submissions may provide evidence about this knowledge deficit. Although much research about diabetes has been done, day-to-day diabetes treatment has not changed in the past two decades (Haire-Joshu, 1996). The true advancement in care has been the discovery that the tools to control the symptoms of diabetes have been available since the early 1980's (Haire-Joshu).

Awareness.

A few researchers have concluded that many nurses have knowledge deficits because nurses are unaware that they have knowledge deficits in relation to diabetes and its management (Baxley et al., 1997; Drass et al., 1989; Hilton, 1982; Lenahan, 1993). Only 3 participants in this study stated that unawareness contributes to the knowledge deficit that nurses experience, and none declared unawareness was the only factor. Unawareness may be a factor for some nurses who lack knowledge in relation to diabetes and its management. However, as recent studies indicate that nurses accurately assess their knowledge about diabetes (El-Deirawi & Zuraikat, 2002; Gossain et al., 1993; Sargant, 2002), and most nurses participating in this study indicated they are aware that they, and their colleagues, have knowledge deficits about this disease, unawareness cannot be the fundamental reason why this problem occurs at this time.

Nurses' role, estimation of disease complexity, and reliance on others.

Although a few researchers indicated that many nurses underestimate the complexity of the disease (Grey, Lipman, Cameron & Thurber, 1997; Hernandez, 1995), this factor has not been linked to nurses' knowledge deficits about diabetes. The judgements that nurses make about the role that nurses have in the care of persons with diabetes, and nurses' reliance

on others to have knowledge about the disease have not been linked to the knowledge that nurses have about diabetes. Participants in this study submitted that nurses have knowledge deficits about diabetes because nurses overestimate or underestimate the complexity of diabetes, nurses' fail to recognize their role in the care of persons with diabetes, and nurses rely on other health care personnel, or the patient for their knowledge about diabetes. While many participants declared that these factors lead to the knowledge deficits that nurses have, these submissions suggest a reversed cause and effect relationship. It may be that participants are disclosing the existence of knowledge deficits, rather than revealing information about causation. Nurses may be inaccurately assessing complexity of the disease because they lack knowledge about diabetes. Nurses may not recognize their role in the care of persons with diabetes because they do not understand the impact that nursing care can have on outcomes for persons with diabetes. Nurses may rely on others to provide care because they do not know how to care for these types of patients.

Effects of Nurses' Knowledge Deficits

Data from this research study support the conclusions of previous investigators who have stated that nurses' knowledge deficits cause (1) delays in the diagnosis of diabetes (Levetan et al, 1998; Meltzer et al, 1998); (2) influence patients' understanding about the disease process (El-Deirawi & Zuraikat, 2001; Sargant, 2002), essential diabetes survival skills (Baxley et al., 1997; El-Deirawi & Zuraikat), and dietary restrictions (Sargant); and (3) lead to the generation of erroneous blood glucose results with SBGM devices (Baxley et al.; Hilton, 1982; Lawrence et al., 1989). Participants in this study also indicated that they believed that knowledge deficits nurses have about diabetes may result in more dire consequences than investigators have suggested in the past. Submissions to the study web

site and bulletin board indicate that knowledge deficits about diabetes will lead to premature death for persons who live with the disease.

Methods to Improve Nurses' Knowledge About Diabetes

Data from this research study support the conclusions of other investigators who have stated that nurses' knowledge about diabetes can be ameliorated by placing more emphasis on diabetes instruction during nurses' training (Leggett-Frazier et al., 1994; Lipman & Mahon, 1999) and by ensuring that nurses take part in continuing education about diabetes on a regular basis (Baxley et al., 1997; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Gossain et al., 1993; Lawrence et. al., 1989; Leichter et al., 1980; Lenahan, 1993; Meltzer et al., 1998; O'Brien et al., 2003; Sargant, 2002; Scheiderich et al., 1983). Although participants in this study and past investigators believe that continuing education about diabetes improves the knowledge that nurses have about the disease, some researchers have found that improvements in knowledge are short lived (Berkowitz et al., 1998; Parker et al., 1995; Waddell, 1991), and frequently, are not translated to changes in practice (Waddell). A few have suggested that combining continuing education with the consistent implementation of diabetes care standards by nursing supervisors can be a powerful method for ensuring that nurses have sufficient knowledge about the disease to appropriately care for persons with diabetes (Davis et al., 1992; Gilman, 2001; Jones, 2002; Walker et al., 2001).

Although many researchers have assumed that awareness of a knowledge deficit will motivate nurses to improve their knowledge (Drass et. al., 1989; El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; O'Brien et al., 2002; Sargent, 2002), only one report reveals that nurses sought information about diabetes when they were provided with the evidence that they had knowledge deficits about the disease (Drass et al., 1989). Sargant notes that "the

most frequently identified common theme was participants' recognition of knowledge deficits in this subject area" (p. 618), but they did not communicate information about nurses' knowledge seeking behaviours. O'Brien, et al. suggested that "many [nurses who took part in their study] were keen to know how they scored" (2002, p. 260), but did not relate how nurses responded when they were told they had knowledge deficits. Although several nurses in this study admitted that they have knowledge deficits about diabetes, and indicated that knowledge deficits have a detrimental effect on patients who live with the disease, just one suggested that she might take action to rectify her knowledge deficit.

In countries where the majority of studies have determined that nurses have knowledge about diabetes, such as the United States, England, and Canada, nursing regulatory bodies have made self-evaluation of learning needs, and rectification of knowledge deficits in relevant areas of practice mandatory for annual re-licensure. In British Columbia, nurses' self-evaluation of learning needs is referred to as a *Personal Practice Review*. Nurses are advised, through pamphlets and fliers in the Helen Randall library, on the RNABC web site, and via printed materials added annually to licensure renewal packages that to obtain re-licensure for the next year, nurses must have "completed a self-assessment based on the *Standards for Nursing Practice in British Columbia*, **and** [emphasis as it appears in text] obtained peer feedback, **and** developed and implemented a learning plan based on the self-assessment and peer feedback, **and** evaluated the impact of the learning on practice" (Continuing Competence Requirement, 2000). Nurses in this study experienced knowledge deficits about diabetes, are frequently aware of their knowledge deficits, and appear to recognize that knowledge deficits about diabetes have a detrimental effect on patient care. The nurses in this study also disclosed that they cared for patients who live with

the disease. However, many have not taken part in any type of educational offering about diabetes in more than 5 years.

In several regions of the United States, participation in continuing education is compulsory for practising health care professionals. Nurses must submit documentation to verify that they have completed a minimum number of hours during the preceding year to qualify for annual re-licensure. The type and theme of continuing educational offerings that are selected are at the discretion of the individual nurse. Nurses in these states, however, have the same, or similar, knowledge deficits about diabetes. Even though several were employed in states that have mandatory continuing education, many of the nurses who took part in the studies that identified these knowledge deficits had not engaged in any type of continuing education about diabetes in the past 2, or more years, and some had never participated (El-Deirawi & Zuraikat, 2001; Lipton & Mahon, 1999; Sargent, 2002). Making continuing education compulsory for nurses does not appear to have improved nurses' knowledge about diabetes.

Response from Nursing Supervisory Personnel

No published reports were found which explored nursing supervisory personnel's reaction to claims that nurses have knowledge deficits about diabetes. Investigators do not indicate how nursing supervisory personnel who were employed in the institutions used to assess nurses' knowledge interpreted the findings that nurses in their institutions had knowledge deficits in this area of care. Although nursing supervisory personnel were not canvassed for information for this research, several persons who identified themselves as nursing supervisors, articulated the belief that general duty staff nurses do not have knowledge deficits about diabetes.

Many of the findings of this study are congruent with the conclusions of other investigations. A few contradict those suggested by other researchers. Analysis of data obtained from this study has revealed new insights into why nurses may have knowledge deficits in relation to diabetes and its management and the strategies that can be implemented to improve nurses' knowledge about this disease. Further review will indicate the implications that these findings have for practice, education, and research.

Implications for Practice, Education, and Research

Practice

The findings of this study indicate that many nurses have knowledge deficits about several aspects of diabetes management. This is an important practice issue as it is general duty staff nurses who instruct persons who live with diabetes in how to manage their disease. As a great deal of the treatment for diabetes is self-administered (Basa & McLeod, 1995; Meltzer et al., 1998; Sacks, 1998; Tildesley et al., 1996; Sullivan & Hunt-Joseph, 1998), persons with diabetes need to be provided with accurate information (Ash & McSherry, 1997; Basa & McLeod; Baxley et al.; Campbell et al., 1990; Carter et al., 1997; Coates & Boore, 1996; Davis et al., 1992; Drash, 1994; Pritchard, 1996; Reid et al., 1995; Tildesley et al.). Nurses must be knowledgeable so that patients with diabetes will be appropriately taught to care for their disease.

The DCCT (Diabetes Control and Complications Trial) and the equally comprehensive UKPDS (United Kingdom Prospective Diabetes Study), two of the largest diabetes care studies carried out in the last thirty years (Expert Committee, 1993; UKPDS Study Group, 1998), have provided those experiencing diabetes and their caregivers with

empirically tested technologies and treatment modalities that can effectively improve health outcomes related to diabetes. Results from these investigations show that with proper use of technology such as SBGM and diligent treatment, persons with diabetes can substantially curtail the incidence, or postpone the onset of complications, as well as escaping the very real possibility of death at an early age (Expert Committee; UKPDS Study Group). One of the ways to ensure that the care nurses provide will reduce the incidence of complications from diabetes is to ensure that the care offered meets or exceeds the standards of care set out for diabetes. Standards of diabetes care, which were first issued by the diabetetic educators' section of the Canadian Nurses' Association in 1985, are based on the findings of the DCCT and UKPDS. These standards of care are achievable by most nurses (McLaughlin, 1985) and can be used "as an important template" (Nichol et al., 1996, p. 18) for all of the nursing care that is offered to patients who live with diabetes. The standards of care for diabetes are available on the Internet web page of the Canadian Diabetes Association, in printed materials located at the Canadian Diabetes Association, and in several professional publications.

Although many of the participants in this study indicated that they have knowledge deficits about diabetes because they do not care for persons with this disease, most nurses will have contact with a person with diabetes and some on a daily basis (Meltzer et al., 1998; Porte & Kahn, 1990). Approximately 3 million Canadians are known to live with diabetes, and the incidence of the disease is growing exponentially in this country (Canadian Diabetes Association, n.d., retrieved 2002). In the future, nurses will be required to care for more persons with diabetes. Every nurse must ensure that they know what the standards of care for diabetes are, and that they understand how to deliver this type of care. Each nurse must compare the care that is offered to patients with diabetes against the standards of care for

these patients. Nurses who do not meet these standards should direct their efforts towards changing their practice. If a nurse becomes aware that they are unable to meet care standards because they do not have sufficient knowledge about some aspect of diabetes care, they must seek out information to improve their knowledge by taking part in inservices about diabetes, accessing published literature in a professional journal, consulting nursing texts and diabetes care manuals, consulting with a diabetes educator, contacting the Canadian Diabetes Association, or accessing the Canadian Diabetes Association web site on the Internet.

Several of the participants in this study declared that they had knowledge deficits about diabetes because diabetes was a secondary diagnosis in their area of care, and therefore, this knowledge was not expected by nursing supervisors. Nursing supervisors must communicate that they require that the care offered to persons with diabetes meets or exceeds the standards of care for diabetes, regardless of the care specialty of that unit, even if diabetes is designated as a secondary disease. Nursing supervisors must ensure that copies of the standards of care for diabetes are accessible to nurses employed on the unit. Nursing supervisors must routinely evaluate the care that is provided to persons with the disease on the unit to determine if the care offered to patients with diabetes meets care standards. Performance appraisals for nurses must include assessments of how successful each nurse has been in achieving care that meets or exceeds the standards of care for persons with diabetes. Nursing supervisors should assist nurses to assess their knowledge about diabetes. In past investigations, researchers have utilized questionnaires about diabetes to assess nurses' knowledge (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Gossain et al., 1993; Lenahan, 1993; Lipman & Mahon, 1999; Sargant, 2002; Scheiderich et al., 1983). Nursing supervisors who make these tools available may help

nurses to accurately evaluate their knowledge about diabetes.

Participants in this study indicated that nurses do not feel compelled to attend continuing education about diabetes because diabetes is a secondary diagnosis for their patients, and as such, nurses place less significance on the importance of knowledge about diabetes. Nursing supervisors must lobby physicians to designate diabetes as a primary diagnosis whenever appropriate. Naming diabetes as a primary diagnosis may inspire nurses who are aware that they have knowledge deficits in this area of care to improve their knowledge.

Nursing supervisors must be alert for nurses who have less actual than self-reported knowledge about diabetes. Nurses who seem unaware of the role that nurses play in the care of persons with diabetes may have a knowledge deficit about diabetes. Nursing supervisors should assess knowledge about diabetes when nurses over or underestimate the complexity of diabetes, or look to others to care for the patients who live with diabetes. Additionally, nurses with knowledge deficits frequently lack information about diabetes survival skills, insulin administration and timing, diet, and the etiology of diabetes. Nursing supervisors should suspect that a nurse has a knowledge deficit if they are unable to meet the care standards for these aspects of diabetes management.

Data from this and previous studies indicate that awareness of a knowledge deficit about diabetes may not invariably motivate every nurse to improve their knowledge. Nursing supervisors must identify the standards of care that nurses are unable to meet and assess if nurses lack knowledge about aspects of diabetes care. If knowledge deficits are noted, resources must be directed at improving nurses' knowledge. Diabetes care manuals, placed on each unit, can provide a readily accessible resource for nurses. If available, contact with a

diabetes educator may improve nurses' knowledge about diabetes and assist nurses to deliver care that meets care standards. General duty staff nurses, who demonstrate an interest in diabetes care and who deliver care that meets the standards for diabetes care, could be assigned to each clinical unit to act as diabetes practice mentors for other nurses. Nurse researchers, who are conducting diabetes-related investigations, could be invited to speak to nurses on the units or within a practice area to foster nurses' interest about diabetes care.

One of the primary difficulties that must be grappled with in the practice setting is that the personnel who normally are the driving force behind change, nursing supervisors, may also have knowledge deficits about diabetes. The process of improving nurses' knowledge about diabetes in the practice may have to be initiated by others. Nurses who are conversant about diabetes must become activists to better the knowledge that general duty staff nurses have about diabetes so that persons who live with diabetes receive care that is recommended by the DCCT and UKDPS Expert Committees.

Knowledgeable nurses must make nursing supervisors, continuing education educators, and general duty staff nurses aware that every nurse has a role in the care of persons who live with the disease. Nurses educated in diabetes care must urge continuing education educators and nursing supervisors to present inservices about diabetes on a regular basis so that every nurse understands how diabetes affects other types of nursing care and impacts patients' lives. Nurses knowledgeable in diabetes care must mentor their colleagues in practice situations by communicating information about diabetes; offering assistance with patient care planning; and initiating discussion about the effect that diabetes has on other types of nursing care.

Nurses who are knowledgeable about diabetes do not have to work in isolation.

"Advocacy is a shared responsibility" (Advocacy and the Registered Nurse, 2000). Nurses who are proficient in this area of care must network with personnel at the Canadian Diabetes Association and other diabetes educators, to request that health care administrators evaluate the level of care that is offered to persons who live with diabetes in their agency, and to provide resources to correct knowledge deficits when the level of care does not meet the minimum standards.

Research

As yet, consensus has not been reached about what constitutes a knowledge deficit about diabetes for nurses. I believe that agreement is necessary so that knowledge deficits can be readily identified when they exist, and if detected, timely actions can be taken to improve knowledge. Researchers must explore what knowledge about diabetes is critical for nurses and develop objective standards to measure nurses' knowledge. These standards can then be applied in practice to determine if a nurse has sufficient knowledge to care for patients with diabetes.

Data from this research and other investigations reveal that several factors contribute to the knowledge deficits that nurses experience, however, agreement has not been reached and causation remains unclear. New research must be directed toward determining the factors that affect a nurses' knowledge, to devising strategies to diminish negative influences and to promoting those that have a positive effect on knowledge.

I located no research regarding the knowledge that nursing supervisors have about diabetes. Few studies reveal nursing supervisors' response to claims that nurses lack knowledge in this area of care. Nursing supervisors in this study expressed the view that general duty staff nurses do not lack knowledge about diabetes. Research is needed to

determine if nursing supervisors also experience knowledge deficits in this area of care.

Future investigations must explore the effect that nursing supervisors' knowledge of diabetes has on the knowledge that general duty staff nurses have.

Data from this and other studies suggest that continuing education improves the knowledge that nurses have about diabetes. It is not a foregone conclusion that by providing continuing education about diabetes, that beneficial effects on knowledge will be produced, or bring about long-term changes in practice. The type of program that will be most effective in improving nurses' knowledge about diabetes and bring about long-term changes in practice must be determined.

The frequency of participation in a continuing educational program that is necessary to maintain knowledge about diabetes must be investigated in future studies. Although nurses have a positive duty to address their knowledge deficits in relevant areas of care, data from this study and prior research reveal that a nurse's awareness of a knowledge deficit may not motivate them to take remedial measures. Continuing education departments and nursing supervisory personnel must know how often to schedule programs so that continuing education about diabetes can be offered to nurses at appropriate intervals.

Participants in this study indicated that individual characteristics, factors in their work environment, and program content affect participation in continuing education about diabetes. Further study is needed into determining what motivates nurses to participate in continuing education about diabetes, and what poses barriers to their participation. Strategies must be developed to reduce or eliminate the negative effects of the identified barriers, and to promote the factors that are motivating.

Participants' identification of diabetes as a secondary diagnosis leaves questions about the effect that diagnosis designation has on knowledge and the quality of care that is offered. Research is needed to determine if care is affected by diagnostic designation and the effects on care. Additionally, study is needed to assess the effect that diagnostic designation has on nurses' participation in continuing education.

Education

Nurses in this study indicated that taking part in continuing education may resolve the knowledge deficits they experience. Continuing education educators are urged to offer programs about diabetes to all nurses at regular intervals. Inservices, diabetes care manuals, professional journal literature, printed materials from the Canadian Diabetes Association, visits to the unit by diabetes educators, and instructions regarding how to access Internet sites with information about diabetes may assist nurses to ameliorate their knowledge about diabetes. Additionally, continuing education educators, nursing supervisors, and nurses must identify barriers that prevent nurses from participating in continuing education about diabetes and, when possible, to eliminate such barriers. When barriers cannot be removed, strategies to reduce the effect of these barriers must be devised.

Nurses in this study and past research indicate that nurses may be unaware of their knowledge deficit about diabetes. Nursing educators may assist nurses to accurately assess their knowledge in this area of care by making assessment tools, such as a diabetes knowledge tests that have been used by investigators (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Gossain et al., 1993; Lenahan, 1993; Lipman & Mahon, 1999; Sargant, 2002; Scheiderich et al., 1983) to be available to nurses in their health care agencies.

Participants in this study suggest that information about diabetes is difficult to find.

Nurses' knowledge about diabetes may be improved if continuing education educators instruct nurses regarding methods to locate information about diabetes in manuals and texts, in journal publications, and on the Internet. Continuing education educators could also assist nurses to improve their knowledge by giving nurses information about continuing educational programs about diabetes that are presented by the Canadian Diabetes Association, other health care institutions, and private pharmaceutical companies.

Participants in this study indicate that nurses' knowledge about diabetes would improve if more emphasis were placed on diabetes during nurses' initial training. Nursing educators are urged to review the programs in their educational institutions to ensure that sufficient instruction is offered. Many believe that the adequacy of initial instruction is not so much a matter of the nurse being familiar with the facts about diabetes but can be better assessed in relation to their understanding of the meaning of the disease, and the impact that diabetes has on a patient's life (Coles, 1995; Hernandez, 1995; Rosenqvist, 1995). While in training, student nurses must be assisted to relate the facts about diabetes to other aspects of nursing care, to determine the effect that nursing care has on patients who live with the disease, and to assess the role that he or she has in the care of persons with diabetes. Before graduation, student nurses must be given the experience of caring for a patient who lives with diabetes so that they can come to understand the impact that this diagnosis has on the life of his or her patient, and the effect that diabetes has on other health problems.

Nursing educators are urged to review the questions asked on licensure examinations to ensure that knowledge about diabetes is adequately assessed. Licensure examinations must assess if the person writing the examination knows the facts about diabetes, as well as

to determine if they understand how to deliver care that meets the standards of care for diabetes. Additionally, questions that test knowledge of how diabetes affects other conditions must be included. If questions do not appear to capture all aspects of diabetes care, nursing educators must appeal to licensing boards to adjust the questions.

Limitations of this Study

I have encountered several drawbacks because I utilized the WWW to gather data for this research. Low participation and high attrition rates, inability to verify the suitability of participants, bias of information, and completeness of data have limited the generalizability of the results of this study.

Nurses wishing to participate in the study had to be able to use a computer that was connected to the Internet and to have at least basic knowledge of WWW navigation. Published studies that employed computers to collect data do not discuss the effect that the ability to use a computer may have had on their studies. Researchers making use of the WWW have found it troublesome to collect data because of the difficulty participants had in locating a computer with access to the WWW (Houston & Fiore, 1998; Rosenfeld et al., 1991). It may be that nurses did not participate because they were unable to locate a computer connected to the Internet, or were unable to navigate the WWW. I attempted to lessen the effect this issue had on the outcomes of this study by instructing nurses in the original introductory letter to utilize one of the public computers found in the library at the RNABC building, an *Internet café*, or the Vancouver Public Library.

A fear of disclosing personal identity while using a public computer, or providing information via the Internet, have been suggested as reasons that it is difficult to attract a

sample population when collecting data through the use of a computer and the Internet (Houston & Fiore, 1998; Rosenfeld et al., 1991). Although it is possible that these factors account for the difficulties that I experienced in attracting a sample population and for the high attrition rate, participation increased during the months of annual re-registration at RNABC when many nurses visited the Helen Randall library and had contact with library staff. Additionally, as several nurses with whom I had face-to-face contact candidly discussed the issues presented in the study, there is little indication that fear of disclosure was a factor that limited participation. Nevertheless, I attempted to reduce the effect disclosure may have had on potential participants of this study by advising participants that although the computers I suggested were in a public space, the information provided would not be directly available to anyone other than myself and it was virtually impossible to discern an individual's identity when a public computer is used to access the Internet (Coomber, 1997; Nicholson et al., 1998),

The study findings may have limited applicability to other nurses because of the possible unsuitability of the participants. I cannot unconditionally establish that the responses gathered were from general duty staff nurses who were then licensed as Registered Nurses with the RNABC; were employed full or part-time, or had been employed within that past year; and who devoted more than 75% of their professional time to the delivery of nursing care. Although the participation criteria for the study was clear in the original introductory letter, in the published advertisement, in the first section of the study web page, and on both the study web page and electronic bulletin board consent forms, it is possible that each and every person participating in the study did not meet the criterion. To ensure that persons not actively involved in the profession of nursing within the province of British

sample population when collecting data through the use of a computer and the Internet (Houston & Fiore, 1998; Rosenfeld et al., 1991). Although it is possible that these factors account for the difficulties that I experienced in attracting a sample population and for the high attrition rate, participation increased during the months of annual re-registration at RNABC when many nurses visited the Helen Randall library and had contact with library staff. Additionally, as several nurses with whom I had face-to-face contact candidly discussed the issues presented in the study, there is little indication that fear of disclosure was a factor that limited participation. Nevertheless, I attempted to reduce the effect disclosure may have had on potential participants of this study by advising participants that although the computers I suggested were in a public space, the information provided would not be directly available to anyone other than myself and it was virtually impossible to discern an individual's identity when a public computer is used to access the Internet (Coomber, 1997; Nicholson et al., 1998),

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Columbia would not make a submission, I limited access to information about the study. The introductory letter about the study was sent only to places where nurses worked, or were involved in the study of nursing within British Columbia, such as the School of Nursing at the University of British Columbia, and the library reserved for nurses within the province located at the RNABC building in Vancouver, British Columbia. The advertisement for the study was placed in a publication directed at nurses with active registration in British Columbia. Information about the study was not listed with any Internet search engines, nor was it posted on Internet directories open to the public.

To guard against using data from persons who made more than one response to the web site, which would result in biased data, I looked for such commonalties as repetitious responses, characteristic diction, and specific recurring themes. While I requested that each participant visit the study web page only once and post any further comments they wished to make on the electronic bulletin board in the initial introductory letter, I believe that at least 1 participant submitted more than a single response to the study web page. I found that two responses contained terms that no other participant had used, had similar diction throughout, and voiced comparable opinions. As a result, only the first data transmission was used in the analysis.

To control for the effect that the above may have had on the generalizability of my findings, I have carefully scrutinized the data that were received from the web site and the electronic bulletin board for indicators that would lead me to believe that the person providing the information did not meet the criteria for the study. As I found that none of the responses contained inappropriate utilization of common nursing or medical terms, or only mentioned nursing experiences of more than 1 year ago, or did not include references to

direct patient care, or were from participants who stated that they did not meet the criteria for participation, I believe that nurses who were actively providing patient care or had been within the past year supplied the transmissions received by the study databank.

Although data obtained from counters connected to the web site indicated that there were six visitors to the web site from time zones in Asia or Europe, and five from other time zones outside of British Columbia, there were 838 from the two time zones located within British Columbia. Even if the 11 visitors from the other time zones sent replies to the web site, the electronic bulletin board, or both, the majority of the responses to the web site and electronic bulletin board had to be from persons living within a time zone located in British Columbia. In spite of the fact that visitors made submissions to the web site, and the electronic bulletin board from the same time zones as British Columbia, it does not guarantee that they were from that province. There are other geographic locations within the same time zone as that of British Columbia. However, access to information about the study was limited outside of that province. The introductory letter with the web site address was just sent to locations within British Columbia. Additionally, as only two persons used a search engine to find the web site, it is reasonable to assume that participants used the address supplied in the introductory letter. Furthermore, as none of the web site or electronic bulletin board responses mentioned nursing experiences outside of British Columbia, I believe that nurses who were within the province supplied the transmissions received by the study databank.

The findings of this study may have limited applicability because each participant's knowledge about diabetes was not assessed. It may be, for example, that nurses who were more knowledgeable about diabetes care were motivated to respond, while those less

knowledgeable did not participate. Although I could have requested that a participant complete a knowledge test about diabetes prior to submitting a response to the study questions, such an assessment would have significantly increased the length of time taken for each participant to finish the study. As nurses frequently indicated to my thesis advisor and myself that they could not take part in this study due to time constraints, lengthening the questionnaire was not desirable. Additionally, potential participants may have felt threatened, and therefore may have been reluctant to participate if their knowledge about diabetes was tested when they were being asked for their opinions about knowledge deficits. Although it may be that more nurses who are knowledgeable about diabetes responded to the study web site than nurses with limited knowledge, the information provided is relevant to the study because the responses were from general duty staff nurses, and therefore, is the type of information I wished to obtain.

Completeness of data, especially of demographic data, is a problem encountered by many other researchers who have used just computers, or computers and the WWW to collect data (Coomber, 1998; Miller et al., 1997; Nicholson et al., 1998; Rosenfeld et al., 1991; Soetikno, et al., 1997). Researchers gathering data using computers alone, or in conjunction with the WWW or another IP, have frequently lamented that they were not able to completely describe the participants of their study (Coomber; Nicholson et al.; Rosenfeld et al.). A few of the participants in this study did not fully complete the demographic questions. As demographic information was not essential to analysis and little data were missing, submissions with incomplete demographic data were included in the analysis.

Investigators utilizing the Internet or the WWW to collect data frequently requested that subjects recruit others to participate in the same study, resulting in non-probability

sampling (Coomber, 1997; Faugier & Sageant, 1997). Nurses completing the web page survey were asked to give information about the study to other general duty staff nurses who they felt might also be interested in participating. Since a snowballing method has been used to attract participants, it may be that the information gathered represents the opinions of only a small segment of the nursing population, namely those nurses interested in this topic, and therefore, have limited in applicability to other nurses in the province.

Lack of truthfulness from participants is a problem in any research asking questions about potentially embarrassing subjects, or gathering information that could be damaging to participants (Lee, 1993; Rosenfeld et al., 1991). Because several nurses expressed their views about the issues raised by this research in a candid manner when I attempted to recruit them for my study, and many nurses disclosed that they had knowledge deficits that had a detrimental effect on the care that patients who lived with diabetes received, truthfulness did not appear to be lacking. Yet, I cannot absolutely guarantee that information obtained via the Internet was forthright because nurses may have had fears that I would attempt to trace the source of a WWW transmission, or that I, or others, would recognize an individual through the information provided. I attempted to lessen the effect that fear of disclosure had on honesty by suggesting that if a participant was concerned that I would discover their identity by tracing their computer source, that they could further decrease the possibility of detection by replying to my inquires on a public computer with Internet access (Coomber, 1997; Nicholson et al., 1998).

Using Computers, the Internet and the WWW to Collect Data

The use of computers, the WWW, and the Internet to collect data for this study has proven to be both an interesting and a challenging experience for this author. While many of

the difficulties that other investigators encountered were not as significant as anticipated, additional factors not mentioned in the published reports of previous investigations were notable barriers. For example, although several researchers indicated that completeness of data, especially demographic data, can be problematic when using a computer, the Internet, or the WWW to collect information, only a small number of participants in this study failed to submit completed demographic questionnaires to the web site created for this study. Other issues, such as the protracted length of time that may be required to inform potential participants; the difficulties in establishing that consent has been obtained when signatures have not been collected; the pithiness of responses; the problem of presenting data that are filled with grammatical, and typographical errors; and the obstacles that must be overcome to verify the analysis of data were not referred to by other investigators but were momentous obstacles to overcome during the course of this study.

Researchers have just begun to use computers, the Internet, and the WWW as tools for data collection. As these tools are relatively new, guidelines for the conduct of research that employs these devices are not readily available. When I had questions about how to proceed, or encountered obstacles, I was frequently unable to find direction in nursing, or other types of literature. However, assistance from my thesis advisor, Dr. Paterson, and other nursing researchers, allowed me to continue and complete this study. Other researchers, who do not have access to creative, supportive mentors may find that they are unable to proceed when the next step is unclear, or obstacles are encountered.

Many believe that the anonymity provided by use of the Internet and the WWW allows participants to be more forthright in their responses to questions about sensitive topics. While the nurses who responded to the study web page or electronic bulletin board

may have only done so because their responses were anonymous, a large number of nurses, more than the number who submitted data to the web site, volunteered a great deal of sensitive information during face-to-face contact with me about their knowledge deficits, and the effect that these deficits have had on the care of their patients who live with the diabetes. Additionally, although many of the nurses who took part in this study may have found the study web page and the electronic bulletin board by other means, visits to these study web sites increased dramatically during the first three months of the year 2001, when I placed information about this study in the Helen Randall library. During this time period, several nurses asked library staff about the study, and the library receptionist informed me that many had discussions with her about the issues that were raised (personal communication, Linda Lister, February 19th, 2002). Contact with an identifiable person, rather than anonymity, appeared to motivate nurses to take part in this study.

Past researchers who have used the Internet and the WWW as data collection tools do not indicate the number of visits that were made to their study web sites. The number of visits that were made to the study web page and electronic bulletin board were much larger than anticipated. Although only a small number of participants submitted data, the number of visits suggests that persons who saw the introductory letter for the study were interested in the project. Additionally, the number of visits that were generated suggests that the Internet holds potential for gathering data from a large number of participants.

Although many problems may be encountered when computers, the Internet, the WWW, or a combination of these devices are used as tools to gather data, these devices hold great potential for future researchers. Benefits, such as the ease by which data can be submitted by participants; the flexibility of allowing investigator and participants to interact

despite differing schedules; and the value of having data submitted in typed form far outweigh the drawbacks that may occur. Future investigators must ensure, however, that they have sufficient resources to overcome the difficulties that they may encounter while utilizing these tools for data collection.

Summary of the Study

The purpose of this study was to gain insight into the views of general duty staff nurses regarding why many nurses have knowledge deficits in relation to diabetes and its management, and the strategies that they believe could be implemented to improve nurses' knowledge about this disease.

Background

Diabetes is a disease that profoundly affects life for more than 3 million Canadians (Canadian Diabetes Association, n.d., retrieved 2002). General duty staff nurses must be knowledgeable about this area of care as nurses play an important role in the education of persons who live with diabetes (Basa & McLeod, 1997; Tildesley et al., 1996), and are the group of health care professionals who have the longest contact with patients (El-Deirawi & Zuraikat, 2001). Nurses must be knowledgeable about diabetes so as to adequately prepare patients who live with diabetes to manage the symptoms of their disease (Baxley et al., 1997; Drass et al., 1989; Sargant, 2002). Nurses provide care to patients who live with diabetes in a number of health care settings (Baxley et al.; D'Eramo-Melkus & Fain, 1994; Meltzer et al.; Sacks, 1998; Tildesley et al.). Nurses in every practice area must maintain a knowledge base about this disease so that these patients will receive care that meets accepted standards regardless of the practice setting.

Literature Review

A review of the literature reveals that for the past 30 years, general duty staff nurses have had knowledge deficits about diabetes (Baxley et al., 1997; Drass et al., 1989; El-Deirawi & Zuraikat, 2001; Etzwiler, 1967; Gossain et al., 1993; Lawrence et al., 1989; Leichter et al., 1980; Lenahan, 1993; Lipman & Mahon, 1999; Meltzer et al., 1998; O'Brien et al., 2002; Sargant, 2002; Scheiderich et al., 1983). Researchers believe that several factors affect the knowledge that nurses have about diabetes but agreement regarding causation has not been achieved. Researchers assert that nurses' knowledge deficits about diabetes have had a detrimental effect on the care that is offered to persons with the disease (Barcelo, 1996; Baxley et al.; El-Deirawi & Zuraikat; Hilton, 1982; Lawrence et al.; Levetan et al., 1998; Meltzer et al., 1998; Sargant). Despite the numerous strategies that have been put forward to improve nurses' knowledge, nurses' knowledge deficits about diabetes have not been ameliorated.

Methodology

An interpretive descriptive design was used for this study because of the potential that this method has to capture the essence of a shared phenomenon, namely knowledge deficits about diabetes from the perspective of those who live it, general duty staff nurses. This interpretive standpoint was believed to be the best suited to answer the research question: Why do many nurses have knowledge deficits in relation to diabetes and its management, and what strategies can be implemented to improve nurses' knowledge about this disease? Data were collected through computers and the Internet via the WWW as I assumed that general duty staff nurses would be more forthright in their responses if they could remain anonymous. General duty staff nurses who were employed full or part-time as staff nurses in

a health care setting other than a diabetes specialty care area, who had no diabetes specialty training, and were presently delivering, or within the past year, had delivered patient care for at least 75% of their working time, were invited to log on to the Internet and proceed to the WWW address provided in an introductory letter. Although there were 817 visits to the study web page, and 317 responses to the study data base, only 46 contained data that could be used for analysis. I had intended to verify my analysis of data submitted to the study web page by posting summaries of the data on the electronic bulletin board, however, although 2,387 visits were made the electronic bulletin board, only 10 comments were posted, and none contained a reply to my queries.

Nurses' Knowledge Deficits In Relation to Diabetes Care and Methods to Improve Knowledge

Repeated immersion into the data that nurses submitted to the study web page and the electronic bulletin board revealed the emergence of four central themes, (1) general duty staff nurses have knowledge deficits about diabetes, (2) many factors affect the knowledge that nurses have about the disease, (3) nurses' knowledge deficits about diabetes have a deleterious effect on the care of persons who live with the disease, and (4) there are strategies to improve general duty staff nurses' knowledge about diabetes.

The majority of the participants in this study indicated that they believed that nurses have knowledge deficits about diabetes. Participants who disagreed gave reasons why these knowledge deficits could occur. Participants suggested that the practice area, the initial nursing educational preparation, and the number of diabetes continuing educational inservices that a nurse has attended are factors that contribute to nurses' knowledge deficits in this area of care. Unawareness was also identified as

a factor. However, unawareness cannot presently be the primary cause of nurses' knowledge deficits as the majority of participants agreed that these knowledge deficits exist, and recent studies indicate that nurses are aware of their knowledge deficits (El-Deirawi & Zuraikat, 2001; Gossain et al., 1993; Sargent, 2002).

Although participants also suggested that nurses have knowledge deficits because they inaccurately assess the complexity of the disease, fail to recognize their role in the care of persons with diabetes, and rely on other health care personnel or the patient to have knowledge about diabetes, these factors may be an indication of the existence of nurses' knowledge deficits, rather than causative factors.

Participants in this study indicated that nurses in some practice areas view diabetes as secondary to the primary foci of care, and as such, may be viewed as less of a concern for nurses to maintain a knowledge base, or deliver knowledgeable care. It may be that some nurses have less actual than self-reported knowledge because they do not believe it is important for them to make the detailed assessments of their knowledge about diabetes that would make them aware that they have knowledge deficits. Additionally, in practice, nurses who view diabetes as a secondary disease may not recognize the complications of diabetes as such.

Participants in this research study suggested that nurses' knowledge deficits have a deleterious effect on the care received by persons who live with diabetes. Participants stated that nurses' knowledge deficits in this area of care cause delays in diagnosis of diabetes; patient's lack of understanding about the disease process, essential diabetes survival skills, and dietary restrictions; the generation of erroneous blood glucose results with SBGM devices; and may lead to premature death for persons who live with diabetes.

Participants in this study indicated that they believe that nurses' knowledge about diabetes can be ameliorated by placing more emphasis on diabetes instruction during nurses' training and by ensuring that nurses take part in continuing education about diabetes on a regular basis.

Conclusion

I believe that the quality of nursing care that is provided to patients who live with diabetes makes an enormous impact on the life of a person who lives with the disease. Nurses who know the etiology and treatment for diabetes, are cognizant of the standards of diabetes care, understand the impact that the diagnosis has on the life of a patient, are aware of the effect that diabetes has on other types of nursing care, and are willing and able to offer patients with diabetes care that meets or exceeds diabetes care standards have the potential to positively influence the outcomes that persons who live with diabetes experience. By controlling the symptoms, complications from diabetes can be substantially curtailed or eliminated (Expert Committee, 1993; UKPDS Study Group, 1998). Retinopathy could be reduced by 50% if blood glucose is kept as close to normal as is safely possible (Beggs, 1996; Expert Committee; UKPDS Study Group; Pritchard, 1996). Diabetic nephropathy could disappear as a significant health problem (Thompson, 1996). It is incumbent upon every nurse to ensure that they are knowledgeable about diabetes, and deliver care that meets, or exceeds the standards of care for diabetes, so that persons who live with diabetes do not experience devastating complications.

While solutions to the problem of nurses' knowledge deficits will not be simple, it is imperative that this problem be addressed. Diabetes will be a health concern for many Canadians for years to come. Dr. Denis Daneman, a speaker at the *Diabetes in the Young*

conference, suggested that “cure is just around the corner, in the year 2040” (personnel communication, April 4th, 1997). Until cure arrives, nurses must be knowledgeable about diabetes so that patients who live with diabetes achieve the best possible outcomes.

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Appendix A: Participant Information Letter

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Participant Information Letter

My name is Gerri Klein. I am a student in the Master of Science Nursing Program at the University of British Columbia. From my work as a nurse and a diabetic educator within a home care setting, and as a mother of a consumer of diabetes care services (my second child has diabetes), I have become interested in the knowledge that general duty staff nurses have about diabetes.

Researchers have indicated that general duty staff nurses have knowledge deficits about diabetes. As well, many of these studies have indicated that frequently general duty staff nurses are unaware of their own knowledge deficits. Although researchers, physicians, nursing administrators, or nursing educators have been canvassed for their beliefs regarding the causes of these knowledge deficits and possible solutions, general duty staff nurses have not been directly consulted for their input. In the proposed study, I intend to solicit the views of general duty staff nurses.

General duty staff nurses who meet the following criteria are invited to participate:

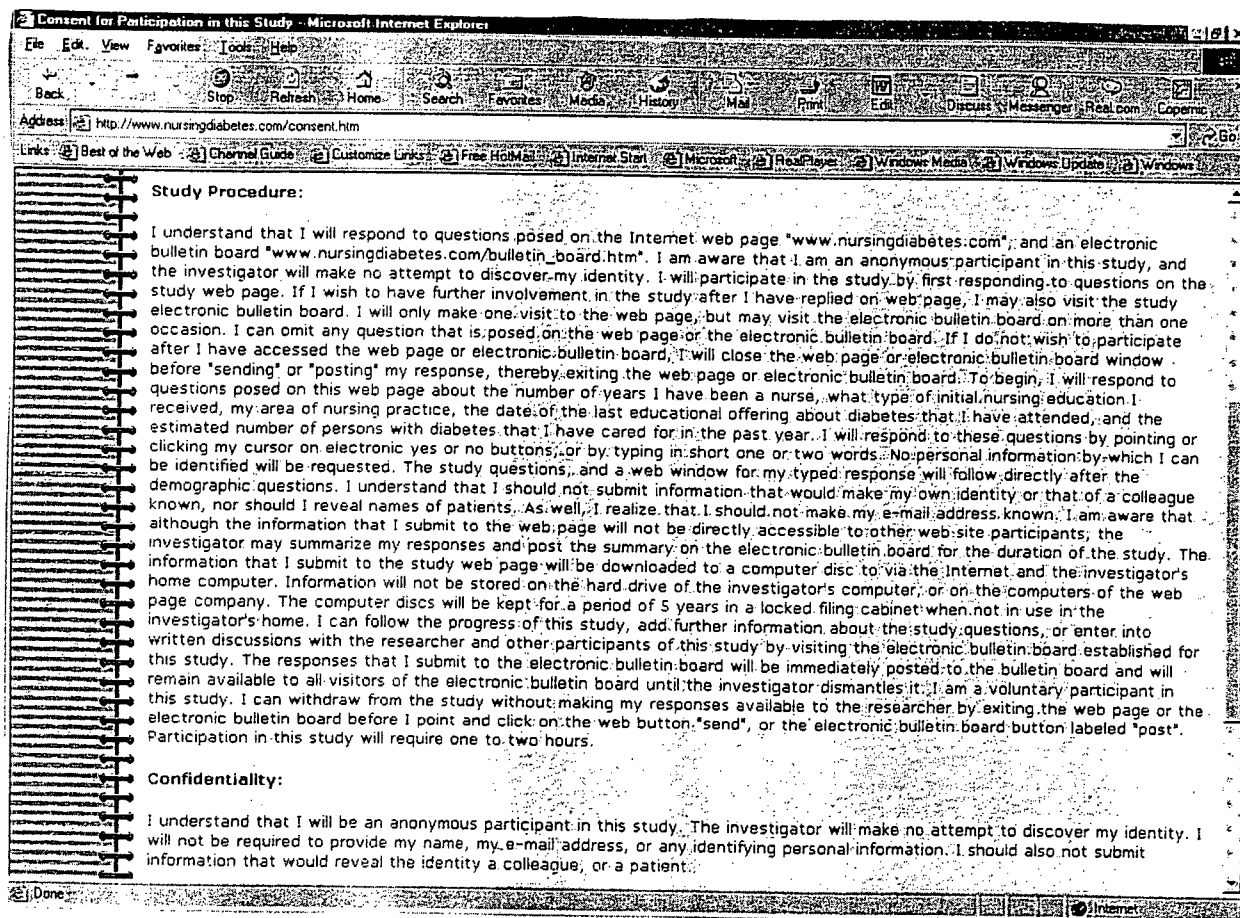
- Are registered in RNABC as an active member
- Do not have the diabetes specialty training required for a diabetes educator certificate
- Are not employed in a diabetes specialty area
- Are presently delivering patient care at least 75% of their working time, or have within the past year

Exclusion criteria:

- Are not registered in the RNABC as an active member
- Have the diabetes specialty training required for a diabetes educator
- Are employed in a diabetes specialty area
- Are presently delivering patient care at less than 75% of their working time.

Participants of this study will be able to respond to my queries over the Internet. Participants can expect to take approximately 1 to 2 hours to respond to study questions and to take part in discussions on the electronic bulletin board. A web site and an electronic bulletin board will be used to gather information from nurses meeting the study criteria. Nurses interested in taking part are asked to log onto the Internet by accessing a computer with an Internet connection such as a personal home, a workplace computer, or a computer located in public space. Public computers are available for use in the Helen Randall Library at the RNABC, at a Vancouver public library, in an Internet café, or another communal area. After logging onto the Internet, nurses are asked to proceed to my web page address "www.nursingdiabetes.com" where the study questions will be posted. At the end of the study my web page, the address of the electronic bulletin board set up for the study will be

Appendix B: Consent For Participation



Appendix C: Consent For Participation In the Electric Bulletin Board

Appendix D: Demographic Information and Study Questions

Demographic Information & Study Questions - Microsoft Internet Explorer

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Address http://www.nursingdiabetes.com/demographics.htm Go

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Demographic Information

Type of initial nursing education ☐ diploma ☐ degree

Year of graduation from initial nursing program:

Highest level of nursing education attained:

Number of years employed in nursing:

Area(s) of nursing practice (mark all that apply to you):

<input type="checkbox"/> Medical	<input type="checkbox"/> Surgical	<input type="checkbox"/> Emergency
<input type="checkbox"/> Critical Care <input type="checkbox"/> ICU <input type="checkbox"/> CCU	<input type="checkbox"/> Psychiatry	<input type="checkbox"/> Labour and Delivery
<input type="checkbox"/> Maternal/Newborn	<input type="checkbox"/> Paediatric Care	<input type="checkbox"/> Geriatric Care
<input type="checkbox"/> Speciality Unit	<input type="checkbox"/> Community Care	
area of speciality: <input type="text"/>	<input type="checkbox"/> Home Care <input type="checkbox"/> Physician's Office <input type="checkbox"/> Outpatient Clinic <input type="checkbox"/> Self-Employed	

Approximate date of the last educational offering about diabetes that I have attended:

Approximate number of persons with diabetes that I have cared for in the past year:

Age:

Gender: ☐ Male ☐ Female

Done

Demographic Information & Study Questions - Microsoft Internet Explorer

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Address <http://www.nursingdiabetes.com/demographics.htm>

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Age:

Gender: ☐ Male ☐ Female


Study Questions

1. Do you think general duty staff nurses have knowledge deficits about diabetes?

2. Why would nurses have knowledge deficits about diabetes?

3. How is the care that persons living with diabetes receive affected by nurses' knowledge about diabetes?

How can the knowledge that nurses have about diabetes be improved?


CLICK HERE

Done

Appendix E: Web Page Participant Thank You

Thank you for participating in this study.

If you would like to follow the progress of this study, add further information about the study questions, or enter into written discussions with the researcher and other participants of this study please visit the electronic bulletin board established for this study, at http://www.nursingdiabetes.com/bulletin_board.htm.

While I ask that you only visit the parts of this web site dealing with the demographic & study questions once, you are invited to bookmark the address of the electronic bulletin board so you may make as many visits to it as you would like.

Gerri Klein

[Proceed to Bulletin Board](#)

Appendix F: Advertisement

You are invited to participate in a nursing study!

A study is being conducted to determine what general duty staff nurses who have no specialized training in diabetes care think about the statement that they have insufficient knowledge about diabetes.

If you are:

- registered in RNABC as an active member
- delivering patient care in any area of nursing at least 75% of your working time (or have within the past year),

you are invited to visit my web site at "www.nursingdiabetes.com" to find out more.

Appendix G: Investigator's Replies On the Electric Bulletin Board

Comments

Thank you for your question regarding "geriatric" diabetes. In fact what used to be referred to as maturity onset or geriatric diabetes is now identified as Type 2 diabetes. Although the causes of Type 2 diabetes are not completely clear, one of the most likely causes is a general wearing out of the Beta cells on the pancreas. As we age, general deterioration of cells occurs within the body and the pancreas experiences this as well. The Beta cells simply wear out, and as a result, no longer produce sufficient insulin to meet the needs of the body. Type 2 diabetes was once thought to only occur in people of mature years (hence the name maturity onset), usually over 40 years of age, but children as young as 9 years of age can have Type 2 diabetes. Treatment of type 2 diabetes is threefold: diet, exercise and medication. Persons who have been diagnosed with Type 2 diabetes will usually start treatment with a weight loss program of diet and exercise. If this weight loss and exercise does not produce sufficient results, oral medication may be added. Oral medications can be of several different types: Sulfonylureas: stimulate the pancreas to release more insulin and reduce the production of glucose by the liver. Meglitinides: stimulate the pancreas to release more insulin after a meal. Biguanides: reduce the production of glucose in the liver and increase sensitivity of cells to insulin. Glitazones: reduce the production of glucose in the liver and increase sensitivity of cells to insulin. Alpha-glucosidase inhibitors: slows the conversion of carbohydrates to glucose and absorption of glucose into the blood stream. As time progresses, insulin may be necessary to gain glycemic control. The doctor who stated that oral hypoglycemics does not control type 2 diabetes as well as insulin may have been referring to any number of things. However, as oral hypoglycemics (Sulfonylureas and Meglitinides) stimulate the pancreas to make more insulin, the effect that these medications have on the body is much the same as injectable insulin. When oral hypoglycemic medications no longer are effective (and this will happen to every person who lives with type 2 diabetes long enough), insulin therapy is

necessary. Below I have listed several up-to-date, informative articles about medications for type 2 diabetes that are available in full-text from the Nursing & Allied Health Full-text database from the RNABC website at <http://www.mabc.bc.ca> or the Canadian Diabetes Association Library (at 8th and Hemlock in Vancouver). To access the RNABC database, go to the RNABC web site, enter the "library site"; proceed to "Nursing & Allied Health Collection". To access the Canadian Diabetes library, call Franka the librarian at the Canadian Diabetes Association at 604-732-1331.

Bodzin, B.J. (1997). Type II (Non-insulin-Dependent Diabetes: New Treatment Options. Home Healthcare Nurse. (15)1, 41-47.

Bailey, C. J. (1992). Biguanides and NIDDM. Diabetes Care. (15)6, 755-772.

Chase, S. L. (1997). Oral Hypoglycemics. RN. December, 45-49.

Drass, J. A. & Peterson, A. (1996). Type II Diabetes: Exploring Treatment Options. American Journal of Nursing. (96)11, 45-49.

Tomky, D. (1997). Diabetes: Taking A New Look At An Old Adversary. Nursing. November, 41-45.

Comments

Thank you for your information. As a "by the way," if a person shows symptoms of diabetes, they must be checked. There is no such thing as "borderline diabetes" nor is diabetes a transient diagnosis. Once you have had abnormal blood glucose readings or experienced sugar in your urine, the chances are you have diabetes and must take care of your disease. The latest issue of Diabetes Quarterly Spring 2001 (available at the Diabetes Association library on 8th and Hemlock in Vancouver; Phone 732-1331 and ask for the librarian Franke) has a report about the First National Conference on Diabetes and Aboriginal Peoples held in Winnipeg June 2001.

Comments

Thank you for all your replies to my study questions. Many nurses have indicated that more educational sessions are needed to teach nurses about diabetes. Although the nursing literature is full of educational strategies that have been suggested by doctors and administrators to assist general duty staff nurses improve their knowledge about diabetes, I'd like to hear from general duty staff nurses.

What type of educational sessions would you find most helpful in improving your knowledge about diabetes?

Comments

I have had a question regarding exercise and diabetes.

The following article is available on-line to nurses with a current RNABC registration number:

American Diabetes Association, (1994). Diabetes Mellitus and Exercise. *Diabetes Care*, 24(1), pS51-56.

Note: This article is available in full-text. Click below (if applicable) or link to the Nursing & Allied Health Full-text database from the RNABC website at

<http://www.rnabc.bc.ca>

This article suggests that exercise is a therapeutic tool to be used to control the blood glucose of a person who lives with diabetes. The amount of exercise that a person who lives with diabetes needs is not that much different from what a person who does not live with the disease needs. The difference between those who live with diabetes and those who do not is that because exercise affects the blood glucose of a person who lives with diabetes, it must be daily part of life. Exercise for the person who lives with diabetes should not be just a couple of times a week. As well, a person who lives with diabetes must prepare for her/his exercise by getting her/his monitor, checking her/his blood glucose, and having readily available sugar, such as juice in case of hypoglycemia.

Comments

I have had a question regarding the mixing of insulin. The following article about insulin is available online to nurses with an active RNABC registration number: Ingle, K. (1994).

Insulin. *Diabetes Forecast*, 47(10), 54-57. Note: This article is available in full-text. Click below (if applicable) or link to the Nursing & Allied Health Full-text database from the RNABC website at <http://www.rnabc.bc.ca> .

This article suggests that short acting (clear) insulin should be put into the syringe prior to long acting (cloudy) insulin, so as not to forget that the short acting insulin has been added to a syringe. Drug companies also suggest that short acting insulin should be added to an insulin syringe first for a different reason. Drug companies suggest that there is a high chance of contaminating the second bottle of insulin when insulin is mixed. If the short acting insulin is

drawn up after the long acting insulin, the short acting insulin can easily be contaminated with the long acting insulin. The possibility of an unrecognized insulin reaction increases because the person living with diabetes may not watch for hypoglycemia for more than 4 to 6 hours after an insulin injection if they have only taken short acting insulin. However, if the long acting insulin is contaminated with short acting insulin, as is likely when short acting insulin is put into a syringe before a long acting insulin is drawn up, the chance of an unrecognized hypoglycemic episode should be reduced. The person living with diabetes will usually watch for dips in her/his blood glucose from the time of her/his injection till as many as 36 hours after the injection. So the advice is: clear before cloudy when mixing insulin.

A question comes to mind..... Where do nurses look for information about such topics as mixing insulin?

Comments

Thank you for your questions and your comments.

First, some information: Maturity onset diabetes is now referred to as Type 2 diabetes, as diabetes is categorized by the cause of the disease, not the treatment. Although the causes of Type 2 diabetes are not completely clear, one of the most likely causes is a general wearing out of the Beta cells on the pancreas. As we age, general deterioration occurs within the body and the pancreas experiences this as well. The Beta cells simply wear out, and as a result, no longer produce sufficient insulin meet the needs of the body. Type 2 diabetes was once thought to only occur in those of mature years (hence the name maturity onset), usually people over 40 years of age, but we have found that children as young as 9 years of age can have Type 2 diabetes. Treatment is threefold: diet, excersize and medication. Persons who live with Type 2 diabetes will usually start treatment with a weight loss program of diet and excersize. If this treatment does not produce sufficient results, oral medication may be added.

As time progresses, insulin may be necessary to gain glycemic control. The Diabetes Association Library has a wealth of literature available for both you and your patients, and in Vancouver can be reached at (604) 732-1331.

As a by the way...

I am interested in your comment that you care for one person who lives with diabetes in a year. Nursing literature suggests that every nurse has contact with a person who lives with diabetes every day of her/his practice. As well, in Canada for every person we know has diabetes, another who actually has the disease has not been diagnosed. Any comments?

Appendix H: Ethical Approval