A Model to Test the Effectiveness of Standardized Nursing Terminologies In Electronic Medical Records

Introduction

There has been an increased interest in research to determine the effectiveness of patient care. Kane (2004) suggests that the reason for this is due to several factors. Patients are increasingly demanding accountability from health care providers for "what happens to patients" (p. ix). The increased use of quality improvement techniques borrowed from industry is also contributing to the trend for outcomes research. Industry leaders who are footing the bill for health care want to see the health care delivery system apply the same techniques that they are using to respond to customers' demands for quality and value.

White (2004) points out that outcomes information can bridge the gap between interventions and what is actually accomplished for patients. The implementation of electronic health records is seen as a method for improving communication between health care providers in the care of individual patients, and as a means of aggregating information about the effectiveness of interventions applied to groups of patients (Currell and Urquhart, 2005a). The United States government has mandated the development of electronic health records in this country. However, there is little evidence that has been presented to demonstrate how effective the use of electronic health records might be. This would seem to be an area that is ripe for research related to the effectiveness of electronic health records, the content of those records, and cost-effectiveness analysis to determine the return on investments in costly technology.

Patients undergoing surgical procedures are an appropriate group in which to conduct outcomes research. According to the Surgical Care Improvement Project, there are 30 million surgical procedures performed annually in the United States (SCIP

Partnership, 2004). The group estimates that "a significant percentage" of these procedures will result in preventable complications. This paper will propose a model to evaluate the effectiveness of standardized nursing terminologies in electronic medical records in decreasing the occurrence of these errors and improving patient outcomes by improving communication between caregivers.

A Proposed Model

Kane (2004) emphasizes the importance of a conceptual model in designing research studies that evaluate intervention effectiveness and outcomes. This step is critical to identifying both the outcomes of interest and the treatment or intervention that is believed to influence those outcomes. Outcomes are a function of the baseline, the clinical characteristics of patients, the demographic and psychosocial characteristics of patients, the treatment or intervention, and the setting in which care is delivered. Each of these components for the proposed model is outlined below.

Characteristics of Patients

For the purposes of this model, the patient population is defined rather broadly. In terms of demographic characteristics, the patients will be adults. While certainly pediatric patients could be at risk for post-operative complications, there is less evidence to specify which complications may be most prevalent in children. Also, caring for children demands the involvement and care of their parent/guardian, which adds a component of communication that may not be present to the same degree when caring for adults.

Clinically, only patients scheduled for elective procedures will be examined in this model. Non-elective or emergent surgery by its definition sometimes lacks the

detailed advanced planning that goes into preparing for a planned surgical procedure. While the risk of post-operative complications is no less "real" for patients undergoing emergency procedures, communication patterns in that instance might differ from those utilized for scheduled patients.

Controlling for age and nature of procedures are two methods of "leveling the playing field", or adjusting for risk (Kane, 2004). Risk adjustment is a method of correcting for differences in the composition of patient groups that are being cared for by different groups of providers or settings, and is a necessary step in designing a study that can apply across providers and/or settings.

Setting

The setting for this evaluation will be an acute care setting in which an electronic documentation system is already in place. Implementation of electronic systems presents a myriad of challenges in and of itself (Stausberg, Koch, Ingenerf and Betzler, 2003; Poissant, Pereira, Tamblyn and Kawasumi, 2005), which might only serve to complicate the evaluation of outcomes in this model. This can also be interpreted as a method of adjusting for risk on the part of the setting.

Intervention

The intervention or treatment to be evaluated in this model is the use of standardized nursing terminologies in an electronic documentation system. Standardized nursing terminologies began to be developed in the late 1980's, as a means of gathering common information about nursing care and patient status (Keenan, Stocker, Barkauskas, Treder and Heath, 2003).

Nurse leaders advocate for the use of standardized nursing terminologies in electronic records. The American Nurses' Association (ANA) has created standards for terminologies, in order to offer guidelines for development of terminologies, implementation and suggestions for future research (Aquilino and Keenan, 2000). Nurse leaders have asserted that the use of standardized nursing terminologies can improve communication between nurses and their colleagues, promote continuity of care, and provide data that can support the nursing profession. Before these benefits can be realized, or even evaluated, standardized nursing terminologies must be utilized in documentation systems.

Currell and Urquhart (2005), in their review of nursing record systems, point out that, because of increasing complexity of health care systems, the ability to communicate effectively about patients is more important than ever, and that delivery of "good nursing care" (¶ 2) is dependent on the quality of information available to nurses. They also point out the key role of nurses in collecting, generating and using patient information. Unfortunately, their review found only seven studies regarding documentation and nursing practice that met their criteria for review. They conclude, and rightfully so, that this is an area in which further research is needed. A brief review of the literature reinforces this position.

Nahm and Poston (2000) studied the effects of a point of care computer system on quality of nursing documentation and patient satisfaction. Their focus was primarily on the use of the computer system to improve the quality of nursing documentation as measured by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), rather than on the terminology used to document nursing care. However, they

did measure patient satisfaction with nursing care, and found that the use of a computer system did not significantly impact patient satisfaction either negatively or positively.

Poissant, Pereira, Tamblyn and Kawasumi (2005) conducted a literature review to compare the effects of computerized documentation systems on time efficiency of physicians and nurses. While they found that computer systems affected the efficiency of nurses positively, they also report that the use of a computer system increased the completeness of information that was documented in several of the studies they reviewed. Patient satisfaction was not a factor in their review.

The differing level of information in paper vs. electronic records was noted by Stausberg, Koch, Ingenerf and Betzler (2003). They found that paper records tended to consist primarily of free-text or unstructured text, while computerized records were more standardized and provided structured text with controlled medical vocabulary. Their work focused on physician documentation, but could also apply to nursing documentation. Standardized nursing terminologies would provide the controlled vocabulary for the purposes of the model under consideration here.

In an ethnographic study of nurses' documentation practices in the United Kingdom, nurses primarily viewed the patient's record as a tool for managers and/or defense against possible future litigation, rather than as a source of information about the patient. The nurses in this study primarily relied on the handoff or report as the place in which to describe patient status and communicate information about non-routine needs (Allen, 1998). There was not a quantitative aspect to this study that measured documentation content. Allen concludes by stating that there is a need for "good record-

keeping" (p. 1229) to support quality patient care, but does not define either good record keeping or quality patient care.

A number of studies have been conducted to evaluate the adequacy of standardized terminologies to capture domains of nursing care (Coenan, Ryan and Sutton, 1997; Moorhead and Delaney, 1997; Burkhart and Androwich, 2004; Junttila, Salanera and Hupli, 2005). For the most part, they have evaluated the application of standardized nursing terminologies in closed medical records or simulated patient care situations. There have been few studies that document the effectiveness of standardized nursing terminologies in "real-world" applications, although work has been done in the area of home health care (Keenan, Stocker, Barkauskas, Treder and Heath, 2003a) and in an adult care nurse practitioner setting (Keenan, Stocker, Barkauskas, Treder and Heath, 2003b).

As Currell and Urquhart (2005b) point out, there is "a paucity of studies of sufficient methodological rigour" (p. 33) in this area. However, the work of vonKrogh, Dale and Naden (2005) in developing a framework for the integration of standardized nursing terminologies into electronic records, and of Keenan et al. (2002) is encouraging in that they begin to address the issues associated with incorporating standardized nursing terminologies in electronic patient records. This work will serve as a foundation for the use of standardized terminologies in communicating and evaluating patient care.

Outcomes

Surgical Site Infection

In 1999, the United States Center for Disease Control (CDC) estimated that surgical site infections (SSI) accounted for 14-16 percent of nosocomial infections.

Among surgical patients, the most common nosocomial infection was SSI, which accounted for 38 percent of all such infections. The occurrence of an SSI leads to increased hospital stays and increased costs, as well as an increased mortality risk (Mangram, Horan, Pearson, Silver and Jarvis, 1999).

Four important interventions have been identified as significant factors in the prevention of SSI (SCIP Partnership, 2004). They include: 1.) Administration of prophylactic antibiotics within one hour prior to surgery; 2.) Selection of appropriate prophylactic antibiotics; 3.) Discontinuation of prophylactic antibiotics within 24 hours after surgery; and 4.) Perioperative glucose control in major cardiac surgical patients.

An additional risk for the development of SSI is perioperative hypothermia. The American Society of PeriAnesthesia Nurses (ASPAN) has developed guidelines for preventing perioperative hypothermia. These include temperature monitoring and passive and active warming methods (ASPAN, 2002).

SSI are diagnosed at varying times post-operatively, and the movement toward shorter hospital stays complicates the tracking of this indicator. For the purpose of this evaluation, hypothermia in postoperative colorectal surgery patients and administration of prophylactic antibiotics will be used as "proxy" measures for SSI. These measures are publicly reported by the Centers for Medicare and Medicaid Services (CMS) in conjunction with the SCIP Partnership (CMS, 2005)

Myocardial Protection

Adverse cardiac events (including myocardial infarction or cardiac death) due to myocardial ischemia in non-cardiac surgery patients have been estimated to occur in 2-5% of patients undergoing surgery, and are associated with mortality rates as high as

40%, prolonged hospital stays and increased costs. Studies have shown that up to half of fatal perioperative cardiac events can be prevented by beta-blocker therapy for patients at risk (SCIP Partnership, 2004). Patients at risk include those with 2 of the following minor criteria:

- Age 65 years or older;
- Hypertension;
- Current smoker;
- Serum cholesterol level of 240 mg/dL or higher;
- Type II diabetes mellitus not requiring insulin therapy.

Patients who fall into this category who are not currently taking beta blockers should be started on atenolol or bisoprolol preoperatively, and continue for 30 days post-operatively.

Administration of beta-blocker agents perioperatively will serve as an outcome measure for this evaluation. This, too, is information available from the SCIP Partnership (CMS, 2005).

Data Source

The source of the comparison data for this evaluation will be the SCIP Partnership database. Access to the database is by membership in the partnership; the setting for this study is a member of the partnership, so has access to the database through its Quality Department (SCIP Partnership, 2004).

The SCIP Partnership collects data in four areas of surgical care improvement: 1.) Surgical Site Infections; 2.) Adverse Cardiac Events; 3.) Deep Vein Thrombosis; and 4.) Postoperative Pneumonia.

Unfortunately, there is little specific information available publicly about the database, although there is information about the specific data elements at the Partnership's website.

Design and Method

For the purpose of this evaluation the HANDS application will be utilized as the vehicle that incorporates the use of standardized nursing terminologies into electronic patient records (Keenan, Stocker, Geo-Thomas, Soparkar, Barkauskas and Lee, 2002). HANDS was developed to provide an automated method for collecting, storing and retrieving clinical nursing data across settings. The application is currently in use in four clinical settings, and expansion to additional settings is planned for 2006.

The HANDS application incorporates the use of three of the standardized nursing terminologies approved by ANA. They are the NANDA nursing diagnosis classification, the Nursing Outcomes Classification (NOC), and the Nursing Interventions Classification (NIC) (Keenan, et al., 2002). NANDA is a system of diagnostic labels that represent nurses' clinical judgment about actual or potential health problems; NOC is a set of patient focused outcomes that are sensitive to nursing interventions; and NIC is a set of interventions that are provided by nurses (Aquilino and Keenan, 2000).

Because of the difficulties in randomizing patients within a single unit, a quasi-experimental non-equivalent groups design will be utilized. This design allows for comparison between two groups: one in the setting with the HANDS application in addition to the electronic documentation system, the second from the national database maintained by the Centers for Medicare and Medicaid Services for the SCIP Partnership (CMS, 2005). This design is recommended when true experimental design cannot be

implemented (Maas, Buckwalter, Reed and Specht, 1998). While randomized controlled trials are usually seen as the "gold standard" for clinical research (Kane, 2004), a number of difficulties in designing randomized controlled trials in research on nursing documentation have been noted (Currell and Urquhart, 2005b). Maas, et al. identify selection bias as a threat to validity in non-equivalent groups; however, patients will be admitted to the unit based on the criteria currently used by the facility. The individuals making the bed assignments will not have knowledge of the evaluation, so are in effect, blinded to it.

Data regarding medical diagnoses, medical history, procedure and vital signs and medication administration are available in the setting's electronic patient record. For both groups of patients, the database will be queried for surgical patients' immediate post-operative temperature and medications administered. The setting in which the study will be carried out reports data to the CMS database, so equivalent measures will be readily available.

Analysis

The actual administration of medications (antibiotics or beta-blockers) is dichotomous; thus these variables are measured on a nominal level. Although temperature is measured on an interval scale (Polit and Hungler, 1995), the determination of whether normothermia is present or not present is also dichotomous. This limits the evaluation to non-parametric statistical tests.

Chi-square is used to evaluate the significance of different proportions by comparing observed frequencies to expected frequencies. The expectation for this study is that the proportion of patients for whom medication will be appropriately administered

will be higher in the HANDS setting than in the national database, so the frequency of appropriate antibiotic and beta blocker administration for that group will be compared to the group of patients drawn from the database. The null hypothesis is that there will be no difference between the groups. A sample table is shown in Figure 1.

Group	Antibiotics Given When Appropriate	No Antibiotics Given When Not Appropriate
Study Setting		
SCIP Database		

Figure 1. Sample Table

As noted earlier, temperature is an interval level measure, but the outcome indicator to be used here is whether normothermia is present. The hypothesis to be tested is that patients whose nurses use the HANDS application to plan and document care will have significantly more normothermia than patients in the national database. This hypothesis will be evaluated using Spearman's rho to determine if a correlation exists between normothermia and use of standardized nursing terminology.

Limitations

Assumptions made for this proposed study present some limitations of concern. The use of proxy or intermediate outcomes may not be the best measure that the end outcome did or did not occur.

The SCIP Partnership (2005) defines the outcome of appropriate care for the prevention of SSI as "Post-operative wound infections diagnosed during index hospitalization". Similarly, the outcome for adequate myocardial protection is "Intra or

post-operative acute myocardial infarction diagnosed during index hospitalization and within 30 days of surgery". The outcomes identified for this evaluation are publicly reported as quality measures, but are in actuality process measures rather than true outcome measures. Because of continually decreasing lengths of stay, it is difficult to follow up to identify SSI or AMI within 30 days of discharge. If the patient were to return to the study setting, a positive identification could be made. However, because patients might present elsewhere for treatment of either condition, the absence of re-admission does not necessarily imply a lack of complication.

Similarly, use of the HANDS application is the method for applying the intervention of the use of standardized nursing terminologies. The use of the terminologies is assumed to improve communication to the degree that patient risk for surgery is appropriately managed. This may not be true, and it may be more appropriate to measure the presence or absence of elements of the terminologies. Such a measurement might provide more detailed information, and certainly presents additional research questions. For example, if the patient has a NANDA diagnosis of "Risk for Infection", does that increase the degree to which patient surgical risk is managed?

It might also be argued that the outcomes as defined here are not really "nursing outcomes"; however, if patient risk is viewed as a potential response to illness or injury, the outcomes as defined for this study can be seen as patient management that falls within nursing's domain.

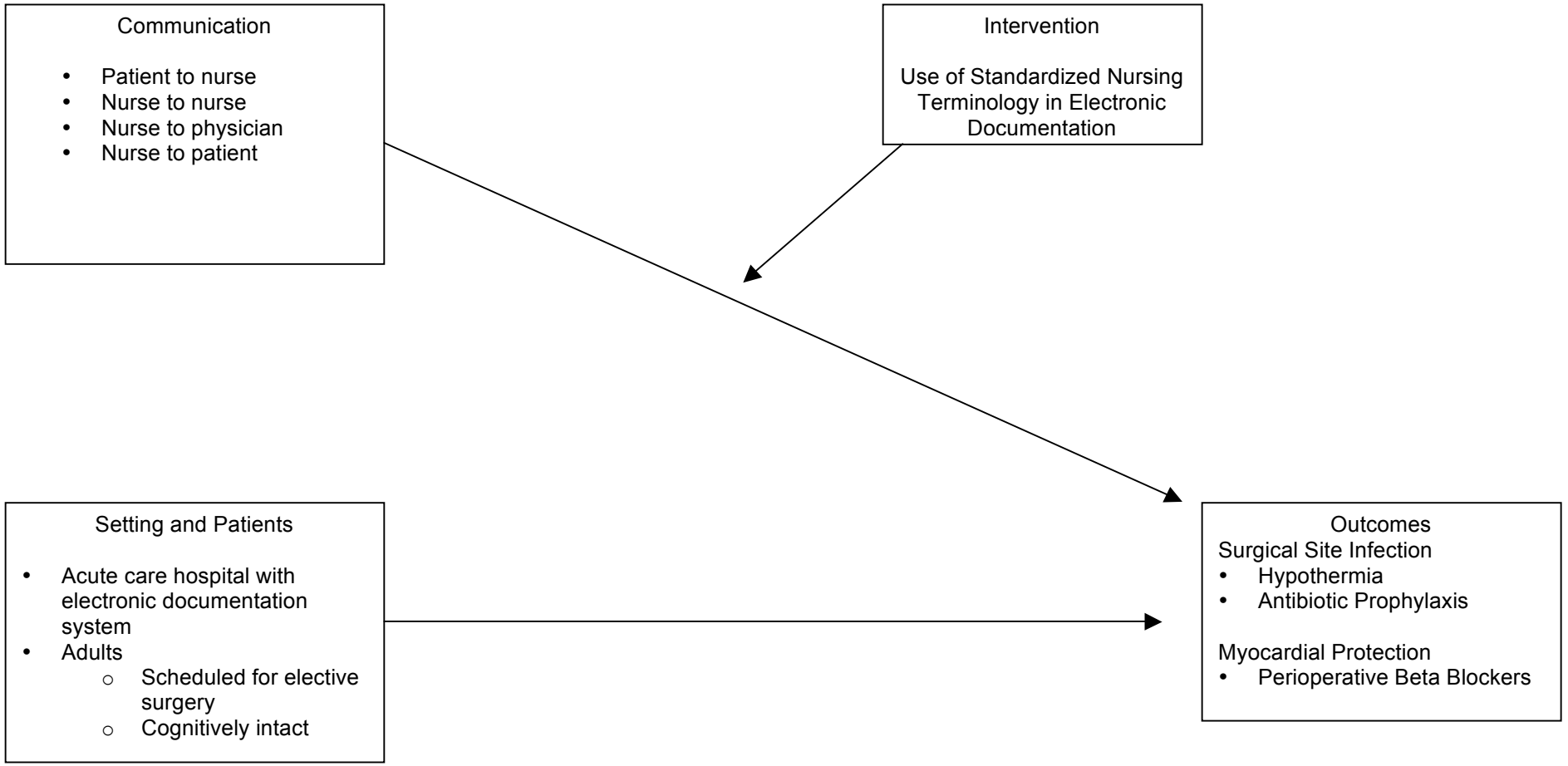
Conclusion

The proposed study was designed to test the model that the use of standardized nursing terminologies can improve communication between caregivers and thus improve

management of the risk of perioperative complications. The results of such an evaluation will surely serve to provoke more discussion about the operationalization and usefulness of standardized nursing terminologies in clinical settings.

Appendix A

Proposed Model



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