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Development of the Hospital Nurse Surveillance Capacity Profile

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Abstract

Better patient outcomes are often achieved through effective surveillance, a primary function of nurses. The purpose of this paper is to define, operationalize, measure, and evaluate the nurse surveillance capacity of hospitals. Nurse surveillance capacity is defined as the organizational features that enhance or weaken nurse surveillance. It includes a set of registered nurse (staffing, education, expertise, experience) and nurse practice environment characteristics. Empirical referents were extracted from existing survey data from 9,232 nurses in 174 hospitals. Using a ranking methodology, a Hospital Nurse Surveillance Capacity Profile was created for each hospital. Greater nurse surveillance capacity was significantly associated with better quality of care and fewer adverse events. The profile may assist administrators to improve nurse surveillance and patient outcomes.

Keywords

surveillance; nurse organization; administration; quality of care

The quality of our nation's healthcare system has come under scrutiny as evidence grows about preventable medical errors (Institute of Medicine[IOM], 2000, 2001, 2004) and uneven quality of care across hospitals (Jha, Zhonghe, Orav, & Epstein, 2005). Concurrently, a research base has emerged documenting a link between greater investments in nursing and better outcomes for patients (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007). We hypothesize that better patient outcomes are achieved through more effective surveillance, a primary and vital function of registered nurses (RNs).

Recently, surveillance has achieved prominence in the nursing literature as a feature of failure-to-rescue, the hospital staff's failure to save the life of a patient who has suffered a complication during hospitalization (Clarke & Aiken, 2003). Researchers have documented a connection between organizational context of care and failure-to-rescue, positing that the nurse surveillance function is heavily dependent upon human resources decisions made by hospital management (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Friese, Lake, Aiken, Silber, & Sochalski, 2008). Although these authors have implied the influence of surveillance on patient outcomes, no prior studies have been performed to understand organizational capacity for nurse surveillance.

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The purpose of this paper is to define, operationalize, measure, and evaluate the nurse surveillance capacity of hospitals. First, the concepts of nurse surveillance and nurse surveillance capacity are developed and defined. Empirical referents of nurse surveillance capacity were then derived from existing nurse survey data to create a Hospital Nurse Surveillance Capacity Profile for each study hospital. Finally, the authors initially validated the profile by exploring associations with nurse-assessed quality of care and adverse events.

Background and Significance

The Concept of Surveillance

Surveillance has multiple meanings in health care. The most familiar is population-based monitoring of health indicators, such as tracking infectious disease vectors or documenting increasing obesity rates in the general population. Nurses may be involved in population health surveillance through activities such as blood pressure and weight screenings at health fairs and in epidemiological studies. There is another less frequently used meaning of surveillance that involves the health care of individuals. Dougherty (1999) defined this type of surveillance as “the application of behavioral and cognitive processes in the systematic collection of information used to make judgments and predictions about a person’s health status” (p.524). In addition, in the Nursing Interventions Classification (NIC), surveillance is defined as “the purposeful and ongoing acquisition, interpretation, and synthesis of patient data for clinical decision-making” (McCloskey & Bulechek, 1996, p.632). A conceptualization has not been developed, however, that captures the essence of nurse surveillance as a cumulative and temporal process, or describes a healthcare organization’s capacity for excellent nurse surveillance.

A Framework for Nurse Surveillance

The Quality Health Outcomes Model (QHOM; Mitchell, Ferketich, & Jennings, 1998) provided a theoretical base for framing the examination of nurse surveillance and nurse surveillance capacity. In the model, system and patient characteristics have a direct effect on outcomes; the effect of an intervention on outcomes is mediated by both system and patient characteristics. In the context of our study, nurse surveillance capacity has a direct effect on outcomes, and the effect of nurse surveillance on outcomes is mediated by nurse surveillance capacity and patient characteristics. The system characteristic in our study is nurse surveillance capacity (i.e., RN characteristics and the nurse practice environment) that influences the intervention of nurse surveillance. A direct measure of nurse surveillance is difficult to obtain; therefore our study does not show how the relationship between the nurse surveillance and outcomes could be mediated by system characteristics. Rather, the focus of this study was on the direct relationship between nurse surveillance capacity and outcomes, including quality of care. Patient characteristics, such as severity of illness at admission, also are theorized to affect patient outcomes. However, the inclusion of patient characteristics was not possible because patient-level data were not collected in the survey.

Nurse Surveillance: An Intervention

Nurse surveillance is a process through which nurses monitor, evaluate, and act upon emerging indicators of a patient’s change in status. The components of this process include: ongoing observation and assessment, recognition, interpretation of clinical data, and decision-making.

Ongoing observation and assessment—Temporality is a critical component in the examination of surveillance (Dougherty, 1999). According to Dougherty, surveillance differs from assessment in that surveillance is an ongoing practice that occurs over time, whereas assessment frequently is referred to as a one-time event. The process of ongoing

observation and data collection in nursing includes physical and mental examinations, and vigilant watching for physiological or behavioral changes using sensory data, such as seeing and hearing, during interactions with patients (Zeitz, 2005). Technological devices, such as electronic monitors, may aid nurses in this function as well. Nurse surveillance also includes the ongoing monitoring of laboratory findings and medications, including side effects and drug interactions (Benson & Briscoe, 2003). As a consequence of surveillance, changes in patient status are identified either as presenting a risk or as evidence of desired responses to treatment.

Recognition—An integral piece of surveillance is the nurse's ability to recognize patient conditions that deviate from baseline measurements or parameters of interest. The parameters of interest are established through the initial assessment of the patient (Dougherty, 1999). Several indicators serve as markers for recognizable change in patient status including: vital signs, neurological and mental status, cardiac and respiratory functioning, and laboratory results (IOM, 2004). The ability to recognize and "read the situation" requires professional knowledge, expertise, and experience. This skill is facilitated by a nurse's ability to recall previous experiences of similar situations and respond (Benner & Tanner, 1987).

Interpretation—After observing and recognizing an alteration, the nurse interprets and synthesizes this information in the context of the patient and the environment, relying heavily upon critical thinking and clinical judgment. Critical thinking entails an attitude of skeptical inquiry as well as intellectual ability (Kenney, 1995). Tanner, Benner, Chesla, and Gordon (1993) defined clinical judgment as the application of formal knowledge and theory to nurses' understanding of patients in the context of a given situation.

Decision-making—After collecting and interpreting patient data, the nurse makes a decision to continue monitoring or act upon indicators of change in a patient's status. Nurses act upon changes in a patient's status by modifying the plan of care, communicating with other providers, or mobilizing resources. Multiple researchers (Kramer et al., 2007; Kramer & Schmalenberg, 2004a; Pearson et al., 2000) have cited the importance of nurses' independent decision making to the quality of care that patients receive. Often, decisions may be influenced by organizational and environmental factors, such as resource availability and the practice environment.

Cumulative and Temporal Aspects of Surveillance

Although surveillance is considered to be a nursing intervention provided by a single nurse on behalf of a single patient, in reality, individual patients are cared for in most contexts by multiple nurses over time. Thus, nurse surveillance as a nursing intervention has cumulative and temporal aspects.

Associating the effectiveness of surveillance by an individual nurse with the outcomes of an individual patient in most contemporary health care settings is not possible because nurse surveillance is cumulative across nurses and over time. Benner (1984, p. 126) illustrated this in her qualitative research reported in *From Novice to Expert*: a charge nurse making rounds enters a room and immediately observes a lidocaine intravenous drip using a macro- rather than a micro-drip. Nurses on two previous shifts, including a float nurse and a new graduate, had failed to associate the patient's lethargy to over-medication. The charge nurse, whose surveillance was excellent, instituted a rescue attempt by turning the drip off, but the collective surveillance across multiple nurses over time contributed to the patient's subsequent cardiac arrest and death. Thus, nurse surveillance is a collective effort of

interventions delivered by multiple nurses over time, as well as interventions by individual nurses.

It is equally difficult to measure individual and collective nurse surveillance. However, an organizational level indicator of nurse surveillance capacity across nurses and over time would offer a metric with the potential to guide decisions that could improve surveillance, quality of care, and patient outcomes. A metric such as nurse surveillance capacity also would be valuable to build research evidence for administrators.

Nurse Surveillance Capacity

Nurse surveillance capacity is defined as the organizational features that enhance or weaken nurse surveillance. Nurse surveillance capacity includes RN characteristics (staffing, education, clinical expertise, and years of experience), and the nurse practice environment. The concurrent evaluation of each of these characteristics comprises the Hospital Nurse Surveillance Capacity Profile.

Staffing—Registered nurse staffing has been associated empirically with patient outcomes (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Mark, Harless, McCue, & Xu, 2004; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002). For example, Aiken, Clarke, Sloane, Sochalski, et al (2002) found an increased risk of 30-day mortality, as well as an increased risk of failure-to-rescue, for surgical patients in hospitals with high patient-to-nurse ratios. Therefore, “the effectiveness of nurse surveillance is influenced by the number of registered nurses available to assess patients on an ongoing basis” (Aiken, Clarke, Sloane, Sochalski, et al., 2002, p. 1992).

Education—In addition to staffing, researchers have focused on the educational background of nurses as a predictor of patient outcomes (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Estabrooks, Midodzi, Cummings, Ricker, & Giovannetti, 2005; Tourangeau et al., 2007). Aiken and colleagues (2003) found significantly lower rates of 30-day mortality and failure-to-rescue among surgical patients in hospitals with higher proportions of nurses who had earned at least a baccalaureate degree in nursing. Aiken’s findings were supported in two studies in Canada (Estabrooks et al.; Tourangeau et al., 2007). Researchers hypothesize that baccalaureate preparation has a positive association with nurses’ critical thinking and clinical judgment skills, which are essential to the surveillance of patients, both in terms of risk for adverse events and in the evaluation of therapies (Aiken et al., 2003; Young, Lehrer, & White, 1991).

Clinical expertise—In an influential work, Benner & Tanner (1987) explored the relationship between expertise and nurses’ practice style, and demonstrated how expert nurses develop intuition - a powerful feature of the surveillance process. Intuition is defined as “understanding without rationale” (Benner & Tanner, p. 23). Expert nurses are able to recognize patterns and relate current clinical situations to past experience, integrate knowledge of the patient’s disease with contextual knowledge about the patient, and are skilled in their specialty areas. Expert nurses also practice deliberative rationality-the capacity to view a clinical scenario from different perspectives; they also possess a sense of salience- the ability to identify the most pertinent observations in a complex assessment (Benner & Tanner). Therefore, expert nurses are able to immediately detect changes in a patient’s condition and intervene to prevent adverse occurrences (Christensen & Hewitt-Taylor, 2006; Houser, 2003).

Years of experience—Experience is necessary to gaining expertise, but the two are not necessarily interchangeable (Christensen & Hewitt-Taylor, 2006; Houser, 2003). The

number of years of experience, however, provides exposure to different patient conditions and clinical scenarios that contribute to the development of knowledge, technical skills, and critical thinking (Benner, 1984; Newman, 1990). Research that links experience to patient outcomes is scarce; however, existing findings are promising. For example, Tourangeau, Giovannetti, Tu, and Wood (2002) found that each additional year of nurse experience was associated with six fewer patient deaths for every 1000 patients discharged from urban community hospitals. In another study, units with more experienced nurses reported lower rates of medication errors and adverse events (Blegen, Vaughn, & Goode, 2001).

Nurse practice environment—The nurse practice environment is defined as “the organizational characteristics of a work setting that facilitate or constrain professional nursing practice” (Lake, 2002, p. 178). Several instruments have been developed to measure the nurse practice environment. One of these, the Practice Environment Scale of the Nursing Work Index (PES-NWI; Lake, 2002), is used to measure elements that are critical to nurse surveillance. Furthermore, the PES-NWI has been endorsed by the National Quality Forum (NQF) as a nursing-sensitive standard measure for inpatient care (NQF, 2004).

The five domains of the PES-NWI are: Nurse Participation in Hospital Affairs; Nursing Foundations for Quality of Care; Nurse Manager Ability, Leadership and Support of Nurses; Staffing and Resource Adequacy; and Collegial Nurse-Physician Relations (Lake, 2002). Nurse participation in hospital affairs is not an obvious component of surveillance. However, in hospitals where nurses are able to influence administrative decisions and policies, nurses are likely to be more efficient in their practice (Aiken, Lake, Sochalski, & Sloane, 1997). Nursing foundations for quality care, such as patient assignments that promote continuity of care, are conducive to surveillance by enhancing the accumulation of knowledge about a patient. Job performance and productivity, including surveillance, depend on the support and ability of the nurse manager (Kramer, Schmalenberg, & Maguire, 2004). Nurses need the staffing support to have adequate time to spend with their patients to perform surveillance, as well as adequate resources available to them to implement necessary interventions (Laschinger & Lieter, 2006; McCusker, Dendukuri, Cardinal, Laplante, & Bambonye, 2004). Further, collegial relationships with physicians are essential to effective surveillance through the exchange of information vital to the patient’s clinical condition (Baggs et al., 1999; Kramer & Schmalenberg, 2004b).

Nurse Surveillance and Outcomes

Better nurse surveillance is considered to be the link between better RN staffing/education and the prevention of mortality and failure-to-rescue in surgical patients (Aiken et al., 2003; Aiken, Clarke, Sloane, Sochalski, et al., 2002; Clarke & Aiken, 2003). With the elements of nurse surveillance capacity in place, nurses are better able to perform adequate surveillance of patients and initiate a timely response when a complication or adverse event is detected. Therefore, theoretically, multiple adverse outcomes may be used to assess the effectiveness of hospital nurse surveillance capacity, including mortality and failure-to-rescue. We posit that nurse surveillance capacity has the same relevance for all patient populations and non-mortality outcomes. Other outcomes of nurse surveillance capacity may include quality of care and adverse events, such as falls and nosocomial infections.

Methods

Data Source

This study was a secondary analysis of data derived from a 50% random sample survey of Pennsylvania RNs that was conducted in 1999. The survey response rate was 52%, for a total of 43,329 RNs (Aiken et al., 2001). The survey was developed to examine the

relationships between nurse staffing, work environment, and patient outcomes (Aiken, Clarke, & Sloane, 2002). The survey contained questions about hospital work environments, workload, workplace safety, quality of care assessments, demographics, education, and experience. Data reflecting individual patient characteristics were not collected in the survey.

Sample

Of the 43,329 respondents, 13,204 nurses indicated they worked in one of the 210 acute care hospitals in the state. Nurses were included in the final sample for this study if they identified their primary position as a staff nurse working in acute care (excluding the emergency room). Hospitals were included in the sample that had a sufficient number of respondents to assure reliable aggregate values of surveillance capacity variables, as described elsewhere (Aiken, Clarke, Sloane, Sochalski, et al., 2002). An average of 60 nurse respondents from each hospital completed questionnaires. One-half of the hospitals had more than 50 nurse respondents and over 80% of the hospitals had more than 25 nurse respondents. The final sample for this analysis consisted of 9,232 RNs in 174 hospitals in the state of Pennsylvania.

Measures

Empirical referents were extracted from the Pennsylvania nurse survey to operationalize nurse surveillance capacity. A Hospital Nurse Surveillance Capacity Profile was constructed for each hospital by ranking hospitals on a set of RN characteristics (staffing, education, clinical expertise, and years of experience) and the nurse practice environment. An aggregate measure of hospital nurse surveillance capacity was constructed by calculating a hospital's average ranking across indicators. Nurse-assessed quality of care and two adverse event variables (nosocomial infections and patient falls with injuries) were the outcomes in this study.

Staffing—Nurses were asked to provide the number of patients cared for on their last shift. The mean number of patients cared for was calculated across all staff nurses within a hospital who reported caring for at least 1 but no more than 20 patients on their last shift. Aiken, Clarke, Sloane, Sochalski, and Silber (2002) considered this measure of staffing to be more accurate than administrative database sources. Harless and Mark (2006) discussed the bias introduced into staffing estimates when using administrative financial data to predict staffing allocation levels.

Education—Nurses were asked to provide their highest level of education in nursing. Respondents chose from: diploma, associate degree, baccalaureate degree, master's degree, or other. The education variable was operationalized as the proportion of staff nurse respondents within each hospital holding a baccalaureate degree or higher.

Clinical expertise—Nurses were asked to describe their clinical nursing expertise by choosing from one of the following response categories defined by Benner (1984): advanced beginner, competent, proficient, and expert. Responses were coded 1 to 4 respectively. The clinical expertise variable was calculated as the mean expertise of nurse respondents in each hospital.

Years of experience—Nurses were asked to provide the number of years they had worked as an RN. The experience variable was calculated at the hospital-level as the mean number of years of RN experience.

Nurse practice environment—The nurse practice environment was measured using the PES-NWI (Lake, 2002). The PES-NWI includes 31 items that use a 4-point Likert scale (*strongly agree, somewhat agree, somewhat disagree, and strongly disagree*) to assess nurses' perceptions of the presence of organizational characteristics in their hospitals. A mean score for each of the five subscales was calculated at the hospital-level from the hospital mean of the individual items composing each subscale (Rousseau, 1985; Verran, Gerber, & Milton, 1995). The reliability of the five subscales was examined at the hospital-level by calculating the intraclass correlation coefficient (ICC (1, k)) across hospitals using a minimum criterion of .60 (Glick, 1985). All five subscales demonstrated acceptable reliability at the hospital-level with ICC (1, k)s ranging from a low of .67 for the Collegial Nurse-Physician Relations subscale to a high of .89 for the Participation in Hospital Affairs subscale. Internal consistency coefficients (Cronbach's alphas) for the five subscales ranged from .78 to .85. Discriminate validity of the PES-NWI has been demonstrated by its ability to detect differences in the nurse practice environments of magnet and non-magnet hospitals (Lake & Friese, 2006).

Quality of care—Nurses were asked to rate the quality of nursing care delivered to patients on their unit using a 4-point Likert scale of *excellent, good, fair, and poor*. The reliability of the quality of care variable was examined at the aggregate level by calculating the ICC (1, k) across hospitals. The ICC (1, k) for quality of care was .73. Responses were collapsed into categories of poor/fair and good/excellent care to examine associations with the nurse surveillance capacity rankings.

Adverse events—Nurses were asked to report how often two different adverse events, nosocomial infections, and patient falls with injuries, occurred involving their patients over the past year. Frequency of adverse events was measured using a 4-point Likert-type scale of *never, rarely, occasionally, or frequently*. The reliability of the adverse event measures at the aggregate level was examined by calculating the ICC (1, k) across hospitals. The ICC (1, k)s for nosocomial infections and patient falls with injuries were .73 and .71, respectively. Responses were collapsed into categories of never/rarely and occasionally/frequently to examine associations with the nurse surveillance capacity rankings.

Data Analysis

The purposes of the data analysis were to describe hospitals' nurse surveillance capacity, to rank hospitals by nurse surveillance capacity, and to associate hospitals' average ranking with quality of care indicators. Individual nurse responses were examined to assess demographics. Nurse responses were then aggregated to the hospital-level to create the nurse surveillance capacity indicators. Distributions for the aggregated variables were calculated. To create a Hospital Nurse Surveillance Capacity Profile, the hospitals first were ranked on each nurse surveillance capacity indicator so that the rank on each indicator reflected the hospital's placement among all hospitals. A profile was developed to display hospital ranks by deciles for clarity of comparison, with 1 as the lowest and 10 as the highest decile. A Hospital Nurse Surveillance Capacity Profile was created for each of the 174 represented hospitals.

Hospitals' overall nurse surveillance capacity was then calculated as the mean ranking across all nine nurse surveillance capacity indicators. Finally, hospitals' overall nurse surveillance capacities were ordered into deciles, with 1 as the lowest and 10 as the highest decile. One hospital profile from the overall highest decile and another from the lowest were selected to illustrate and to contrast a highly ranked hospital and its consistent performance across indicators with a low ranked hospital.

To associate hospitals' rankings with quality of care indicators, outcomes of hospitals in the highest and lowest deciles of overall nurse surveillance capacity ranking were compared. Nurse responses were aggregated to the hospital-level to create the outcome measures. Same-source bias was of concern as the nurse survey was used to measure the independent and dependent variables. Therefore, a split sample approach was used to test the robustness of the estimates. In every hospital, a random half of the nurses' responses was aggregated for the organizational measures. The other half was aggregated for the outcome measures, and the analysis was repeated.

Findings

Nurse Respondent Demographics

Demographics of the nurse respondents were examined. Nearly all respondents were female (94%). The average respondent was 39 years of age. The majority of the nurses worked on a medical/surgical unit (38%); about a quarter of the respondents (24%) worked in intensive care.

Nurse Surveillance Capacity Distributions

Distributions for the nurse surveillance capacity variables for the 174 study hospitals are shown in the first two columns of Table 1. Average staffing across all hospitals was just over 5 patients per nurse. On average, one-third of the nurses within a hospital held at least a baccalaureate degree, had over 13 years of experience as an RN, and rated themselves as competent to proficient in their clinical expertise. A low proportion of hospitals (1 in 10) had a majority of nurses who rated their practice as proficient or expert (average expertise ≥ 3.0). Hospitals tended to score highest on the Nursing Foundations for Quality of Care subscale of the PES-NWI; the lowest scored subscale was Staffing and Resource Adequacy.

Nurse Surveillance Capacity Rankings

Nine percent of hospitals ranked above the 50th percentile on all nurse surveillance capacity indicators. The last two columns in Table 1 display the means of the nurse surveillance capacity indicators in the overall highest and lowest deciles. Nurses in the highest ranked hospitals took care of approximately two fewer patients than nurses in the lowest decile of nurse surveillance capacity. Over 40% of the nurses in the highest ranked hospitals had a bachelor's degree as compared to 20% of nurses in the lowest decile. Nurses in the highest decile of nurse surveillance capacity also rated their clinical expertise higher than those in the lowest grouping. Hospitals in the top decile of nurse surveillance capacity also had more years of RN experience as compared to the bottom decile. Nurses in hospitals in the top decile of nurse surveillance capacity consistently evaluated the nurse practice environment more favorably as compared to nurses in the lowest decile. The differences in means across all five subscales of the PES-NWI were sizable. The largest difference between deciles was observed in the Staffing and Resource Adequacy subscale.

Figure 1 illustrates the Hospital Nurse Surveillance Capacity Profile of two hospitals chosen from the highest and lowest deciles after average ranking across indicators. The figure compares the Hospital Nurse Surveillance Capacity Profile of a hospital with consistently high rankings, theoretically demonstrating a strong capacity for nurse surveillance, with a hospital in which the capacity for surveillance may be deficient based on the proposed conceptualization. Hospital values for each of the nine indicators are displayed to provide a more meaningful comparison.

Quality of Care and Adverse Events

Table 2 displays the mean ratings of nurse-assessed quality of care indicators in hospitals ranked in the highest and lowest deciles for overall nurse surveillance capacity. In the highest decile, significantly fewer nurses rated the quality of care in their unit as fair or poor, compared with nurses in the lowest decile. Significantly fewer nurses in the highest decile also reported occasional or frequent nosocomial infections and patient falls as compared to nurses in the lowest decile.

Our outcome variable mean values in the highest and lowest surveillance capacity deciles were essentially equivalent in the split-sample approach. In the highest decile, 6.6% of nurses rated the quality of care in their unit as fair or poor, compared with 21% of nurses in the lowest decile ($p<.001$). Thirty-two percent of nurses in the highest decile reported occasional or frequent infections compared with 48% of nurses in the lowest decile ($p<.01$). Finally, 15% of nurses in the highest decile of overall nurse surveillance capacity reported occasional or frequent falls compared to 29% of nurses in the lowest decile ($p<.05$).

Discussion

The nurse surveillance capacity of hospitals was examined in this study. Nurse surveillance capacity was operationalized as a set of organizational features derived from RN characteristics and reports of the nurse practice environment collectively referred to as the Hospital Nurse Surveillance Capacity Profile. The results of this study suggest that an organization composed of well educated, expert, and experienced nurses, with adequate staffing and a supportive practice environment promotes quality of care and prevention of two adverse events—falls with injury and nosocomial infections. The hypothesized mechanism for this association is more effective surveillance across individual nurses and over time.

The findings from this study suggest that modifying organizational features to support surveillance is a promising strategy for reducing adverse patient outcomes and improving quality of care. The analysis confirmed that the organizational characteristics that foster nurse surveillance are associated with better quality of care and fewer falls with injury and nosocomial infections based on self-reports from nurses. Hospitals in the highest and lowest deciles of overall nurse surveillance capacity indicators were compared relative to quality of care and adverse events. Nurses in the highest ranked hospitals of nurse surveillance capacity reported better quality of care and less frequent nosocomial infections and patient falls with injuries.

We operationalized nurse surveillance capacity in a way that the concept could be measured. Multiple literature syntheses have demonstrated the association between nurse staffing and patient outcomes, including mortality, complications, and length of stay (Kane et al., 2007; Lang, Hodge, & Olsen, 2004; Lankshear, Sheldon, & Maynard, 2005). In a comprehensive review of the literature, Kazanjian, Green, Wong and Reid (2005) concluded that the hospital nursing environment affects patient outcomes; however, the need for additional research was highlighted. The IOM report, *Keeping Patients Safe: Transforming the Work Environment of Nurses* (Page, 2004), cited all of the identified nurse surveillance capacity indicators as important factors to consider in the examination of patient care and safety.

Management Applications of the Profile

In this study we translated the theoretical underpinnings of and organizational contributors to nurse surveillance that have been established in the literature into a measure of nurse surveillance capacity, an organizational property that can be monitored and modified by nurse executives and hospital administrators. With this approach, administrators could

profile their hospital's surveillance capacity, benchmark that profile against peer hospitals with similar characteristics, and evaluate themselves over time. Benchmarking against similar hospitals with comparable macro characteristics, such as location, size, and teaching status, carries an additional advantage, as patient characteristics could be accounted for by proxy of hospital characteristics. Further, the NQF's (2004) endorsement of the PES-NWI and the technical specifications prepared by The Joint Commission (JCAHO, 2005) allows hospitals to benchmark their institution against a broader range of hospitals. The Hospital Nurse Surveillance Capacity Profile can be used to detect weaknesses in the nurse surveillance system and highlight areas in which more attention and resource allocation are needed to ensure patient safety and quality care.

The findings in this study demonstrate how organizational capacity for nurse surveillance may be measured and evaluated. Institutions increasingly have the data to construct their own Hospital Nurse Surveillance Capacity Profiles. The Hospital Nurse Surveillance Capacity Profile could be added to a dashboard monitored by nurse executives and hospital administrators. Using the Hospital Nurse Surveillance Capacity Profile for benchmarking across like hospitals may only be possible through national databases, like National Database of Nursing Quality Indicators (NDNQI), or health care systems that have multiple facilities, where data can be collected from and aggregated for a large number of facilities. For other facilities, the concept may be feasible for internal quality improvement at the nursing unit level. In addition to comparing similar units within hospitals, individual specialty units may follow their own surveillance capacity over time.

Research Considerations

This study is a secondary analysis of survey data. The use of survey data to describe organizations is challenged by the issues of respondent bias, response rate, and aggregation. Strengths of this survey data included the large number of respondents and hospitals, and a research design that did not permit hospitals to opt out. A limitation was deriving the data from nurses working in a single large state. The response rate of 52% is considered good by the current standards of social survey research (Asch, Jedrzejewski, & Christakis, 1997). Individual respondents were similar to the Pennsylvania nurses in the National Sample Survey of Registered Nurses (Aiken, Clarke, Sloane, Sochalski, et al., 2002; U.S. Department of Health and Human Services, 2000). The survey data were compared previously with American Hospital Association (AHA) annual survey data and the findings revealed that the number of responding nurses from each hospital was directly proportional to the number of RNs in each hospital as reported by AHA (Aiken et al., 2003).

The amount of same-source bias was likely to be reduced by the aggregation of our independent and dependent variables to the hospital-level (Rousseau, 1985; Verran et al., 1995). The effect sizes were equivalent in the split sample approach; therefore, the amount of same-source bias was negligible. Nurse informants responding to Likert-type scale items provided the outcomes in this study. The three outcome measures demonstrated reliable estimates using standard criteria. Recall bias is also a threat to the accuracy of these reports. However, nurses' retrospective reports of adverse events have been substantiated by adverse event data collected prospectively (Aiken, Sloane, & Klocinski, 1997; Gerolamo, 2006).

Although these data were collected in 1999, the concepts discussed in this study remain salient to current hospital executives (Donaldson, Brown, Aydin, Bolton, & Rutledge, 2005). Several study measures have been disseminated widely since 1999 through endorsement by the NQF (2004), the development of technical specifications by The JCAHO (2005), and by inclusion in the annual RN Survey of the American Nurses Association-sponsored NDNQI, which was conducted in over 500 hospitals in 2007 (NDNQI, 2006; 2008).

Future Research

Methods to directly measure nurse surveillance present a challenge to the field. Nursing intervention classification systems' measurement of nurse surveillance has been useful to begin to understand the process. However, these systems lack the specificity needed to construct a measure that accounts for each component of the surveillance process, and the organizational context in which nurses perform surveillance.

To ensure the generalizability of these findings an important next research step would be to replicate and improve upon the current study using new data sets. Research on nurse surveillance capacity could expand to incorporate and evaluate patient characteristics and outcomes. By contrast to nurse reports, objective patient outcome data, including mortality, require patient-level risk-adjustment. To date, well-developed risk adjustment models exist only for surgical patient mortality using solely administrative data. Although efforts to risk-adjust mortality for medical and other patient populations have been made (Escobar, Greene, Scheirer, Gardner, Draper, et al., 2008; Tourangeau & Tu, 2003), these models need further development and refinement.

Nurse surveillance capacity may be associated with other hospital structural characteristics, such as size, teaching status and location. Opportunities to enhance nurse surveillance capacity, however, may be limited by hospital resource constraints. Additional research may reveal how units might be staffed to offset surveillance capacity inadequacies, such as insufficient RN staffing, few nurses with baccalaureate degrees, lower expertise, many new graduates, or unfavorable environments. We plan to examine this question in future work. The influence of physician workforce characteristics and technology status on the quality of surveillance will be important to consider. Moreover, information technology is a developing area, and its effectiveness on nurse surveillance remains unclear (Koppel et al., 2005).

Conclusion

In this study, the investigators defined nurse surveillance as both an individual and collective process and established a method of combining hospital nursing characteristics to profile a healthcare institution's nurse surveillance capacity. Examination of the Hospital Nurse Surveillance Capacity Profile provides insight into the compositional staffing elements and environmental context that support this nursing intervention that is central to good patient outcomes.

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Figure 1. Surveillance Capacity Profile Examples of a High and a Low Ranking Hospital

Note: Ranking on each indicator reflects the hospital's placement among all sample hospitals. All hospitals were ranked on each indicator in deciles (1=lowest.10%, 10=highest 10%). †-4-point Likert scale: 1-*Advanced Beginner*; 2-*Competent*; 3-*Proficient*; 4-*Expert*. ‡-PES-NWI (Practice Environment Scale of the Nursing Work Index) - 4-point Likert scale: 1= *Strongly disagree*, 2= *Somewhat disagree*, 3= *Somewhat agree*, 4= *Strongly agree*

Table 1

Distribution of Nurse Surveillance capacity Indicators in Study Hospitals

Registered Nurse Characteristic	All Hospitals (<i>n</i> =174)		Highest Decile (<i>n</i> =15)	Lowest Decile (<i>n</i> =15)
	Mean (<i>SD</i>)	Range	Mean (<i>SD</i>)	Mean (<i>SD</i>)
Staffing (patients cared for last shift)	5.52 (1.2)	3.51–9.16	4.61 (0.7)	6.72 (1.3)
Education (proportion of nurses with baccalaureate degree or higher)	0.32 (0.1)	0–0.74	0.42 (0.1)	0.20 (0.1)
Clinical Expertise [†]	2.80 (0.1)	2.40–3.15	2.89 (0.1)	2.69 (0.1)
Years of Experience	13.45 (2.5)	7.76–21.21	14.44 (2.3)	12.62 (2.2)
<u>Nurse Practice Environment</u> [‡]				
Nurse Participation in Hospital Affairs	2.33 (0.2)	1.65–2.87	2.62 (0.1)	2.12 (0.2)
Nursing Foundations for Quality of Care	2.83 (0.2)	2.09–3.29	3.07 (0.1)	2.55 (0.2)
Nurse Manager Ability, Leadership, and Support of Nurses	2.36 (0.3)	1.78–3.18	2.68 (0.2)	2.08 (0.1)
Staffing and Resource Adequacy	2.19 (0.3)	1.36–2.91	2.56 (0.2)	1.87 (0.3)
Collegial Nurse-Physician Relations	2.74 (0.2)	2.18–3.16	2.89 (0.1)	2.56 (0.2)

[†]Note. 4-point Likert scale: 1-*Advanced Beginner*; 2-*Competent*; 3-*Proficient*; 4-*Expert*.

[‡]-Measured by Practice Environment Scale of the Nursing Work Index (PES-NWI) on 4-point Likert scale: 1= *Strongly disagree*, 2= *Somewhat disagree*, 3= *Somewhat agree*, 4= *Strongly agree*

Table 2

Nurse-Assessed Quality of Care and Adverse Events in Hospitals Ranked in the Highest and Lowest Deciles of Surveillance Capacity

Outcome	Highest decile (<i>n</i> =15)	Lowest decile (<i>n</i> =15)	t-value(<i>df</i> = 28)
	Mean % (<i>SD</i>)	Mean % (<i>SD</i>)	
Quality of nursing care on their unit is fair or poor	6.9 (0.04)	23.4 (0.1)	-4.56 **
Adverse Events (occasional or frequent)			
Nosocomial infections	31.8(0.1)	41.5 (0.1)	2.47 *
Patient falls with injuries	14.7 (0.1)	32.4 (0.1)	4.99 **

*
Note. *P*<.05

**
P<.001