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Using the Nursing Interventions Classification as a Potential Measure of Nurse Workload

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Abstract

Standardized terminologies, such as the Nursing Interventions Classification (NIC) taxonomy, may be used in multiple ways to represent nursing constructs. This study is the first known to explore the NIC as a framework for the development of a nursing workload measure. While the NIC may not represent the complexity of nurses' work, the classification system may represent uniformly the work of nurses in health information systems to yield reliable data for a nursing workload measure.

Keywords

Delphi methods; nurse workload; nursing interventions classification

The association between nurse staffing and patient outcomes has been explored extensively in the nursing literature. A meta-analysis of 96 studies found that an increase of 1 registered nurse (RN) full-time equivalent per patient day was associated with a 9% reduction in the odds of a death in intensive care unit patients, a 16% reduction in the odds of a death in surgical patients, and a 6% reduction in the odds of a death in medical patients.¹ Other researchers have demonstrated the economic value of improved quality of care achieved through higher staffing levels.^{2,3} Adequate nurse staffing is important in terms of both quality of patient care and fiscal responsibility.

Determining adequate nurse staffing may depend ultimately on workload. Generally, workload is a function of the time, complexity, and volume of the interventions that must be performed in a given period.⁴ Carayon and Alvarado⁵ propose several dimensions of nursing workload including physical, cognitive, time pressure, emotional, quantitative, qualitative, and variability. *Physical workload* is defined as the manual direct tasks (ie, moving and lifting patients and bathing patients) and physical organization (ie, gathering intravenous pumps and vital signs monitoring equipment) associated with patient care.⁵ Cognitive workload is the intellectual processing of patient information that drives performance and decision making.⁶ Time pressure is the demand exerted by the number of tasks performed under temporal constraints (ie, necessary assessments, measurements, documentation, and therapies performed on a regular and/or frequent basis).⁵ Quantitative and qualitative workload are defined as the amount and difficulty of work, respectively.⁷ Finally, workload variability is the degree to

which workload fluctuates during a period of time.⁷ These dimensions operate in tandem and yield the overall nursing workload for a given set of patients and their nursing requirements.

A challenge that nurse managers face is the ability to collect data on the various dimensions of nurse workload to make informed staffing decisions. With the increased use of health information technology in the hospital setting, measuring nursing workload by using these technologies would be ideal. A fundamental building block of most healthcare information technologies is standardized terminologies.

Standardized terminologies provide a foundation by which domain-specific information and data are transformed for knowledge generation and local aggregated use.⁸ The power of a standardized language compared to various local colloquial terms is that standardization allows for data aggregation and analysis across settings.⁹ A standardized nursing terminology not only provides a common language for nursing care plans but also may facilitate nursing communication and enhance continuity of care.¹⁰

The Nursing Interventions Classification (NIC) is a comprehensive standardized nursing terminology that has been used to systematically classify nursing care in clinical settings.¹¹ The 514 NIC interventions are organized in 7 domains and 30 classes.^{11,12} The NIC terminology is often used in conjunction with the development of electronic health records (EHRs). Other nursing terminology classification systems include the Nursing Outcomes Classification (NOC) and standardized Nursing Diagnoses (NANDA).¹³

Currently, none of the nursing taxonomies mentioned above have been integrated in a health information system that captures entirely the care that nurses provide to patients.¹³ Researchers continue to develop and expand current classification systems, especially for use in EHR. Electronic tools that integrate standardized nursing terminology, such as NIC, enable the representation of nursing concepts (eg, interventions or outcomes) in a consistent manner. These electronic tools may be used to collect nursing specific workload data, including direct patient care, patient and family education, and counseling. These data are useful for nursing research, and nursing administration functions such as quality improvement and operations.⁹

An advantage of the NIC over other terminologies is its link to SNOMED (Systematized Nomenclature of Medicine), which is a more comprehensive controlled vocabulary for biomedical sciences. This link, or mapping, integrates the NIC with other healthcare classifications from different healthcare disciplines and is used in more than 25 countries.¹⁴ The NIC can also be linked to the International Classification for Nursing Practice, which provides a common structure for nursing diagnoses, interventions, and outcomes.

The NIC was developed to determine nursing costs based on standardized interventions.¹⁵ Interventions that make up the NIC were selected by small groups of research teams who identified nursing interventions in their area of expertise and rated the (1) education needed for the implementation of the intervention and (2) average time to provide the intervention.¹² The nursing staff's education level is categorized as either nursing assistant or RN. The time needed to provide an intervention is grouped in 15-minute intervals (ie, 15 minutes or less, 16–30 minutes, 31–45 minutes, 46–60 minutes, or more than 1 hour).¹⁰

While research has shown the usefulness of the NIC to represent nursing care activities, the NIC has not been used to measure nursing workload.^{16,17} However, the need for a measure of volume of nursing care was highlighted through the inclusion of nursing care intensity in the seminal work on the Nursing Minimum Data Set.¹⁸ With the rapid expansion of healthcare information technology in hospitals, nursing intervention taxonomies are increasingly being integrated into electronic systems for purposes such as nursing documentation. Therefore, understanding how these systems may inform measures of nurse workload is timely.¹⁹

Furthermore, reliable and valid measures of nurse workload should help inform nurse managers in making evidence-based staffing decisions.

PURPOSE

As part of a larger study, we explored the potential usefulness of multiple data sources as inputs in a predictive unit-based staffing model to support managerial decision making. The primary purpose of the current exploratory descriptive study was to ascertain the utility of the NIC terminology to classify nursing care interventions of a nursing workload measure. We compared the time to complete nursing interventions on our study unit and the NIC published times and explored which care interventions could be expected to occur routinely.

METHODS

Study design

A Delphi consensus approach that was informed by focus groups and an expert review of the NIC provided the methodological framework for this study. The essence of the Delphi technique is to obtain consensus of the opinions of experts through a series of structured questionnaires. Delphi is an iterative multistage process designed to combine opinion into group agreement.

Setting and informants

Information about time-sensitive nursing care interventions was obtained from RNs who worked on a 42-bed orthopedic surgical unit of a level III urban teaching hospital. Full- or part-time direct patient care RNs who were employed for at least 3 months on the study unit and nurse managers were recruited to participate in this study. In 2006, there were 2,942 patient admissions. The institutional review board of the affiliated university and hospital approved the conduct of this study.

Procedures

The 7 NIC domains (ie, Physiological: Basic, Complex, Behavioral, Safety, Family, Health System, and Community) and 514 interventions were reviewed by the research team to identify potential study unit-specific nursing interventions. A nurse expert panel (ie, 5 study unit RNs) determined that the family and community domains did not contain nursing interventions provided by the nurses on the study unit. After the nurse expert panel confirmed the appropriateness of the 5 remaining domains and 410 interventions, focus groups were performed to gain a clearer understanding of the specific nursing interventions performed on the study unit.

Focus group participation was elicited via interdepartmental email. The purpose of the focus groups was to identify NIC taxonomy interventions that represented the universe of care delivered on the study unit. Two separate focus groups were composed of (1) 8 direct care RNs employed full- or part-time for at least 3 months on the unit and (2) 8 nurse managers or administrators familiar with the unit. Nursing interventions that were identified as those that occur “often” or “very often” were used in the Delphi consensus phase of this study.

Direct patient care nurses and nurse managers were invited to participate in an electronic Delphi consensus phase. Nurses who agreed to participate in this phase were entered into a lottery to win an educational prize worth 25 dollars. A Web-based questionnaire was developed to collect data that could be potentially used to develop a measure of nursing care demands.

During Round I, participants were first asked, “Is the nursing intervention time sensitive?” A time-sensitive nursing intervention was defined as an activity that if not provided within a relatively short period of time (ie, less than an hour) may jeopardize the real or perceived quality of care. Next, the nurse responded to “How often has the intervention been needed on your unit considering all days of this week, and both day and night shifts?” Nurses reported how often the intervention occurred based on a categorical measure (ie, never, rarely = “less than one time per week,” sometimes = “more than one time per week, but less than everyday,” often = “one time everyday,” and very often = “more than one time everyday”). Finally, nurses reported the average time in minutes it would take them to perform the intervention. Consensus was defined as achieving 75% agreement among participants. In Round II, a second survey was distributed to previous participants who were invited to reconsider the frequency and average time to perform time-sensitive nursing care interventions that did not reach 75% consensus in Round I.

All data were reviewed by 2 nurses on the research team. Descriptive statistics including minimum, maximum, mean, and standard deviations for the time to complete each NIC intervention were used. The average time reported by nurses to complete an intervention was compared with the published average times.¹² The unit specific time sensitive interventions were then categorized as “scheduled” or “unscheduled” to better understand the variation in the volume of care associated with nursing workload on the study unit. *Scheduled* was defined as an intervention that a nurse could anticipate and would allot time for the intervention in a given shift. An *unscheduled* intervention was defined as an unpredictable intervention that may or may not occur during a shift. We obtained feedback on our categorization of scheduled versus unscheduled interventions from a panel of experts in the fields of nursing informatics, health services research, and clinical practice. SPSS Version 16.0 was used to analyze the data (SPSS Inc., Chicago, Illinois).

RESULTS

Prior to our focus groups with staff nurses and managers to identify nursing interventions that represent the care delivered on their unit, the panel of nurse experts selected 224 nursing interventions as potentially relevant to care delivered on an orthopedic unit. The results of the focus groups revealed 42 of these interventions relevant to the care of patient on the study unit. Based on the focus group results, 6 interventions were combined to reflect how these interventions are expressed in nursing practice and communication on the study unit. These combined interventions used in the Delphi process were as follows: (1) environmental management was combined with safety and fall prevention, (2) splinting was combined with traction/immobilization care, and (3) nausea management was combined with vomiting management.

A sample of 54 direct patient care nurses and nurse managers were invited to participate in the Delphi consensus phase. Completed questionnaires were received from 45 participants, which represent an 83% response rate. In Round I, agreement was reached on the time-sensitive nature of 36 of 42 nursing interventions. In addition, nurses agreed that more than 50% ($n = 24$) of the interventions were carried out “often” or “very often” during the period of a week. Questionnaires for Round II of the Delphi survey were sent to the 45 participants who responded to Round I. Completed questionnaires were received from 25 participants (56%). The Delphi procedures concluded after the second round because the participants agreed that all 42 interventions were time sensitive.

The time to complete each of the 42 interventions ranged from 8.45 to 38.31 minutes ($M = 19.6$; $SD = 8.10$). However, nurses reported that more than 50% ($n = 22$) and 25% ($n = 12$) of the 42 interventions took more or less time, respectively, on average to complete on their unit

compared to the range of times published by NIC. The other 11 interventions, according to the study unit nurses, could be completed within the NIC published times. Of the 42 nursing interventions in this study, a total of 17 interventions were categorized as unscheduled interventions. These unscheduled interventions included only 1 intervention that could be completed within the NIC published time (ie, self-care assistance). Of the 25 scheduled interventions, two thirds ($n = 10$) were completed within the NIC published times.

Table 1 shows the 31 interventions that nurses reported took more or less time to complete when compared with the NIC published times. These interventions were nearly evenly distributed between scheduled and unscheduled categories. That is, 10 scheduled and 12 unscheduled interventions were estimated by the participants to take less time on average than the times published by NIC researchers, and 5 scheduled and 4 unscheduled interventions were estimated by the participants to take more time on average than the times published by NIC researchers.

DISCUSSION

The NIC terminology captured the full scope of work performed by the orthopedic nurses in this study. However, not all of the interventions were thought to be clearly understandable in their original forms. There was substantial variation in the nurse-reported times to complete each of the interventions compared to the NIC published times. This finding does not suggest that the published times are invalid; instead, the times reported in this study may reflect the highly specialized nature of nursing care on the orthopedic study unit. Nurses in this study reported shorter times to complete a majority of the interventions compared with times published in the 4th edition of the *Nursing Interventions Classification*. In other words, the nurses on the study unit may require less time to complete the majority of care because they provide similar care to most of the patients, especially when the intervention is scheduled or can be anticipated. Nevertheless, the NIC terminology provides the foundations that can be used to capture a valid measure of nursing workload.

The large proportion of nursing interventions that were identified as unscheduled has the potential to influence greatly the workload on the study unit. Indeed, in our study only 1 unscheduled intervention fell within the NIC published times, which may be reflective of the increased variability of time needed to complete these types of nursing interventions. Other researchers have documented that nursing care interruptions related to unscheduled patient care activities account for between 4% and 75% of the increases in nursing workload.²⁰

While we attempted to capture various dimensions of nursing workload, the nursing interventions we identified in this study do not necessarily encompass nursing work in its entirety. Clearly, professional nursing is not solely a list of manual tasks. Cognitive tasks, such as critical thinking, may occupy a substantial part of the time and complexity associated with overall workload. In addition, individual and unit experience as well as other contextual factors should be taken into account when considering how best to measure nursing workload.

The variation in unscheduled nursing interventions found in this study has implications for operations research. Since it is unlikely that all orthopedic nursing units, for that matter nursing units in general, will experience equal proportions of unexpected nursing care demands, it is necessary to develop unit specific models to measure workload and inform staffing. This study also reinforces the need for the nursing discipline to use a standardized nursing terminology, such as the NIC, to represent uniformly the work of nurses in health information systems. This is not only the first step in developing a nurse workload measure but also important for investigating the contribution of nursing care to patient outcomes.

As with any study, there are limitations. The findings of this study pertain only to the nursing care of the study unit and cannot be generalized to other orthopedic and/or nursing units. Ideally, direct observations would be a more reliable way to identify scheduled and unscheduled nursing interventions, measure the time it takes for nurses to complete nursing interventions, and confirm if, in fact, all 42 nursing interventions are the universe of interventions on the study unit. However, this is very labor intensive. Additionally, our goal in the larger study was to find electronic time stamped data to capture nursing workload. Therefore, it was logical to start with a nursing taxonomy that is used in many EHRs. Unfortunately, despite the use of EHRs and other electronic data sources on our study unit, we were ultimately unable to collect usable time-stamped electronic data associated with the 42 NIC interventions to develop a unit-specific measure of nursing workload. Unfortunately, the data in the EHR, were not easily retrievable and they were time stamped based on when charted, not completed.

While the nursing profession has struggled to agree on a standardized nursing intervention terminology for use in EHRs, only 1.5% of US hospitals have a comprehensive electronic-records system.²¹ The technology is available to collect electronic data on nurses' time caring for patients (ie, time stamped activity) as well as nursing information systems programs that capture the actual work of the nurses. These data are necessary as inputs for a staffing prediction model that takes into account nursing workload. The use of a standardized nursing intervention terminology, such as NIC, is important to create a valid measure of nursing workload.

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Table 1Nurse reported average times to complete selected nursing interventions and NIC published ranges^a

	Unit Specific Mean (SD)	Range	Published NIC range
Interventions taking less time on study unit than times published in NIC			
Scheduled interventions ^b			
0740 Bed rest care	11.96 (6.42)	3–30	16–30
4030 Blood products administration	31.08 (16.99)	5–60	>60
0140 Body mechanics promotion	15.08 (6.81)	5–30	16–30
7370 Discharge planning	31.70 (22.27)	4–60	46–60
4210 Invasive hemodynamic monitoring	22.71 (19.70)	5–120	46–60
6540 Infection control	14.42 (8.52)	1.5–30	31–45
2620 Neurologic monitoring	11.00 (7.89)	1–30	16–30
2690 Seizure precautions	14.62 (8.05)	2–30	16–30
2690 Surgical preparation	29.35 (17.19)	7.5–75	46–60
3660 Wound care	22.65 (15.54)	4–60	31–45
Unscheduled interventions ^c			
4020 Bleeding reduction	17.47 (15.83)	1.5–60	46–60
0450 Constipation management	15.90 (11.70)	5–45	16–30
7910 Consultation	24.96 (19.43)	4–62	46–60
5240 Counseling/family support ^d	22.04 (13.08)	5–45	46–60
6460 Dementia/chronic confusional state management ^d	35.50 (32.43)	1.5–120	>60
4110 Embolus precautions	13.47 (7.73)	2–30	16–30
6486/6490 Environmental management: safety and/or fall prevention	16.74 (11.86)	1–45	31–45
7680 Examination assistance	14.85 (10.87)	2–45	16–30
1450/1570 Nausea and/or vomiting management	14.25 (9.14)	2–45	16–30
1400 Pain management	13.39 (10.64)	2–45	>60
3590 Skin assessment/surveillance ^d	11.89 (6.97)	2–30	16–30
5606 Teaching: Individual	21.91 (15.33)	4–60	31–45
Interventions taking more time on study unit than times published by NIC			
Scheduled interventions			
7310 Direct admission care	38.31 (18.28)	5–75	16–30
2080 Fluid/electrolyte management	19.66 (15.42)	1.5–60	≤15
0910/0940 immobilization/splinting	15.67 (14.38)	2.5–60	≤15
2300 Medication administration	27.11 (27.98)	2–120	≤15
0960 Transport	27.97 (20.40)	4–75	≤15
Unscheduled interventions			
6200 Emergency care	40.52 (31.75)	2–120	16–30
7960 Healthcare information exchange	22.34 (16.46)	3–60	≤15
1806 Self-care assistance: transferring	18.98 (10.75)	3.5–45	≤15
0580 Urinary catheterization	17.61 (7.48)	3.5–30	≤15

Abbreviation: NIC, Nursing Interventions Classification.

^a All values are in minutes. The 11 interventions missing were not included in this table because nurse-reported average completion times fell within the NIC range.

^b Scheduled interventions are those that could be anticipated in a given shift.

^c Unscheduled interventions are unpredictable that may or may not occur during a shift.

^d Interventions were combined to reflect how these interventions are expressed in nursing practice and during communication.