

Leveraging Technology for Research

Frances VLASSES^a, Mary MALLIARIS^b, Ida ANDROWICH^c, Barbara CASPERS^d,
and Mary DOMINIAK^e

^a*Loyola University Chicago Niehoff School of Nursing, Chicago, IL, U.S.A.*

^b*Loyola University Chicago School of Business Administration, Chicago, IL, U.S.A.*

^c*Loyola University Chicago Niehoff School of Nursing, Chicago, IL, U.S.A.*

^d*Catholic Health Initiatives, Denver, CO, U.S.A.*

^e*Loyola University Chicago Niehoff School of Nursing, Chicago, IL U.S.A.*

Abstract: One of the most exciting promises of technology lies in the potential to support research on complex questions through the capture, maintenance and analysis of large data sets. This is especially true in cases where research involves multiple contextual variables such as organizational research. The possibilities for increasing our scope and reaching to global proportions when designing research projects is within reach. This paper reports the results of research conducted within the United States and yields useful lessons for application in other settings and countries.

Keywords: technology, research, collaboration

I. Introduction:

Despite efforts to improve the quality of care in hospitals, there are still barriers to decreasing the numbers of adverse events [1]. Nursing leadership strives to help meet the challenge by assisting in designing and implementing safe and effective systems of care [2]. Unfortunately, this comes at a time when the nursing shortage projections continue to rise and the tenure of nurse managers is decreasing, which could negatively impact quality and safety initiatives [3]. Further, while nurses are attracted to positions in healthy work environments [4], little evidence exists to inform managers about how to create these environments.

Consequently, research is needed to examine factors that affect the nurse manager and nurse retention, as well as the impact of these variables on patient care outcomes. Although the importance of the nurse manager to nurse retention is well documented [4] the impact of the nurse manager on quality patient care outcomes is inadequately conceptualized and researched. "Future research should include work environment variables to better understand their influence on patient and nurse outcomes." [5. p. 4, 5].

In Vance & Larson's [6] analysis of research studies conducted between 1970 and 1999, only two included information on the relationship between leadership and patients. Their findings indicate that an understanding of the nurse manager's impact on patient outcomes represents a more complex relationship than previously considered and calls for a conceptualization of leadership as "a pluralistic, interactive phenomenon" (2, p. 169). In a subsequent literature review, Wong & Cummings identified only seven additional studies. These studies involved different settings and contained a level of variability in design and measurement that precluded a meta-analysis [2]. Only four of the seven studies were multi-center studies. Their findings suggest a positive relationship between nursing leadership and patient outcomes

possibly mediated by nurse performance and/or work environment. Wong and Cummings [2] call for additional research on management practices, style, behaviors and competencies. Further recommendations include the use of longitudinal multi-center studies utilizing more sophisticated statistical techniques and strong theoretical frameworks. They concurred that the relationship between leadership and patient outcomes would not be “modeled in a simple set of bivariate relationships” (7, p. 510) and recommended research that explores moderating factors such as work environment and /or staff performance [7].

Evidence suggests that the association between the nurse manager and patient outcomes exists as a non-linear, complex relationship, possibly impacted by organizational patterns and trends. The conceptualization of these relationships supports the use of the theory of Complex Adaptive Systems (CAS) as the conceptual framework for this study. According to Anderson and McDaniel [8], healthcare managers traditionally have been trained in the mental model of ‘healthcare functioning as a machine’ and focusing on the linear relationship between people and job assignments. However, evidence suggests that the current healthcare dynamics are non-linear, a CAS concept. Anderson and McDaniel further describe a characteristic of CAS as including connections and patterns of relationships among people that vary based on the experience of the people involved, not a linear relationship. In CAS, it is theorized that leadership practices must focus on relationship building, less managerial control and work group self-organization, hallmarks of a professional practice environment. Based on the conceptual framework and the literature, the design for the proposed study includes approaches that can support multiple sets of variables to reveal previously undetermined patterns and trends. Thus, multivariate techniques and data mining methods, which can support the discovery of underlying relationships and structures based on large data sets [9], will be used.

II. Objectives

1. Describe technology solutions for multi-center research partnerships
2. Explore, using existing datasets, results to date on the relationship between the nurse professional practice environment (NPE), nurse manager preparation and selected nurse-sensitive patient outcomes.

III. Methods and Measures

Phase I of this project aimed to discover relationships between nurse manager academic preparation and the staff nurses perception of the professional practice environment. This project is an existing, multi-center collaborative study with Catholic Health Initiatives (CHI). Over 1,440 staff nurses and CNO’s from twenty-eight hospitals have participated in this study. This project was conducted almost entirely without face to face meetings. This includes time spent building “electronic” relationships with Chief Nurse Executives and National Office staff in order to develop an infrastructure for the research interaction with a large 72 hospital system. Webinars were used for education on the research process; recruitment of sites and a process improvement meeting at the study midpoint. E-mail and telephone supported the communication. A web-based survey tool was used for gathering data from study participants. Technology provided the avenue for the successful completion of this

study. Moreover, through the use of technology we were able to develop a community of practice with mutual interest in research and benchmarking.

In order to recruit sites for the study, three Webinars lead by the researcher were conducted for Chief Nurse Executives. The researchers distributed detailed study procedures to each site to insure consistency. Unique online links for the staff nurse survey were established for each of the study sites using Survey Monkey™ and emailed to site coordinators. The CNO survey was emailed to the chief nurse leader at each participating site to be returned by mail to the researcher. This information is being hand entered into corresponding Survey Monkey™ links.

Sample: Currently 1,446 registered nurse staff nurses and chief nurse executives from 20 CHI community acute care settings from across the U.S. have completed the study instruments. Study sites maintain between 14 and 367 licensed beds with 73% of the sites being less than 110 licensed beds.

Measures/Instruments: Instruments used for the initial study measured the professional practice environment, nurse manager educational preparation, demographic data of the organization, staff nurse, and CNE and are explained below.

- 1) *Professional Practice Environment (PPE) Scale* [10]. This scale consists of 38 items ranked using a 4-point Likert scale. The scale includes 8 sub-scales that measure Magnet characteristics such as autonomy, control over practice and interpersonal communication along with communication about patients, teamwork, handling disagreement and conflict, internal work motivation, and cultural sensitivity. Psychometric evaluation demonstrates internal consistency reliability with Cronbach's alpha co-efficients for the scale and sub-scales ranging from .78 to .93, and construct validity through factor analysis revealed 8 sub-scales [10] and specific adverse events were used to gather the data for this study and are explained below.
- 2) *Demographic Tools.* There are 2 demographic tools each developed by the researcher. a). Staff Nurse: Collects information about the age, gender, education level, tenure as a nurse and at the organization, type of unit she/he is currently employed, knowledge of nurse manager demographics, and organization information; b). Chief Nurse Executive: Collects information about the age, gender, education level, tenure as a nurse and as CNE, tenure at the organization, educational preparation of the first line managers and organization information regarding average daily census and annual turnover rates.

Phase I data is analyzed to describe the relationship between managers and staff nurse outcomes. *Phase II* leverages this data through technology to provide a platform for exploration of the nature of the relationship between the nurse manager and patient outcomes.

Having established a database from phase I, future plans include a secondary analysis of data from *Phase One* combined with patient outcome data from existing CHI databases. Adverse event data have been used successfully by several researchers as a legitimate indicator of quality [11]. Patient outcome variables (de-identified) for the time period coinciding with the data collection period from *Phase I* (January 08-January 2009) would be drawn. Three endorsed standards from the National Quality Forum (NQF) are suggested: Pressure ulcer prevalence; falls prevalence; and falls with injury. These outcomes were chosen because they are amenable to nursing intervention

and represent 3 hospital acquired conditions that are Medicare exceptions for reimbursement. All data from this phase is then entered into an Excel database and will be de-identified for the secondary analysis.

Procedures for Phase II will follow guidelines established by the Cross-Industry Standard Process for Data Mining Model (CRISP-DM) [12] which include:

- a. *Data understanding (CRISP-DM)* - In this phase determination of data source variables and feasibility analysis will take place. The data source for the proposed study includes nurse sensitive indicators of care. An initial meeting with key nurse stakeholders and database managers from CHI will be held to orient the researcher to CHI databases and data elements available for capturing nurse sensitive patient outcomes. The nurse sensitive outcomes proposed for this study are prevalence of falls, falls with injury, and pressure ulcer prevalence. Additional information describing patient characteristics e.g. LOS will be used based on input from data base managers, consultants and available data elements.
- b. *Data preparation (CRISP-DM)* - Data from all data sources (both initial study data and proposed study data) will be combined and imported into a new database. The aim of data preparation is to position the data set for optimum exposure to further statistical techniques and data mining [9]. This phase can include data identification, extraction; and transformation.

At completion of this phase the proposed study data warehouse will be complete, including de-identified results of the PPE, staff nurse, CNO and organization demographics, and patient outcomes data defined as NQF endorsed standards for nurse sensitive care: pressure ulcer prevalence, falls prevalence, falls with injury and restraint use.

Plan for Data Analysis: The application of data mining methods to this database will bring additional strength to our understanding of the complexity surrounding nurse managers, staff and patient outcomes and “allows for the discovery of relationships and patterns that might otherwise be missed” (9, p. 125). The data mining software application, Clementine, will be used to determine if there are underlying structures in the data set and analyzed for significance and trends. Cluster analysis will allow us to identify grouping of behavioral traits that might inform recruitment, retention and manager development.

IV. Results

This project demonstrates how technology can be used for the successful development of an academic/service partnership. Specific implementation strategies will be discussed in detail. Study findings demonstrate positive trends on clinical practice, relationship/communication, leadership/teamwork, conflict management, internal work motivation, cultural sensitivity and patient care model subscales. These trends seem to be impacted by academic preparation and experience of the respondents. It is expected that the staff nurse's positive evaluation of the professional practice environment will correlate with manager characteristics and academic preparation.

V. Discussion and Conclusions

This project would not have been possible without technology. Utilizing technology solutions in partnership development; data collection; analysis and presentation allows

researchers to design large scale studies which can potentially cross national boundaries to address highly variable complex organizational problems. Findings from this study will generate empirical evidence to enhance understanding of the complex relationship between nurse manager practice, staff and patient outcomes. They will also be used to direct interventions for the professional development of nurse leaders. In addition, examination of proposed statistical methods will contribute to understanding the application of data mining techniques in outcome research.

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Email address for correspondence: fvlasse@luc.edu