HOSPITAL NURSE MANAGERS’ PERCEIVED USE OF DASHBOARDS FOR QUALITY AND PERFORMANCE IMPROVEMENT

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HOSPITAL NURSE MANAGERS’ PERCEIVED USE OF DASHBOARDS FOR QUALITY AND PERFORMANCE IMPROVEMENT

Lisa Young

ABSTRACT

Quality and patient safety are ongoing concerns affecting hospital patient outcomes. Dashboards are one tool often used for monitoring and benchmarking performance so healthcare leaders and clinicians can identify areas for improvement. While dashboards are widely used in hospitals, little is known about dashboard use by hospital nurse managers. This descriptive qualitative study aimed to characterize hospital nurse managers’ perceived use of dashboards and the factors influencing dashboard use for unit quality and performance improvement focused on improving patient outcomes.

Eleven hospital nurse managers (9 females and 2 males with managerial experience ranging from less than 1 year to over 15 years) were interviewed from one health system consisting of 11 hospitals serving a metropolitan city and surrounding areas of the Midwestern United States. Thematic analysis was used to identify two major themes: Manager as Quality Improvement (QI) Leader and Influencers of Dashboard Use. Managers used dashboards to support and increase the visibility of unit performance. Perceived factors influencing dashboard use included external, personal, data, and technology features. Findings from this study suggest dashboards should be simple, easy-to-use, useful, accurate, and timely so hospital nurse managers can effectively communicate, engage, and support staff in unit quality and performance improvement initiatives. Future research should focus on developing and testing designs that address the needs and influencing factors of dashboard use so hospital nurse managers can continue to effectively impact patient outcomes.
CHAPTER 1: INTRODUCTION

Hospital-acquired conditions (HACs), which are infections, conditions, or other harm experienced by patients during a hospital stay, are costly and largely preventable (Hamadi et al., 2021). HACs cost more than $2 billion annually, increase mortality risk by 72%, and increase a patient’s length of stay by eight days (IBM Watson Health, 2018). Hospital nurse managers can impact these patient outcomes as they are uniquely positioned to influence direct patient care. Nurse managers are responsible for implementing and supervising their unit’s quality and performance improvement initiatives (Dainty & Sinclair, 2017; Kaky & Xiao, 2017; Sjølie et al., 2020); however, nurse managers need data for decision-making to optimize patient care and improve outcomes (Ruppel et al., 2022).

Nurse Managers' Role in Quality Improvement

Quality improvement (QI), a methodology using systematic structures and processes that reduce variations and produce predictable results, is used by organizations to improve the delivery of patient care (Centers for Medicare and Medicaid Services, 2021; Schroeder et al., 2019). QI relies on data for measurement (Glassman, 2017; Jones, 2016), and nurses use data to monitor their performance and identify areas for improvement (Bleich et al., 2018; Burston et al., 2014; Easter & Tamburri, 2018; Kampstra et al., 2018; Lockhart, 2018; Shinners et al., 2017). Nurses directly care for patients and often participate in implementing QI activities (Jones, 2016; O’Donoghue et al., 2021), and thus, play a pivotal role in influencing HACs and hospital-related patient outcomes.

Hospital nurse managers, defined in this paper as managers who oversee at least one direct patient care department and report to a hospital leader in a more senior position, use data to influence patient outcomes. Their role includes QI, and they are accountable for
implementing changes at the front line while also reporting departmental performance to the executive level (Dainty & Sinclair, 2017). Nurse managers are also responsible for engaging and involving front-line staff in QI by providing the support, time, and resources for teams to accurately identify problems and prioritize initiatives (L. Jeffs et al., 2016; O’Donoghue et al., 2021; Tschannen et al., 2021). Therefore, nurse managers can play a pivotal role in influencing QI work impacting patient outcomes by leveraging their oversight and responsibilities at the unit level.

Dashboards

Dashboards visually display key performance indicators on a single report by combining data from multiple databases (Wilbanks & Langford, 2014) and are one tool that hospitals use to track and monitor data to reduce harm and improve patient outcomes (Randell et al., 2020). There are two types of dashboards reported in the literature: 1) quality dashboards, which display aggregate patient data (e.g. infection or fall rates) intended for leaders in operational decision-making, and 2) clinical dashboards, which display individual patient-level details (e.g. outstanding care tasks) intended for clinicians in direct patient care (Dowding et al., 2015). Quality dashboards, which are the focus of this dissertation, are used for making decisions, benchmarking and monitoring performance, identifying patterns or problems, providing feedback on processes or initiatives, and communicating information (Bucalon et al., 2022; Buttigieg et al., 2017; Dowding et al., 2015; Iftikhar et al., 2019; L. Jeffs, Beswick, et al., 2014; Khairat et al., 2018; Pace & Buttigieg, 2017; Wilbanks & Langford, 2014).

Dashboards use data visualizations, which focus on pictorial or graphical representations of information to aid cognitive processing so users can draw insights and
make decisions (Caban & Gotz, 2015; Dowding & Merrill, 2018; Engelbrecht et al., 2015; Franklin et al., 2017; Khairat et al., 2018). Examples of dashboard data visualizations in healthcare include graphs (e.g. bar, line, pie), numerical values and tables, color-coding, gauges, bullseyes, and icons (Dowding et al., 2019; Fischer et al., 2020; Fletcher et al., 2018; Franklin et al., 2017; Khasnabish et al., 2020; Le et al., 2013; Reeder et al., 2020; Romero-Brufau et al., 2018; Schall et al., 2017; Tiase et al., 2021; Wu et al., 2019). Dashboard visualizations should match user needs and be presented in easy-to-understand display formats so data can be engaging and actionable (Noël et al., 2017).

**Problem Statement**

While dashboards are widely used within hospitals, little research exists on hospital nurse managers’ use of dashboards for quality and performance improvement to influence patient outcomes (Young & Vogelsmeier, In Press). One published research study focused on nurses' perspectives on implementing unit-specific quality dashboards reported nurses using dashboards for tracking, identifying problems, and understanding the impact of nursing care on unit outcomes (L. Jeffs, Beswick, et al., 2014). While this study explored nurses' and nurse managers' perspectives, the authors did not focus on the nurse managers' role in using dashboards to influence QI at the unit level. Other published nursing articles have described organizational experiences of implementing and using dashboards but are not research studies (Frazier & Williams, 2012; Frith et al., 2010; Mazzella-Ebstein & Saddul, 2004; Piech et al., 2021; Ruppel et al., 2023).

Furthermore, little is known about what factors influence hospital nurse managers’ use of quality dashboards. The same researchers from the 2014 above-mentioned study performed a qualitative study to identify enablers and barriers to unit nursing dashboards.
Their findings included a supportive learning environment and finding time among care priorities as factors influencing use (L. Jeffs, Lo, et al., 2014). In the broader healthcare literature, some suggested factors, such as organizational, technology, and user, may explain dashboard use (Mashinchi et al., 2021). For example, organizational goals shape the fit and needs of a dashboard (Frazier & Williams, 2012; Ruppel et al., 2022), and dashboards need to integrate into organizational workflows and adapt to ever-changing stakeholder needs (Weggelaar-Jansen et al., 2018). Dashboard development and evaluation studies assess for usability (i.e. ease of use) and usefulness (Alvarado et al., 2021; Dowding et al., 2019; Fischer et al., 2020; Franklin et al., 2017; Khasnabish et al., 2020; Le et al., 2013; Reeder et al., 2020; Schall et al., 2017; Tan et al., 2013), which may suggest technical designs and functionalities (e.g. filter, drill-down, hyperlinks to additional information, alert functions) play a role in dashboard use. Individuals also have varying levels of graph and numeral literacy, as well as differing cognitive abilities and analytical skills (Dowding et al., 2018; Lopez et al., 2016; Noël et al., 2017; Weggelaar-Jansen et al., 2018), which may influence their understanding, perceptions, and use of dashboard technologies.

**Study Purpose and Significance**

The purpose of this study is to describe hospital nurse managers’ perceived use of quality dashboards and characterize the factors influencing perceived dashboard use for quality and performance improvement. The goal is to understand how and why dashboards are used (or not used) as a tool for unit quality and performance improvement, which affects patient outcomes. Knowledge gained from this study can guide the development of quality dashboards, as well as identify enablers or barriers associated with the integration of quality dashboards into nurse managers’ QI workflows. This study will contribute to the nursing
literature on dashboard use in hospital settings and identify priorities for optimizing unit-based quality dashboards in nursing.

**Specific Aims**

Aim 1: Describe hospital nurse managers’ perceived use of quality dashboards designed for unit-level performance.

   Research Question 1: How do hospital nurse managers perceive their use of quality dashboards?

Aim 2: Identify and describe factors influencing hospital nurse managers’ perceived use of quality dashboards designed for unit-level performance.

   Research Question 2: What do hospital nurse managers perceive as factors influencing quality dashboard use?

   Research Question 3: How do those factors influence hospital nurse managers’ perceived quality dashboard use?

**Theoretical Framework**

The Technology Acceptance Model (TAM), as shown in Figure 1 below, illustrates how users adopt and use a technology. The TAM has been studied in health information systems, e-prescribing, and telehealth research (Hsu & Wu, 2017; Rahimi et al., 2018), as well as in dashboard development and evaluation (Fischer et al., 2020; Khasnabish et al., 2020; Lee et al., 2017).
In the TAM, *Perceived Ease of Use* and *Perceived Usefulness* influence an individual’s attitudes and behavioral intentions to use a technology (Pai & Huang, 2011; Rahimi et al., 2018). *Perceived Ease of Use* is how straightforward a system is to use or understand; *Perceived Usefulness* is the extent a system can enhance job performance and is associated with satisfaction (Holden & Karsh, 2010). *External Variables* precede and influence *Perceived Usefulness*, *Perceived Ease of Use*, and one’s *Intention to Use* the technology (Holden & Karsh, 2010; Ketikidis et al., 2012; Rahimi et al., 2018).

This study will use a modified version of the TAM intended to explain dashboard adoption in healthcare settings (Mashinchi et al., 2021). As part of a larger work focused on how analytics dashboards can support decision-making for clinicians and patients in prostate cancer treatment and care, Mashinchi et al. (2021) clarified *External Variables* and their influence on *Perceived Usefulness* and *Perceived Ease of Use*. They identified ten higher-level factors in a user’s decision to adopt and use a dashboard: external environment, organizational characteristics, health professional manager support, trust, user, user beliefs, user emotions, technology, sociotechnical fit, and cognitive fit. Because the user population was clinicians and patients, these factors will serve as a guiding framework for this study. The focus will be on the organizational, user, and technology factors to identify and describe...
what influences nurse managers’ perceived use of quality dashboards. These three factors are described in Table 1 below.

Table 1

*Influencing Factors* (Mashinchi et al., 2021)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational</td>
<td>This factor includes organizational characteristics in the decision to adopt new technology, including its implementation and use. Examples include the hospital’s norms, expectations, or culture, the need for the dashboard, and compatibility of information technology infrastructure, and resource commitment.</td>
</tr>
<tr>
<td>User</td>
<td>This factor refers to the users' capabilities and characteristics that affect their perception and beliefs of the dashboard. Examples include literacy (graph, numeral, visual), previous knowledge and experience, enthusiasm and confidence, and education level.</td>
</tr>
<tr>
<td>Technology</td>
<td>This factor refers to the dashboard, such as the visual interface or design, interactivity with the data to answer questions, real-time access to data, quality of information, and support available for users.</td>
</tr>
</tbody>
</table>
References


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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7153077/


CHAPTER 2: SYSTEMATIC REVIEW

QUALITY DASHBOARDS IN HOSPITAL SETTINGS: A SYSTEMATIC REVIEW WITH IMPLICATIONS FOR NURSES


ABSTRACT

**BACKGROUND:** Dashboards visually display quality and patient safety data to aid nurses in making informed decisions.

**PURPOSE:** This systematic review evaluated quality improvement dashboard characteristics associated with 1) interventions to improve patient outcomes and 2) positive end-user evaluation (response).

**METHODS:** Literature was searched from 2012 to 2022 in PubMed, CINAHL, Scopus, Medline, and Google Scholar.

**RESULTS:** Sixteen articles were included. Varied dashboard characteristics were noted with mixed patient outcomes and end-user responses. Graphs and tabular presentations were associated with improved patient outcomes whereas graphs were associated with end-user satisfaction. Benchmarks were noted with improved patient outcomes but not end-user satisfaction. Interactive dashboards were important for end-users and improved patient outcomes.

**CONCLUSION:** Nurses can find dashboards helpful in guiding patient outcome projects. Dashboards may include graphs and/or tables, benchmarks, and interactivity but should be useful, usable, and aligned to unit needs. Future research should focus on the use of quality dashboards in nursing practice.
**Keywords**: visual data displays; quality improvement; performance improvement; patient outcomes; evaluation
INTRODUCTION

Hospital-related preventable harm such as falls, infections, and adverse events increase mortality risk by 72% and can increase a patient’s length of stay by eight days (IBM Watson Health, 2018). To improve quality and safety, healthcare organizations use dashboards to facilitate efforts toward improving patient outcomes (Dowding et al., 2015).

Dashboards display key performance indicators often on a single report by leveraging large amounts of data from multiple databases (Wilbanks & Langford, 2014). These dashboards serve as tools to provide a concise overview of data-driven information useful to facilitate actionable decisions toward influencing patient outcomes (Khairat et al., 2018; Wilbanks & Langford, 2014). To support the cognitive processing of data so information can be easily understood and evaluated, dashboards use data visualization focused on graphics or pictures to represent and communicate data (Franklin et al., 2017; Khairat et al., 2018).

Dashboards are used in quality improvement (QI) for tracking performance toward achieving a desired outcome, identifying problems that might impede goal achievement, and improving the visibility and communication of information to motivate goal achievement among the team (Bucalon et al., 2022; Dowding et al., 2015; Khairat et al., 2018; Wilbanks & Langford, 2014). Effective dashboards should be designed to enable end-users to select relevant performance indicators, identify causes of outliers, communicate performance with key stakeholders, and assess their performance using trends or benchmarks (Randell et al., 2020). Dashboards should also display relevant, timely, and accurate data in designs that are comprehensible to users (Dowding et al., 2015; Weggelaar-Jansen et al., 2018). Examples of performance indicators include patient falls, pressure injuries, infection rates, and lengths of stay; indicators that are often aggregated at the patient care unit level.
Nurses play a pivotal role to improve the quality of patient care at the bedside. Comprising the nation’s largest healthcare profession (American Association of Colleges of Nursing, 2022), nurses at all levels directly influence patient outcomes through participation in QI activities (O’Donoghue et al., 2021; Tschannen et al., 2021). To influence care delivery, nurses need actionable data (Easter & Tamburri, 2018; Glassman, 2017) such as those displayed on dashboards so they can see their impact, track performance, and identify opportunities for improvement (L. Jeffs, Beswick, et al., 2014). Evidence about dashboards used in QI activities has been published (Frazier & Williams, 2012; Frith et al., 2010; L. P. Jeffs et al., 2013; Ruppel et al., 2023); however, there is little guidance on dashboard characteristics associated with positive quality and performance improvement activities.

Therefore, the purpose of this review was to evaluate dashboard characteristics associated with quality and performance improvement activities designed to influence patient outcomes in hospital settings. The research questions were: 1) What dashboard characteristics were associated with interventions resulting in improved patient outcomes? and 2) What dashboard characteristics were associated with positive end-user evaluation (response)?

METHODS

A literature search was performed for studies published between 2012 through 2022 in PubMed, CINAHL (EBSCO), Scopus, and Medline (Ovid). The search time frame was limited to the last ten years due to the evolving nature of dashboards and technology over time. Additional articles were identified using Google Scholar and citations in relevant literature reviews. Search terms included “quality”, “clinical”, “patient outcome”, “visualization”, “dashboard”, “data displays”, “hospital” and “department”. Inclusion
criteria were peer-reviewed English journal articles focused on quantitative evaluation of hospital-based quality dashboards, including their influence on patient outcomes (e.g., falls, infection rates, mortality, and readmissions). Exclusion criteria were non-English articles, editorials, books or book reviews, presentation or poster abstracts, commentaries, study protocols, and literature reviews. Dashboards designed for 1) the direct care of individual patients (e.g., view new orders or lab results, administer medication), 2) individual clinician performance (e.g., provider prescribing rates, nurse medication scanning rates), 3) patients or families to monitor their health information, and 4) financial, operational, or productivity purposes were excluded.

Search results were saved to a citation program manager. Duplicates were removed, and articles were exported to a web-based tool for systematic reviews. The first author (LY) reviewed each article’s title and abstract for eligibility during the initial screening and evaluated full-text articles for final inclusion during the second screening. Data extraction was initially completed by the first author (LY) and reviewed by the second author (AV). Articles were summarized into a literature matrix for first author, publication year, country; context/setting of use; design; end-user type; dashboard visual design; benchmark; interactivity; outcome category; and reported outcome/evaluation. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) workflow diagram (Moher et al., 2015) was used to guide and record the steps.

The Center for Evidence-Based Management (CEBMa) critical appraisal tools, which evaluate best practices in management and leadership (Center for Evidence-Based Management, 2019), guided the quality assessment. The Critically Appraised Topic (CAT) Manager app, which assesses study trustworthiness, was first used followed by manual
checklists. Positive responses were scored to indicate the criterion was present. The first author (LY) independently appraised each study using tools appropriate to the study design (e.g. cross-sectional study (quantitative), qualitative study, and case study). The assessment was then independently validated by the second author (AV). Discrepancies in the appraisal assessment were resolved through discussion between the two reviewers.

RESULTS

After systematically evaluating articles retrieved from the search, 16 met criteria and were included in the final review. The PRISMA diagram shown in Figure 1 provides a detailed flow of the article selection, screening, and inclusion process.

Study Characteristics

The literature matrix, shown in Supplemental Digital Content Table 1, includes the data elements summarized for each study. Seven studies were case reports where authors shared their organization(s)' experiences (Banerjee et al., 2017; Birdas et al., 2019; Chemparathy et al., 2021; Connolly et al., 2021; Hester et al., 2019; McLaughlin et al., 2014; Staib et al., 2017). One was a collective case study (Logan et al., 2022), two used descriptive surveys to evaluate dashboards (Daley et al., 2013; Fischer et al., 2020), and one was an interrupted time series to evaluate patient outcomes (Weiss et al., 2018). Five used mixed methods for dashboard evaluation that included interviews, observations, and surveys/questionnaires (Laurent et al., 2021; van Deen et al., 2019; Williams et al., 2021; Wu et al., 2019); with one applying a realist evaluation framework (Alvarado et al., 2021).

Quality Assessment

Assessments of study quality are shown in Supplemental Digital Content Table 2. Study designs were assessed as not appropriate for measuring an effect, impact, or causal
relation except one (Weiss et al., 2018), which used an interrupted time series design. Using the manual checklist, 11 studies met at least 80% of the quality appraisal criteria. None of the seven case reports met transferability to other settings, four (Banerjee et al., 2017; Chemparathy et al., 2021; Connolly et al., 2021; Hester et al., 2019) met all other criteria, and three (Birdas et al., 2019; McLaughlin et al., 2014; Staib et al., 2017) did not meet criteria in data collection and analysis. Five mixed methods studies (Alvarado et al., 2021; Laurent et al., 2021; van Deen et al., 2019; Williams et al., 2021; Wu et al., 2019) met all qualitative appraisal criteria but not for sampling, statistical analyses, and effect size. These three criteria were also lacking in 3 quantitative studies (Daley et al., 2013; Fischer et al., 2020; Logan et al., 2022). The interrupted time series study (Weiss et al., 2018) met all quantitative appraisal criteria.

**Context and Setting of Use**

Nearly one-third of the articles described quality dashboard use among multiple hospitals (Alvarado et al., 2021; Fischer et al., 2020; Logan et al., 2022, 2022; Weiss et al., 2018) while the remaining described single hospital experiences. Patient care areas included maternity (Weiss et al., 2018), pediatrics (Alvarado et al., 2021, 2021; Chemparathy et al., 2021; Hester et al., 2019), neonatology (Logan et al., 2022), critical care (Williams et al., 2021), emergency (Staib et al., 2017; van Deen et al., 2019), psychiatry (Daley et al., 2013), dialysis (Fischer et al., 2020), cardiology (Banerjee et al., 2017), surgery (Birdas et al., 2019; McLaughlin et al., 2014; Wu et al., 2019), and anesthesiology (Laurent et al., 2021). One dashboard was designed for health equity (Connolly et al., 2021). Eleven studies were in the United States; the remaining were from the United Kingdom (Alvarado et al., 2021; Daley et
al., 2013), Canada (Weiss et al., 2018), France (Laurent et al., 2021), and Australia (Staib et al., 2017).

**Dashboard Uses and Characteristics**

Quality dashboard use in hospitals included data sharing and communication (Alvarado et al., 2021; Daley et al., 2013), evidence-based decision-making, analysis of information, monitoring performance, and driving change (Fischer et al., 2020). Ten studies described quality dashboards for general outcomes monitoring (Alvarado et al., 2021; Birdas et al., 2019; Connolly et al., 2021; Daley et al., 2013; Fischer et al., 2020; Laurent et al., 2021; Logan et al., 2022; McLaughlin et al., 2014; Williams et al., 2021; Wu et al., 2019); for example, the addition of equity measures to identify disparities in care (Connolly et al., 2021). Other studies focused on a specific improvement initiative. Examples include dashboards for reducing heart failure hospital readmission rates (Banerjee et al., 2017), reducing central line-associated bloodstream infection (CLABSI) (Chemparathy et al., 2021), reducing testing and medication prescribing for pediatric patients with bronchiolitis (Hester et al., 2019), and improving outcomes related to transfer between units (Staib et al., 2017).

Dashboard end-users were categorized by primary users, including clinical staff (e.g. physicians, nurses), leaders/administrative staff (e.g. managers, directors, quality or technology support staff), or both. Eight articles discussed quality dashboards intended for clinical staff (Alvarado et al., 2021; Banerjee et al., 2017; Birdas et al., 2019; Daley et al., 2013; Laurent et al., 2021; McLaughlin et al., 2014; van Deen et al., 2019; Wu et al., 2019), while four were for leaders and/or administrative staff (Chemparathy et al., 2021; Fischer et al., 2020; Staib et al., 2017; Williams et al., 2021). Four studies included both (Connolly et al., 2021; Hester et al., 2019; Logan et al., 2022; Weiss et al., 2018).
Thirteen studies (Alvarado et al., 2021; Banerjee et al., 2017; Chemparathy et al., 2021; Connolly et al., 2021; Daley et al., 2013; Fischer et al., 2020; Hester et al., 2019; Laurent et al., 2021; Staib et al., 2017; van Deen et al., 2019; Weiss et al., 2018; Williams et al., 2021; Wu et al., 2019) described the use of electronic dashboards with interactive functions such as filtering, customization, and drill down. Visuals to display trends and aggregate data included graphs and numbers. Bar and column graphs were most popular (Alvarado et al., 2021; Banerjee et al., 2017; Chemparathy et al., 2021; Connolly et al., 2021; Daley et al., 2013; Hester et al., 2019; Laurent et al., 2021; Staib et al., 2017; van Deen et al., 2019; Weiss et al., 2018; Williams et al., 2021; Wu et al., 2019) followed by line graphs (Alvarado et al., 2021; Banerjee et al., 2017; Chemparathy et al., 2021; Connolly et al., 2021; van Deen et al., 2019; Wu et al., 2019), tabular (table) presentations (Fischer et al., 2020; Hester et al., 2019; Laurent et al., 2021; Weiss et al., 2018; Wu et al., 2019), numeral data (Daley et al., 2013; Hester et al., 2019; van Deen et al., 2019; Williams et al., 2021), odometers (Banerjee et al., 2017; Daley et al., 2013; Staib et al., 2017), and heat maps (Connolly et al., 2021). Line graphs were most noted for displaying trends, whereas bar or column graphs and tabular presentations were popular for displaying aggregate data. Three studies described static dashboards (Birdas et al., 2019; Logan et al., 2022; McLaughlin et al., 2014) in Microsoft Excel using tabular presentations where columns were populated with data over a defined timeframe (e.g. monthly, quarterly) to show trends. Color-coding (e.g. red, yellow, green) for benchmarking performance was most common, as noted in 5 of the 16 studies (Birdas et al., 2019; Connolly et al., 2021; Hester et al., 2019; McLaughlin et al., 2014; Weiss et al., 2018).

**Patient Outcomes**
Eight studies evaluating patient outcomes described the inclusion of a quality dashboard as a supporting tool for the intervention(s). Five reported improvements in outcomes, including reduced heart failure readmission rates from 18.2% to 10.1% (Banerjee et al., 2017), reduced emergency department (ED) length of stay (7.2 to 3.8 hours) and reduced patient mortality (2.3% to 1%) (Staib et al., 2017), reduced surgical mortality, length of stay and postoperative complications (Birdas et al., 2019), and reduced CLABSI rates (Chemparathy et al., 2021) and Clostridium difficile rates (McLaughlin et al., 2014). These authors discussed how dashboards were useful tools to communicate, monitor, and analyze data to identify areas for improvement, which may have contributed to the success. Three studies described dashboards that used graphs (Banerjee et al., 2017; Chemparathy et al., 2021; Staib et al., 2017), while two used tabular displays (Birdas et al., 2019; McLaughlin et al., 2014). All five studies included dashboards that used benchmarks, which included color-coding, lines, or gauges/odometers; three (Banerjee et al., 2017; Chemparathy et al., 2021; Staib et al., 2017) had interactive functions.

Three studies reported mixed findings. Two studies evaluating multiple hospitals’ perinatal outcomes reported mixed results with overall improvements noted in episiotomy rates, inductions, repeat cesarean section in low-risk women, and thermoregulation in newborns (Logan et al., 2022; Weiss et al., 2018). Both studies used dashboards with tabular presentations; one used color-coding as benchmarks and had interactive functionalities (Weiss et al., 2018). Alternatively, one study (Hester et al., 2019) included an interactive dashboard using graphs and color-coding benchmarks as part of an intervention to reduce unnecessary testing and medication prescribing in pediatric patients; however, the authors
reported that improved outcomes such as ED length of stay and 7-day revisit were unlikely related to dashboard due to low usage and timing of dashboard deployment.

**End-user Evaluation (Response)**

Eight of the 16 studies included quality dashboard technology evaluations based on end-user perception, usage, and feedback. Quantitative evaluation methods included usability (ease of use), usefulness, usage, and satisfaction. Four studies (Alvarado et al., 2021; Connolly et al., 2021; Laurent et al., 2021; Wu et al., 2019) that included clinical staff as end-users reported positive evaluation scores. Two studies used the System Usability Scale (SUS), a standardized validated survey with responses ranging from 0 to 100 with higher scores indicating higher usability and reported scores of 82.9 (Wu et al., 2019) and 82.6 (Laurent et al., 2021), indicating above-average usability. One (Alvarado et al., 2021) used an investigator-developed survey and reported high perceived ease of use with average question ratings between 3.5 to 4 out of 5, and average perceived usefulness scores of 3.2 to 3.8 out of 5. One study (Connolly et al., 2021), where the dashboard was intended for all staff roles, reported 235 unique individuals of 4000 staff used the dashboard. Most users were administrative staff, and despite low usage, the authors reported success in identifying 2 use cases to inform future QI initiatives. All dashboards used graphs, but only one (Connolly et al., 2021) used visual benchmarks. All had interactive functionalities.

The other four articles (Daley et al., 2013; Fischer et al., 2020; van Deen et al., 2019; Williams et al., 2021) that included clinicians and leaders as end-users reported mixed feedback. All used investigator-developed surveys. Perceived ease of use was overall high, such as average scores of 6 out of 7 (van Deen et al., 2019), and 71% (Daley et al., 2013) and 64% (Fischer et al., 2020) of respondents agreeing the dashboard was easy to use. Perceived
usefulness was mixed, such as average scores of 4 out of 7 (van Deen et al., 2019), and 48% to 73% of respondents finding the dashboard useful or helpful (Daley et al., 2013; Fischer et al., 2020; Williams et al., 2021). Approximately one-third of respondents were satisfied with the dashboard design (Fischer et al., 2020; Williams et al., 2021). One dashboard (Fischer et al., 2020) used tabular presentations, and one dashboard (Williams et al., 2021) did not show visual benchmarks. All had interactive functionalities.

Open-ended feedback was also used to evaluate satisfaction with various dashboard characteristics. For example, users voiced favorable dashboard enhancement opportunities, such as modifying some data displays or functionalities to improve data comprehension and ease of use (Alvarado et al., 2021; Daley et al., 2013; Laurent et al., 2021; van Deen et al., 2019; Wu et al., 2019). End-users also identified barriers with dashboard use, such as access, timeliness and accuracy of data, incomplete data, and lack of integration into workflow (Alvarado et al., 2021; Daley et al., 2013; van Deen et al., 2019).

Supplemental Digital Content Table 3 summarizes dashboard characteristics with the associated patient outcomes and end-user evaluation (response).

**DISCUSSION**

This systematic review provides a summary of the evidence about dashboard characteristics associated with quality and performance to improve patient outcomes. Critical appraisal of study quality revealed the trustworthiness of the results to be low, which is reflective of non-intervention studies. Generalizability of findings was limited by sampling methodologies; however, sampling within an organization or to individuals of convenience can be reasonable given that quality dashboards are typically limited to their setting, users, or
specific QI project. A dashboard for one population may not be transferrable to a similar population and/or setting due to user preferences, goals, and organizational influence.

Findings from this review align with previous reviews (Bucalon et al., 2022; Dowding et al., 2015; Iftikhar et al., 2019; Khairat et al., 2018; Wilbanks & Langford, 2014), suggesting quality dashboards can be effectively used for sharing data and increasing communication among stakeholders, as well as for analyzing data for decision-making and implementing change (Alvarado et al., 2021; Daley et al., 2013; Fischer et al., 2020). Importantly, dashboards that support initiatives or projects (Banerjee et al., 2017; Staib et al., 2017) to improve patient outcomes can be integrated into QI frameworks so data can be systematically reviewed (McLaughlin et al., 2014; Weggelaar-Jansen et al., 2018). Further, this review adds to the existing literature by evaluating dashboard characteristics associated with quality and performance improvement outcomes. Based on this review, no one-size-fits-all dashboard exist, as findings revealed various visual displays and characteristics were associated with positive and mixed patient outcomes and end-user satisfaction. However, general guiding principles can be drawn.

For studies reporting patient outcomes, five (Banerjee et al., 2017; Birdas et al., 2019; Chemparathy et al., 2021; McLaughlin et al., 2014; Staib et al., 2017) of the eight noted improvements in the clinical indicators, further supporting dashboards’ contribution to patient outcomes when used as tools for presenting data that direct and/or support behaviors or interventions; however, evaluation should include a holistic assessment of QI interventions in addition to the use of dashboard. Graphs and tabular presentations were equal among the 8 studies, and both types of visuals were found to be associated with improved patient outcomes. However, when tabular presentations were further analyzed by single versus
multiple sites, improvements in patient outcomes were noted in single sites (Birdas et al., 2019; McLaughlin et al., 2014) but mixed when used across hospital sites (Logan et al., 2022; Weiss et al., 2018), suggesting dashboards with tabular presentations may need to be customized for site- (or department-) specific needs. Benchmarks, such as color coding, were noted in all five studies reporting improved patient outcomes, and three of these five studies described interactive dashboards. Thus, for quality and performance improvement dashboards focused on patient outcomes, visual benchmarks should be used, and dashboards may contain graphs or tables with the consideration of including interactive functionalities.

For studies reporting end-user evaluation, four (Alvarado et al., 2021; Connolly et al., 2021; Laurent et al., 2021; Wu et al., 2019) of eight reported positive ease of use, usefulness, or satisfaction with overall higher perceived ease of use than perceived usefulness. Open-ended user feedback also indicated the need to improve design and functionality in addition to some challenges such as data integrity (Alvarado et al., 2021; Daley et al., 2013; van Deen et al., 2019; Williams et al., 2021). These findings suggest dashboards need continual evaluation in collaboration with users as modifications are made to assure dashboards are useful and easy to use. Graphs were the predominant display, and all dashboards were interactive. Benchmarks were associated with mixed user satisfaction (three (Daley et al., 2013; Fischer et al., 2020; van Deen et al., 2019) of four studies) as opposed to positive user evaluation responses (one (Connolly et al., 2021) of four studies). Thus, when focusing on end-user satisfaction, dashboards should include graphs with interactive functions, but more research is needed on end-user responses to visual benchmarks.

**Implications and Recommendations for Nursing**
Nurses play a critical role in improving outcomes at the unit and organization level. Findings from this review provide nurses and their healthcare partners with important lessons on how dashboards may be used in QI efforts to influence those outcomes. First, dashboards are important tools to include in QI projects so nurses can track their performance, identify areas for improvement, and see the impact of their work (L. Jeffs, Beswick, et al., 2014). However, caution must be taken to not rely solely on dashboards because they alone do not lead to improved patient outcomes but rather supplement QI work by providing the data necessary for decision-making. Second, dashboard evaluation for usefulness and usability is an important and continual ongoing process and is necessary if they are to be effective in QI efforts. Nurses and their healthcare partners need to be involved in ongoing dialogue with dashboard designers to ensure the dashboard meets their needs. Third, dashboard characteristics such as graphs and tabular presentations with benchmarks or interactive functions may be effective visuals to enhance QI efforts but should be tailored to the unit/specialty/department to be most effective. Nurses should consider various visual options when displaying data on quality dashboards to what best suits the project, users, or needs.

**Limitations**

There are limitations to this systematic review. First, gray literature was not included, which limits findings not published in peer-reviewed journals. Second, one reviewer (LY) conducted the initial systematic review, resulting in potential subjective biases during the selection and review process. However, the second reviewer (AV) was routinely consulted in the selection and extraction process as well as assisted in the quality review process. Third, other related keywords used for the search could have been missed, which could limit articles fitting inclusion for this review.
CONCLUSION

Evaluating quality dashboards in hospital settings based on their outcomes can provide directions for nurses participating in quality and performance improvement initiatives. Variations in dashboard displays and context-of-use suggest there may not be a one-size-fits-all; however, dashboards may contribute to improvement in patient outcomes and should be useful and usable. Tables and graphs with benchmarks and interactive functionalities should be considered when designing quality dashboards to fit department needs, but more research is needed on specific display types so dashboards can be better designed to meet end-user needs while contributing to improved outcomes. Most importantly, future research is needed to explore how quality dashboards are used by nurses and nursing leaders, as well as factors influencing dashboard use, as nurses directly impact care and are influential in improving patient outcomes.
References


Figure 1

*PRISMA Flow Diagram*

- **Identification**
  - Records identified through database searching (n = 1166)
  - Additional records identified through other sources (n = 40)

- **Screening**
  - Records after duplicates removed (n = 700)
  - Records screened (n = 700)
    - Records excluded (n = 467)
      - Title/Abstract not relevant = 408
      - Not in English = 6
      - Literature Reviews = 15
      - Wrong setting = 38

- **Eligibility**
  - Full-text articles assessed for eligibility (n = 233)
    - Full-text articles excluded, with reasons (n = 217)
      - Not journal article = 5
      - General dashboard articles = 43
      - Quality indicators or dashboard development = 36
      - Patient dashboard = 9
      - Clinical dashboard = 62
      - Performance dashboard = 62

- **Included**
  - Studies included in literature synthesis (n = 16)
Supplemental Digital Content Table 1 *Literature Review Matrix*

<table>
<thead>
<tr>
<th>First author, Year, Country</th>
<th>Context or Setting of Use</th>
<th>Design</th>
<th>End-User Type</th>
<th>Dashboard Visual Design</th>
<th>Benchmarks</th>
<th>Interactivity</th>
<th>Outcome Category</th>
<th>Reported Outcome/Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banerjee, D., 2017, US</td>
<td>Cardiology (Heart Failure)</td>
<td>Case Report</td>
<td>Clinical Staff</td>
<td>Combo bar/line graph, Gauges/odometers, progress bars</td>
<td>Gauges/odometers, progress bars</td>
<td>Yes</td>
<td>Patient Outcome</td>
<td>Improvement</td>
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<td>Birdas, T., 2019, US</td>
<td>Surgery</td>
<td>Case Report</td>
<td>Clinical Staff</td>
<td>Tabular presentation</td>
<td>Color-coding</td>
<td>No</td>
<td>Patient Outcome</td>
<td>Improvement</td>
</tr>
<tr>
<td>Chemparathy, A, 2021, US</td>
<td>Pediatrics: Medical and/or surgical (CLABSI)</td>
<td>Case Report</td>
<td>Leaders/ Admin</td>
<td>Line graph, bar graph</td>
<td>Line on graph</td>
<td>Yes</td>
<td>Patient Outcome</td>
<td>Improvement</td>
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<td>Hester, A., 2019, US</td>
<td>Pediatrics</td>
<td>Case Report</td>
<td>Both</td>
<td>Bar graph, Numeral data in tables and tabular presentation</td>
<td>Color-coding</td>
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<td>Logan, J., 2022, US</td>
<td>Neonatology</td>
<td>Quantitative</td>
<td>Both</td>
<td>Tabular presentation and sparklines</td>
<td>None Noted</td>
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<td>McLaughlin, N., 2014, US</td>
<td>Neurosurgery</td>
<td>Case Report</td>
<td>Clinical Staff</td>
<td>Tabular presentation and statistical process control (SPC) charts</td>
<td>Color-coding</td>
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<td>Patient Outcome</td>
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<td>Staib, A., 2016, Australia</td>
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<td>Case Report</td>
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<td>Gauges/odometer</td>
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<td>Alvarado, N., 2021, UK</td>
<td>Cardiology / Pediatric Critical Care</td>
<td>Mixed Methods</td>
<td>Clinical Staff</td>
<td>Bar, line, stacked bar, and combo bar/line, pie graph</td>
<td>None Noted</td>
<td>Yes</td>
<td>End-user evaluation</td>
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<tr>
<td>First author, Year, Country</td>
<td>Context or Setting of Use</td>
<td>Design</td>
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<td>Benchmarks</td>
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<td>Daley, K., 2013, UK</td>
<td>Psychiatry / mental health</td>
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## Supplemental Digital Content Table 2. Quality Assessment

### Case Reports

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1. Clearly focused question/issue
2. Method (study design) appropriate for research question
3. Setting and subjects representative to population to which findings will be referred?
4. Researcher’s perspective clearly described
5. Methods for data collection clearly described
6. Methods for data analysis valid and reliable? Quality control measures used?
7. Analysis repeated by another researcher for reliability?
8. Results credible, relevant to practice?
9. Conclusions drawn justified by the results?
10. Findings transferrable to other settings?

### Quantitative Studies

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1. Clearly focused question/issue
2. Method (study design) appropriate for research question
3. Method selection described?
4. Sample selection introduce selection bias?
5. Subjects representative to population to which findings will be referred?
6. Sample size based on pre-study considerations or statistical power?
7. Satisfactory response rate achieved?
8. Measurements (questionnaires) valid and reliable?
9. Statistical significance assessed?
10. Confidence intervals given for main results?
11. Confounding factors not accounted for?
12. Results be applied to your organization?

Mixed Methods (includes qualitative and quantitative assessment tools)

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1. Clearly focused question/issue
2. Method (study design) appropriate for research question
3. Content clearly described
4. Fieldwork/methods/data collection clearly described
5. Could evidence be inspected independently by others?
6. Procedures for data analysis reliable? Quality control measures used?
7. Analysis repeated by another researcher for reliability?
8. Results credible, relevant to practice?
9. Conclusions drawn justified by the results?
10. Findings transferrable to other settings?
11. Method selection described?
12. Sample selection introduce selection bias?
13. Subjects representative to population to which findings will be referred?
14. Sample size based on pre-study considerations or statistical power?
15. Satisfactory response rate achieved?
16. Measurements (questionnaires) valid and reliable?
17. Statistical significance assessed?
18. Confidence intervals given for main results?
19. Confounding factors not accounted for?
20. Results be applied to your organization?

✓ indicates criterion was present
* indicates “no” or “can’t tell”
Supplemental Digital Content Table 3. *Dashboard Characteristics Association with Outcomes*

<table>
<thead>
<tr>
<th></th>
<th>Patient Outcome: Improvement reported</th>
<th>Patient Outcome: Mixed</th>
<th>End-user Evaluation: Positive</th>
<th>End-user Evaluation: Mixed</th>
</tr>
</thead>
<tbody>
<tr>
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<td>60% (3)</td>
<td>33% (1)</td>
<td>100% (4)</td>
<td>75% (3)</td>
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<tr>
<td><strong>Tabular Presentations</strong></td>
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</tr>
<tr>
<td><strong>Benchmarks</strong></td>
<td>100% (5)</td>
<td>67% (2)</td>
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<td>75% (3)</td>
</tr>
<tr>
<td><strong>Interactivity</strong></td>
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<td>100% (4)</td>
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<tr>
<td><strong>TOTAL studies</strong></td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

*NOTE: The numbers in the matrix represent the percent (number) of studies with the criteria present.*
CHAPTER 3: METHODS

Study Design

This study used a qualitative descriptive design, which is intended to provide straightforward descriptions of participant perspectives and experiences (Doyle et al., 2020). A qualitative descriptive approach was chosen because the study did not focus on nurse managers’ lived experiences (phenomenological), the development of a theory (grounded theory), spoken or written stories (narrative analysis), a particular group’s culture (ethnographic), or a specific health system’s experience (case study). Quality, in this study, was defined based on the unit’s patient population; examples may include but are not limited to hospital-acquired conditions such as falls, pressure injuries, and infections, processes such as bundle or protocol compliance, length of stay, mortality, or readmissions.

Setting

The sample was collected from a not-for-profit health system serving approximately ten million people living in a metropolitan city and surrounding suburban area in the Midwestern United States. This health system includes eleven hospitals: an 894-bed academic medical center, a 25-bed critical-access hospital, a 125-bed rehabilitation hospital, and eight acute-care facilities in community settings with bed sizes ranging from 56 to 425. Approximately 130 nurse managers oversee the patient care units in this health system. Eight of the 11 hospitals are Magnet-designated, which is a recognition program from the American Nurses Credentialing Center (ANCC) that awards health care organizations valuing nurses’ talent, excellence, and commitment to quality patient care (American Nurses Association (ANA), 2017). All hospitals in this health system use one electronic medical record and data warehouse. There is a centralized Information Technology (IT) department along with local hospital IT support teams.
Sample

Participants were hospital nurse managers employed full-time by a single health system. Nurse managers report to a director or above and have direct supervision and accountability over (a) patient care area(s). Purposive sampling was used to ensure participants met the study's eligibility criteria. The anticipated sample size was approximately 15 nurse managers or until data saturation was reached, which was the point at which no new codes emerged (Guest et al., 2006; Vasileiou et al., 2018). The suggested sample size was based on reviewing similar qualitative dashboard research studies that involved managers as participants. Sample sizes ranged from five to 25 (L. Jeffs, Beswick, et al., 2014; Pace & Buttigieg, 2017; Taber et al., 2021; Weggelaar-Jansen et al., 2018). Two of those studies that had 21 and 25 participants also included executive leaders (e.g. directors, vice presidents) (Pace & Buttigieg, 2017; Weggelaar-Jansen et al., 2018). In this study, data saturation was reached with 11 participants.

Inclusion/exclusion criteria

Inclusion criteria were nurse managers who 1) directly oversaw at least one hospital unit or department, 2) had direct reports who were bedside nurses, 3) had been a nurse manager for at least three months, and 4) participated in QI. All specialties were considered, including medical-surgical, behavioral health, emergency department, maternity, surgical or procedural units. Exclusion criteria were 1) direct care nurses, educators, administrators, and/or nurse leaders at the director level and above, 2) nurse managers overseeing a non-clinical patient care department, such as professional development or care coordination, and 3) ambulatory departments not attached to a hospital, such as clinics.

Recruitment
Permission and approval from the health system to conduct the research were first obtained. Institutional Review Board (IRB) approvals from the University of Missouri–Columbia and the health system were then obtained. An email recruitment flyer was then sent on the researcher’s behalf by a Clinical Quality Leader for each hospital. These clinical leaders support QI initiatives, are not in a supervisory role, and have no reporting relationships to nurse managers. Interested participants were directed to an online Microsoft Forms survey, which included questions to determine study eligibility, basic demographics as an attempt to diversify the sample, and contact information for scheduling preferences. See Appendix A: Screening Survey for Potential Participants. After the study closed, the link was deactivated. Participants were compensated with $25 Amazon egift cards.

**Data Collection**

Data were collected using interviews to gather rich in-depth data, allow participants more time to speak about the topic, encourage honest responses in a private rather than a group setting, and for ease of scheduling (Webb & Kevern, 2001). Other methods of qualitative data collection were considered, including focus groups and observation with think-aloud. While focus groups provide valuable insight into group interactions, agreements, and inconsistencies (Gill & Baillie, 2018), the intention was to understand personal perceptions about dashboard use, and thus, collective thoughts were not necessary at this descriptive phase of the study. Observation with think-aloud is a method where users share screens and articulate their thoughts as they move through the system to express their opinions, impressions, likes, and dislikes (Rubin & Chisnell, 2008). This method could have further enhanced interview self-reported responses to understand dashboard use; however,
due to the health system’s data compliance and privacy policies, managers were not allowed to share screens showing unit-specific dashboard data.

Eligible participants were contacted by the primary researcher to schedule 60-minute one-on-one interviews over videoconferencing using Microsoft Teams. During scheduling, nurse managers were asked to find a private location with internet access. The researcher conducted the sessions from a private, quiet location. Interviews were audio recorded and transcribed using Microsoft Teams. Participants were informed to turn off video, and no screen sharing was allowed. Verbal consent for audio recording was obtained before the interview. A backup audio voice recorder software, Vidmore Screen Recorder, was also used.

Before beginning the interview, participants created a demographic profile, as shown in Appendix B: Participant Profile. Questions included race, ethnicity, gender, age group, years of experience as a nurse and nurse manager, highest level of education, and comfort level with data and dashboards. Semi-structured interviews were then conducted using predetermined questions derived from the literature, factors identified in Mashinchi et al. (2021) TAM model, and a pilot test completed in November 2022. Probing or additional questions to clarify responses were also integrated into the interviews as appropriate. See Appendix C: Semi-Structured Interview Guide.

**Human Subjects Protection**

Hospital nurse managers were the human subjects for this proposed study. There were no direct benefits to the subjects although lessons learned from the study can provide future benefits related to dashboard use for QI. There were minimal risks such as possible discomfort with answering organization-related questions. To minimize risks, study participation was completely voluntary, and participants could defer answering questions. An
informed consent document was emailed with the recruitment flyer and meeting invite and reviewed at the beginning of the interview. The informed consent included the study purpose, expectations, and how to contact the researcher for questions or concerns. Participants were informed they could withdraw from the study at any time without penalty.

Data Management

Interview transcriptions were reviewed by listening to each audio recording to validate for accuracy. During transcription, any identifying information was redacted and participants were given a pseudonym to maintain anonymity. Participant profiles were included with the participant transcripts, which were saved under their pseudonym. A list of participant pseudonyms was saved in a separate file away from the study data. No protected health information (PHI) was collected.

All data were stored in a dedicated folder on Microsoft OneDrive, which is secured with a username and password that only the researcher had access to. A research folder was created with separate subfolders for the audio recordings, transcripts, and data analysis. After the study concluded, all audio recordings were permanently deleted. Direct quotes had no identifying information and were reported anonymously.

Data Analysis

Data were analyzed using Braun & Clarke's (2022) thematic analysis. Thematic analysis emphasizes identifying, analyzing, and reporting patterns, which are then grouped into categories. The focus is on meaning and rich detail in the data, which goes beyond simply organizing or counting phrases in a text (Braun & Clarke, 2006). This method fitted the study, as attention was on explaining the meanings within the data when describing dashboard use and identifying factors related to dashboard use.
There are six phases in thematic analysis: 1) becoming familiar with the data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, and 6) producing the report (Braun & Clarke, 2006). First, the researcher read through the transcripts and recorded initial ideas in writing as memos. Then, a more thorough line-by-line analysis was done to generate initial codes. Third, initial themes were created by collating similar codes into categories that could be potential themes. Those themes were reviewed by checking them against the codes and the entire data set to ensure an accurate representation of the data. Finally, themes were named and defined to produce the final report.

As qualitative data analysis is an iterative process between data collection and analysis (Merriam & Tisdell, 2009), transcripts were analyzed as additional data were being collected to determine if emerging themes corroborated with new incoming data. Codes and themes were identified inductively as they emerged, but deductive approaches were used during the latter steps to validate if the codes and themes fit the framework identified. There were originally 64 initial codes. The first participant yielded 36 codes, nine codes were added with the second participant, four additional codes with the third participant, and five codes added with the fourth participant. An additional ten new codes were added with the remaining 7 participants. When all transcripts were coded, initial codes were reevaluated to determine if any codes were similar that could be combined. Corresponding transcripts for similar codes were evaluated and some transcripts were re-coded while others were added to an existing code that was renamed to broaden and incorporate similarities. For example, the “Technology Features” categories had overlapping codes that included opposing perspectives of what was desired or frustrating to participants. Rather than separate codes to label each
perspective, one code was expanded to include all perspectives on the same topic. This process of reviewing and redefining codes was done three times until 12 codes were eliminated by redefining or combining them into similar existing codes, resulting in a total of 52 codes in the final code book.

Codes were then combined into categories, which were then grouped into subthemes, and further organized into themes. Codes, categories, subthemes, and themes were reviewed continuously with the researcher’s advisor until a consensus was reached. Data was analyzed using Microsoft Word and Excel. A codebook was created to store the definitions of each code and their corresponding categories, subthemes, and themes. See Appendix D: Codebook.

**Addressing Trustworthiness**

Establishing trustworthiness in qualitative studies relies on addressing transferability, credibility, dependability, and confirmability. Transferability refers to the application of findings to another setting or population. Credibility assesses if the results match reality and if the data explains the phenomenon under study. Dependability refers to consistency, in which replicating results would produce similar findings. Confirmability is maintaining research objectivity free from potential biases (e.g. researcher bias). (Merriam & Tisdell, 2009; Morse, 2015)

Several steps were taken to ensure the trustworthiness of the findings. First, the researcher performed member checking throughout and at the end of each interview to validate understanding and capture accurate reflections of participant perceptions. Second, codes and themes were continuously reviewed by the researcher’s advisor during data analysis to ensure that the findings were consistent and objective. Third, the researcher
maintained a detailed audit trail to assure data dependability and stability by detailing the step-by-step actions and decisions taken during the study and the data analysis process. The audit trail was kept with the data analysis files.

Researcher bias was also addressed to maintain objectivity throughout the study due to the researcher’s role as a Clinical Quality Leader who collaborates with nurse managers on QI initiatives. To mitigate preconceived notions that could bias data collection and analysis, the researcher bracketed her thoughts about the topic before beginning the research. She wrote down expected findings and other ideas related to nurse manager use of dashboards. She also practiced reflexivity by journaling how her background, values, beliefs, and attitudes about the topic may have influenced the research. These notes were included with the data analysis files.
References


CHAPTER 4: RESULTS
(Manuscript to be submitted to Journal of Nursing Care Quality)

HOSPITAL NURSE MANAGERS’ PERCEIVED USE OF DASHBOARDS FOR QUALITY AND PERFORMANCE IMPROVEMENT: A QUALITATIVE STUDY

Abstract

Background: Hospital quality and patient safety measures are often displayed on dashboards aimed to improve patient outcomes; yet little is known about dashboard use by hospital unit nurse managers.

Purpose: The purpose of this study was to describe hospital nurse managers’ perceived use of dashboards and the factors influencing dashboard use for quality and performance improvement.

Methods: Using a descriptive qualitative design, 11 hospital nurse managers were recruited from a health system in the Midwestern United States. Semi-structured interviews were conducted, and transcripts were analyzed using thematic analysis.

Results: Two major themes emerged: Manager as QI Leader and Influencers of Dashboard Use. Managers use dashboards to support unit performance and share information. Perceived factors influencing dashboard use included external, personal, data, and technology features.

Conclusions: Hospital nurse managers need simple, easy-to-use, useful, accurate, and timely dashboards to effectively communicate, engage, and support unit quality and performance improvement initiatives impacting patient outcomes.

Keywords: dashboards, quality and performance improvement, nurse managers, qualitative research
INTRODUCTION

Hospital-acquired conditions (HACs), such as falls and infections, are costly and largely preventable (Hamadi et al., 2021). For example, hospital-acquired infections (HAIs) affect an estimated one in 31 hospitalized patients (Center for Disease Control and Prevention, 2020), and many are preventable with a potential cost savings of $25 to $31.5 billion (Office of Disease Prevention and Health Promotion, 2020). Patient falls occur in an estimated 700,000 to 1 million hospitalized patients each year (Agency for Healthcare Research and Quality (AHRQ), 2019), costing an additional $6,694 per hospital fall (Agency for Health Research and Quality, 2017). Despite efforts to reduce HACs through quality and performance improvement initiatives, HACs remain a concern.

Hospital nurse managers are uniquely positioned to impact HACs and influence patient outcomes. Managers oversee unit-level quality and performance improvement interventions at the front line while reporting unit performance to the executive level (Dainty & Sinclair, 2017; Kakyo & Xiao, 2017; O’Donoghue et al., 2021; Parand et al., 2014; Sjølie et al., 2020). Nurse managers are also responsible for involving direct patient care staff in quality improvement (QI), which requires tools and resources to accurately identify problems and prioritize initiatives (O’Donoghue et al., 2021; Tschannen et al., 2021). One such tool is dashboards, which allow nurse managers to recognize and communicate opportunities influencing patient outcomes (Randell et al., 2020; Ruppel et al., 2023).

Dashboards synthesize large amounts of data into a single report so healthcare leaders and clinicians can make decisions, communicate information, increase compliance with care protocols or guidelines, monitor performance against benchmarks, and identify patterns requiring practice changes (Bucalon et al., 2022; Buttigieg et al., 2017; Dowding et al., 2015;
Dashboards have varying characteristics and displays (Dowding et al., 2015; Iftikhar et al., 2019); however, they are often interactive (e.g. filter, drill down) and use data visualization, or graphical representations of data (e.g. graphs, tables, icons, color-coding), to support cognitive processing so users can draw insights and analyze data more easily (Barnum et al., 2019; Engelbrecht et al., 2015; Franklin et al., 2017; Khairat et al., 2018; Mlaver et al., 2017). In QI, dashboards display performance metrics of aggregated patient data (e.g. infection rates) intended to support operational decision-making and are referred to as “quality dashboards” (Dowding et al., 2015). Quality dashboards should allow users to 1) select relevant performance indicators, 2) identify causes of outliers, 3) communicate performance with others, and 4) assess performance using trends or benchmarks (Randell et al., 2020).

While dashboards are widely used within hospitals, including nursing units, little is known about how hospital nurse managers’ unique perspective on dashboard use contributes to unit quality and performance improvement initiatives influencing patient outcomes (Young & Vogelsmeier, In Press). As dashboards must integrate into organizational, operational, and clinical workflows (Alvarado et al., 2021; Weggelaar-Jansen et al., 2018), understanding dashboards at the unit level can provide direction for designing and optimizing dashboards that are actionable toward improving patient outcomes. Thus, this study’s purpose was to describe hospital nurse managers’ perceived dashboard use and characterize the factors influencing dashboard use for unit quality and performance improvement.

**THEORETICAL FRAMEWORK**

The Technology Acceptance Model (TAM) illustrates how users adopt and use technology. This study used a modified TAM developed by Mashinchi et al. (2021), whose...
work was part of a larger study focused on explaining factors associated with healthcare professionals’ and patients’ use of dashboards for value-based prostate cancer treatment and care. Their model expanded on the TAM’s External Variables construct by identifying ten factors in a user’s decision to adopt and use a dashboard: external environment, organizational characteristics, health professional manager support, trust, user, user beliefs, user emotions, technology, sociotechnical fit, and cognitive fit. The organizational, user, and technology factors, which are further described in Table 1, were selected as a guiding framework for this study.

METHODS

Design

This study used a descriptive qualitative design with data collected via semi-structured interviews between January 2023 and April 2023. The human subject institutional review boards from the University of Missouri Health Sciences and the health system where the study was conducted approved the study as exempt. A waiver of documentation of consent was used due to minimal risk and no protected health information (PHI) discussed.

Setting and Sample

Participants were sampled from a not-for-profit health system serving a population of approximately ten million people living in a metropolitan city and surrounding suburban area of the Midwestern United States. This health system included eleven hospitals: an academic medical center, a critical-access hospital, a rehabilitation hospital, and eight acute-care facilities in community settings.

Purposive sampling was used to recruit hospital nurse managers employed full-time by the health system. Eligibility criteria included nurse managers who 1) reported to a
director or above, 2) had direct supervision and accountability over at least one hospital unit or patient care area(s), 3) had direct reports who were bedside nurses or patient care staff, 4) been a nurse manager for at least three months, and 5) participated in QI. Exclusion criteria were direct care nurses, nurses in administrative roles, directors and above, nurse managers overseeing non-clinical hospital departments, and ambulatory departments not attached to a hospital, such as clinics.

Recruitment began after obtaining IRB approvals and permission from the health system and concluded when data saturation was reached, which was the point at which no new codes emerged (Guest et al., 2006; Vasileiou et al., 2018). An email recruitment flyer and consent form describing the study and participant expectations were sent to nurse managers. Interested participants filled out an online screening form to determine eligibility. The primary researcher (LY) maintained all responses and contacted qualified participants for a 60-minute one-on-one interview.

Data Collection

Semi-structured interviews were conducted over videoconferencing and audio recorded for transcription. Consent for audio recording, use of de-identified direct quotes, and human subjects protection concerns were addressed before beginning the interview. Participants completed a demographic profile including race, ethnicity, gender, age group, years of experience as a nurse, years of experience as a nurse manager, and highest level of education. Participants were also asked to rate their comfort level with data and dashboards using a 5-point Likert scale, where 1 = very uncomfortable and 5 = very comfortable. Open-ended questions were then asked, and probing was used to clarify, validate, and expand on participant responses.
Interview transcripts were reviewed by listening to each audio recording to validate for accuracy. Any identifying information was redacted, and participants were given a pseudonym to maintain anonymity. Participant profiles were included with the participant transcripts, which were saved under their pseudonym. All data were stored in a dedicated folder over a secured, password-protected cloud storage platform.

**Data Analysis**

Braun & Clarke's (2022) six phases of thematic analysis were used to conduct data analysis. The primary researcher (LY) became familiar with the data, generated initial codes, searched for themes, reviewed themes, defined and named themes, and produced the report (Braun & Clarke, 2006). Initial codes and themes were identified inductively, but deductive approaches were used during the latter steps as themes were labeled and finalized. The primary researcher (LY) independently coded all transcripts, and codes, categories, subthemes, and themes were continuously reviewed and revised with the primary researcher’s advisor (AV) until consensus was achieved.

**Ensuring Trustworthiness**

Four steps were taken to assure trustworthiness of findings. First, member checking was performed throughout and at the end of the interviews to ensure an accurate reflection of participant perceptions. Second, codes and themes were reviewed by a second researcher during data analysis to assure findings were consistent and objective (AV). Third, the primary researcher (LY) kept a detailed audit trail by detailing actions taken during the study including decisions made throughout the analysis process. Lastly, the primary researcher (LY) practiced bracketing and reflexivity by journaling to reflect her thoughts on the topic.
before and throughout the research study to minimize subjective bias and maintain objectivity.

RESULTS

Descriptives

Study participants included 11 hospital nurse managers from seven hospitals in a single health system located in the suburban and rural areas surrounding a Midwestern metropolitan city. Hospital bed sizes ranged from 25 to 425 beds per hospital. Four participants were from one hospital, two from another hospital, and the remaining five participants each worked in separate hospitals. Half of the participants were known to the primary researcher (LY) but did not work closely with the primary researcher in their QI work within this health system. Interviews ranged from 40 to 63 minutes with an average of 52 minutes. All participants identified as non-Hispanic, 91% (n=10) were White, and 82% were female (n=9). Most participants identified as Gen X (n=8; 74%), had >15 years of experience as a nurse (n=9; 82%), and > 6 years of management experience (n=7, 64%). Five held a Bachelor’s degree, five held a Master’s degree, and one held a doctorate. Detailed participant demographics are shown in Table 2.

Using the Likert scale, participants rated a relatively high level of comfort using data and dashboards. The average response was 4.5 out of 5 for comfort with using data on dashboards. The average response was 4.1 out of 5 for comfort with navigating through an electronic dashboard.

Themes

Two themes emerged from the data: (1) Manager as Unit QI Leader and (2) Influencers of Dashboard Use. The first theme, Manager as QI Leader, aligns with aim one to
describe hospital nurse managers’ perceived use of quality dashboards designed for unit-level performance. The second theme, Influencers of Dashboard Use, aligns with aim two to describe factors influencing nurse managers’ perceived use of dashboards for quality and performance improvement. These two themes, their corresponding subthemes, categories, and additional selected quotes are listed in Table 3.

**Manager as Unit QI Leader**

All managers voiced responsibility for their unit's outcomes when performing QI. As unit leaders, managers used dashboards to facilitate and support QI initiatives with the care team. They identified dashboards as helpful tools for sharing unit information and performing QI work. This theme included two subthemes: (1) Supporting Unit Performance and (2) Increasing Visibility of Unit Performance.

**Supporting Unit Performance**

Managers voiced responsibility for unit outcomes with quotes such as “everything stops at my table” (P2) and “the buck stops here” (P9). To support QI initiatives, managers discussed using dashboards for making decisions that influence unit outcomes. Participant 2 described using dashboards “to generate what the situation looks like based on data. I generate my information, and then from there I'm able to make a decision.” A few managers described dashboards as creating “efficiencies and standardizations, streamlining processes” (P3) for QI work, while most used dashboards as tools to analyze outliers, track and monitor trends and patterns, review performance against goals, and advocate for unit needs.

We were seeing a lot of falls in the department and it was only through pulling a dashboard with lots of information that we were able to determine that a lot of these falls were from patients sliding out of their devices…So we were able to identify that
and put in a measure to stop the patients from sliding but had we not had all this data about how the fall occurred, where the fall occurred at the time like it would be difficult to pinpoint what is the solution you’re looking for. (P10)

Managers perceived dashboards as helpful tools that showed the totality of information so they could visualize trends and implement solutions. Participant 8 noted that once she “noticed that our compliance was down, that set us forth to finding a process improvement plan.” Managers also value benchmarks so they can measure their performance against goals, standards, or similar units and identify areas they can make the biggest impact. Participant 10 shared, “we use them for benchmarking. We use them for goal setting. We use a dashboard to help kind of figure out if are we hitting goal or are we not?”

**Increasing Visibility of Unit Performance**

**Communicating the Data.** Managers described using dashboards to increase the visibility of unit data, which helps facilitate communication to the staff about QI work. Managers identify opportunities from the data and then use dashboards to ensure transparent and open discussions. Managers share dashboard information with individual nurses, at staff and/or quality meetings, via email, and as unit displays to start and drive QI conversations.

…I'm seeing outliers or concerns, I'm either talking with a nurse directly or I am putting it into our daily huddle. If I see something that's more global or bigger of a problem, then I feel like everybody could benefit from it. I might put something into the newsletter. I am talking with my educator, letting her know concerns as well, so she can also monitor. (P5)

…so it's a natural physical item that lives right on our unit that displays the outcomes of the unit, the goals that we're trying to hit. I write out trends that are happening and
things for the team to remember…It's something I can refer back to with the team. So when we huddle twice a shift, we huddle by that whiteboard and we can call out things or it keeps us on track for those things that we think are high priority. (P10)

As a communication tool to increase information awareness, managers also used dashboards to celebrate achievements and boost morale. Managers emphasized not only looking at the improvements but also well-performing areas to encourage staff to continue QI work.

I'm trying to use the data to build on strengths rather than make them feel like they're being berated by the data. That's become very loud and clear. The staff have made that clear, the communication needs to include the good, not just the bad. And so I'm trying to do that, pointing out where we're good. (P6)

So I'm actually a big proponent of celebrating the wins. I think you can focus on the opportunities, but you shouldn't dwell only on opportunities because it just drags the culture down of the unit. So that's why all of my dashboards are very much color-coded. And so seeing the green is what we celebrate. I don't even really bring up the poor data points unless we're seeing a trend. If it's a one-time, one month happens to drop before below our benchmarks, you know the team can see it, but I don't dwell on it. We dwell on the good. We dwell on what made those scores productive. (P9)

**Engaging the Team.** Managers also described their role as ensuring staff had the information to be aware of how their care influences patient outcomes. Participant 3 stated, “It's my responsibility to make sure that the direct care staff have an understanding of how their essential job duties and their day-to-day interactions impact our quality metrics.” By sharing dashboard data, managers can discuss the dashboard relevance and the impact of unit
initiatives on dashboard data. This allows managers to engage staff in unit QI by helping staff see the data so they can recognize how their work contributes to achieving unit goals. Engaging staff also helps create staff buy-in so direct care members are involved in the implementation process.

They have to see it [data/dashboard]. They have to be able to ask questions to understand it and then say, how do you think we can fix this? Anybody has any quick whip ideas that we could put into place that won't take up a whole lot of effort and if we can see if it makes a change or not? (P7)

**Influencers of Dashboard Use**

Managers identified factors they perceived influenced dashboard use for unit quality and performance improvement. Those factors were divided into four subthemes: (1) External (2) Personal, (3) Data, and (4) Technology Features.

**External**

**Regulatory/Standards.** Most managers described regulations and practice standards that influenced quality metrics displayed on their dashboards. These regulatory and accrediting bodies included federal, state, local, and professional organizations that set quality standards that managers “don’t have control over” (P3). Participant 10 stated, “We have some dashboards that are tied to CMS [Centers for Medicare and Medicaid Services] …we have goals and measures that we track in order to maintain CMS compliance.”

We have state regulations that we have to abide by. So most of these quality improvements are from the state…So these are some of the indicators, the requirements …the standard we have to maintain as a perinatal department. So they give us indicators and then we track them… regulatory bodies. We get some of those
indicators from there as well. So standard of practice or standard of care, those are some of the places where we get those indicators. So that's how we track the things that we do on the units. (P2)

**Organizational Expectations.** Managers also discussed senior leadership and organizational expectations influencing dashboard use. For example, Participant 3 stated, “Both at an organizational, hospital, and then department level, those expectations are set.” Participant 9 stated the dashboard “just became a standardized communication tool... just like using e-mail, it's just part of the expectations. It's part of the data sharing process.” In contrast, two participants stated there were no expectations within their hospital, such as “[my leaders] don’t really expect [using dashboards], but I do it if it makes sense” (P1). Most participants mentioned “loose expectations” where managers receive directions from senior leadership based on organizational goals but “it's up to [them] to facilitate it and reach [their] goal” (P8).

I’m expected to know what I need to know to run my unit well… there’s no mandate you need to be in this dashboard daily or this one weekly. They’re available for use to operationalize and to leverage as we see fit. And I see fit to do so I try to use them. (P11)

**Organizational Resources.** Most managers referred to organizational departments, such as Quality and Safety, Risk, Infection Prevention, and Information Technology (IT), that influenced receiving data or metrics on dashboards. Participant 7 mentioned, “We have the help of Quality to help get the data.” One manager shared how organizational resource availability influenced access to quality data.
If you have an organization that is willing to spend the money on [IT] analytics, not only with the personnel but with the technology portion of it, you can go so far with that because we had that for a moment and then budget cuts came and they scaled back…Once that [ability to request or pull reports] was taken away, the analytics team started telling us what we should be monitoring rather than us telling them where we thought that the problems were and that became very unhelpful…so you're as successful as the systems that you finance and build…it is the organizational resources willing to work with you as a frontline staff to be able to determine what you needed, right? … [but] it's the people at the front line that maybe have the trends, they know the trends in their brain. (P6)

Few managers, especially those in specialty areas, relied on resources within their units, such as direct care nurses or staff with administrative responsibilities assigned to the unit. These individuals performed audits or gathered dashboard data for unit-specific QI work. For example, in the rehabilitation unit, “a clinical or quality coordinator… puts together a lot of internal data … [to] track physician documentation, compliance, the rates at which patients are admitted” (P10).

**Personal**

*Personal characteristics.* Managers described their personal qualities as being competitive, confident, optimistic, black-and-white, and adaptive. Nearly half discussed being data-driven and analytical. These personal qualities helped explain how they used dashboards for QI.

I am very data-driven. My brain naturally goes to that. I'm a blue color. So I am a ‘give me the facts, give me the numbers.’ I'm very in tune with graphs that show
positive results or negative results. So that's kind of my personality style. I'm not really a light and fluffy and how do people feel about it and how do you interpret it? I'm more black and white, so either the number goes up and it should go up or the number is going up and it should be down. We're gonna fix it. So I'm very black and white or type A…So maybe that's why I like dashboards so much. (P9)

Understanding and Familiarity. Managers perceived understanding how to use data and dashboards influenced their comfort and confidence in sharing dashboards as the unit leader. Participant 7 shared, “I have to understand it [dashboard] in order to be able to speak about it. So if I don't understand it, I'm not gonna share it, cause I'm gonna feel uncomfortable.” Knowledge of data and statistics was also associated with understanding dashboards. For example, Participant 10 shared, “I feel competent reading data and that can be overwhelming perhaps for others.” Participant 9 with less data knowledge agreed, “I definitely think if I had my masters and had gone through some of my analytics courses before becoming a manager, maybe the transition wouldn't have been so hard. Maybe I could have understood the data a little bit better.” Managers also perceived understanding came with familiarity developed over time. Participant 2 noted, “it just takes getting used to. The more you do them [dashboards], the more you kind of get familiar with them.” Lastly, managers voiced a lack of knowledge about using dashboards and stated more education was needed so dashboards could be used more effectively.

I do think that's a gap. I think leaders need to have more classes on like how to use <data warehouse> correctly and how to use <EMR> reports too... And I feel like that's a gap that we could really learn more about because I'm sure there's a lot of
things that I do manually that I probably could do more extracting the data electronically. But I just don't know how to do it. No one taught me that. (P1)

**Data**

**Data Availability.** The amount of data available to managers were found to be overwhelming for some. “…just there's so much out there and which one should we really be focusing on? … If there's 10 reports...I think we need direction of what those ten are” (P1).

Others found dashboard data valuable and underutilized. “I think our ability to leverage data is increasing every year, and the expectation that we do so increases as well” (P11).

Participant 6 shared “I think there’s opportunities where we can use our data a lot more... [And] in order to articulate [data trends] and gather your resources for senior leadership or whatever to create your business case, you need the data.”

Due to the availability of data, multiple dashboards were used to support QI work, including those in the electronic medical record, from government or professional organization's data registries, the organization's enterprise data warehouse, and custom-made unit-specific dashboards. Participant 2 stated, “I have multiple dashboards, like there's a dashboard for everything.” A few managers found multiple dashboards confusing. Participant 1 shared, “It is confusing. It really is at the end of the day, I personally use a couple different ones that I look at all the time”; however, multiple dashboards were perceived as valuable, as dashboard use was situation-dependent.

I think the two dashboards that we have serve different purposes….As a leader, for educating my teams on our quality metrics initiatives, I think that the nursing excellence dashboard, so that stagnant dashboard serves its purpose. I think it works well. I think for me as a manager trying to better understand whether it's to verify or
challenge things, I personally like having the ability to be able to weave in and out of [EMR]. (P3)

Data Quality. Managers also discussed data accuracy in QI work. A few trusted the data: “I don't think I've ever had an opportunity or a concern that something didn't seem right” (P5); however, most felt accuracy was a concern. Some mentioned automated reports feeding into dashboards were flawed because of a coding error, how they were set up, or “some piece of logic, whether it's a computer upgrade or something else” (P6). Others discussed errors related to manual data entry into dashboards. “Well, obviously, manual data always makes you kind of nervous, right?” (P4). Access to accurate data were also mentioned. Participant 6 stated, “Because really, I mean, I'm gonna use data to prove a point…[so] you want it to be complete. You want it to be accurate. You certainly don't want to have a whole bunch of numbers and missing something.”

Participant 10 went beyond challenging data accuracy and discussed bias in interpretation:

It is incredibly beneficial to understand bias…not only bias that goes into the data … you're trying to measure. But then also recognizing human bias when trying to come to conclusions, not trying to be swayed by anchor results or happenstance or by the immediacy of something…but trying to be objective.

Timeliness of receiving data was associated with data quality and the ability to implement and monitor interventions. A few participants kept track of outliers in real-time to maintain timely data. Participant 3 shared, “As a leader, I'm already aware of those kinds of what's happening on the unit…a fall…a pressure injury because I'm doing a more patient-specific or event-specific drill down.” However, most participants were frustrated with the
lack of real-time data, as they were “looking at [dashboards with] old data…so the fastness of getting data is important” (P9).

Sometimes, I’ll get the data three months out. And, I feel like we should be able to abstract or collate that data and get it to the important people that are gonna take action on it a little bit faster than quarterly for some of the things that are so impactful that we're tracking. (P11)

**Useful Data.** Most importantly, managers perceived data had to be meaningful on their dashboards. Dashboards should display relevant unit quality indicators; otherwise, managers would not find value in collecting or reviewing data that did not drive interventions and outcomes.

I'll have trouble…it was 100 patient days or 1000 patient days…it's hard for me to picture how many falls I've had. If somebody says I've had 2.5 falls per 1000 patient days, that really doesn't mean much to me. Now, if you…say you've had four falls this month, four falls last month and four falls the prior month. That's like ‘Oh My.’…it's more significant than saying 2.5 falls per 1000 days, that means nothing to me. (P5)

I'm never afraid to challenge the format of something or the data that's being collected. If I don't think it's gonna have value, I don't see any reason to monitor it or just take time to fill it out. So we do modify our dashboards to fit whatever our purpose is. I don't like to collect data just to collect data. It's gotta have an actual impact and a goal. (P9)

*Technology Features*
Dashboard Displays. Managers described favorable dashboard presentations and characteristics as those that are simple, easy to understand, easy to use, and on one page or location. Participant 6 stated, “[Dashboard] is clear. There's not too much information on there when there is a description of the events, it's short and succinct.” Participant 9 similarly noted, “It's not going through multiple pages... All the data is in one spot... I can look at multiple metrics, see how they compare to each other without flipping through various graphs and line items.” Thus, complex dashboards were not favored. “If [dashboard] was very complex and lots of different clinks, clicks and links, I think it would be underutilized because we wouldn't know how to use it” (P1).

User Interactions. Managers mentioned important and desirable technical features such as the ability to filter, perform further drill-down, or manipulate dashboard displays. Participant 10 shared, “I really like that ability to apply the same filter to different types or amounts of data or timeframes so I can... look at things through different frames or different lenses to get a better sense of what is happening.” Similarly, Participant 4 noted, “I find that when technology takes you in layers, I find that to be the most useful.” One manager desired the ability to interact with the dashboard by inserting comments so others could understand the QI work done.

I sometimes wish there was a way to notate in the trend lines... make comments where if you had investigated a trend, determined what may have impacted the trend... so that if you go back six months later and be like, well, why did that dip down there? ... you would be able to reference a spot in that timeline... and find your outlier or an explanation of what occurred. (P11)
Customization. As a feature, managers described how they created their own dashboards because existing dashboards did not fit their needs. For example, Participant 4 said, “When I get into really specific things, it gets a little bit harder to run reports and have dashboards made for things that I might identify as being an issue.” Thus, managers built customized dashboards, a preferred and accepted feature. Participant 10 shared, “I really like that our EMR lets you kind of build dashboards …on the fly to quickly synthesize information, as long as you understand what it is you're trying to get information on.” Not all were proficient at using features that allowed dashboard customization, and thus, most created dashboards on spreadsheets where they manually retrieved and entered data. Participant 11 said, “And then I just go manually and insert the stuff in [dashboard].” This manual work of populating unit dashboards was perceived as time-consuming. Participant 5 described, “It actually takes me, I know it doesn't sound like a lot of time, but it probably takes me half an hour, 45 minutes a month to enter the data.” Thus, automation was desired. “I think probably the only thing would be is that they [dashboards] are manually populated. I think it would be very helpful if they could be auto-populated” (P9).

DISCUSSION

There are few published studies on dashboard use in nursing that include the hospital nurse managers’ unique perspective on quality dashboards at the unit level to influence QI work (L. Jeffs, Beswick, et al., 2014; L. Jeffs, Lo, et al., 2014; Piech et al., 2021), which is a gap in the current literature (Young & Vogelsmeier, In Press). Our findings revealed that dashboards are useful and important tools for driving unit quality and performance improvement initiatives that are influenced by various factors in the hospital nurse managers’ personal and work environment.
Nurse Managers’ Perceived Use of Dashboards

As leaders responsible for unit outcomes, managers described using dashboards to 1) make decisions in QI and 2) increase the transparency of unit information. Managers use dashboards to assess overall unit performance by trending, monitoring, and benchmarking themselves against similar units and/or best practice standards. They identify patterns and opportunities in the data, so they can implement solutions and improve unit structures, processes, and outcomes. As leaders, their role is to understand and synthesize dashboard information to make decisions and direct unit QI initiatives impacting patient care. These findings align with the existing interdisciplinary healthcare literature that dashboards are tools used to aid in decision-making so leaders and clinicians can evaluate and improve performance (Bucalon et al., 2022; Buttigieg et al., 2017; Dowding et al., 2015; Iftikhar et al., 2019; Wilbanks & Langford, 2014).

Nurse managers also described using dashboards as active and passive communication tools with staff nurses to encourage their awareness of unit performance and to tell the unit’s story. By providing regular unit performance feedback, frontline nurses can understand how their care contributes to patient outcomes (L. Jeffs, Beswick, et al., 2014; L. Jeffs, Lo, et al., 2014). Further, nurse managers share dashboard data to recognize opportunities and achievements. Managers not only communicated problems but described how they also praise staff, so they feel empowered to take accountability for driving care outcomes (Piech et al., 2021). Showing where the unit performed towards improvement or in the “green” has helped managers build morale and capitalize on their staff’s strengths so the team can continue to achieve better patient outcomes. This use of dashboards to positively reinforce and encourage nurse engagement in QI further supports the importance for nurse
managers as leaders in sharing data to facilitate staff engagement in QI, which has been associated with better quality care and patient outcomes (C. Alexander et al., 2022; Brennan & Wendt, 2021; Dempsey & Assi, 2018).

Increasing the visibility of unit performance data also helps nurse managers use dashboards to engage staff in QI work. Findings from a literature review noted that enhanced visibility and integration of information can foster collaboration between staff, leaders, and departments due to the recognition of how teamwork and improved performance can impact organizational goals (Buttigieg et al., 2017). In our study, managers described sharing dashboards so they could provide the supporting tools needed to encourage active team participation in the implementation plan. By showing dashboard data, managers can review opportunities and discuss solutions with staff. This helps staff understand the focus of unit QI work so their involvement can ensure interventions are successful and sustained. These findings add to the nursing literature by suggesting that nurse managers can use dashboards as informational sharing tools to fulfill their managerial responsibilities in supporting and engaging front-line staff in unit QI efforts (C. C. Alexander et al., 2022; Dainty & Sinclair, 2017; Dempsey & Assi, 2018; L. Jeffs et al., 2016; L. Jeffs, Lo, et al., 2014).

Factors Influencing Nurse Managers Perceived Use of Dashboards

How hospital nurse managers used dashboards to perform and share unit QI was influenced by factors within their work environment and inherent within themselves. Using the modified TAM model as a guide (Mashinchi et al., 2021), our findings revealed four perceived factors influencing dashboard use: External, Personal, Data, and Technology Features. External factors provided direction and support for dashboards used for unit QI work. Data and technology features were factors that described the availability, accessibility
integrity, and characteristics of dashboard tools. Personal factors shaped how varying
personalities and knowledge levels contributed to dashboard use.

Regulations, standards, and hospital expectations overall guided dashboard use in the
nurse managers' work environment but outside of their control. In our study, managers
discussed measuring certain quality indicators pertinent to their patient populations to
maintain accreditation or compliance with national, state, or local guidance and standards of
practice. A few managers were also expected to use dashboards required by their hospital
leadership; however, many were expected to maintain unit quality outcomes but could choose
which dashboards to use to meet those expectations. These findings support dashboards
developed and implemented within hospital settings, where regulatory governances and
senior leadership heavily influence measurements, requirements, and expectations of quality
dashboards (Bohm et al., 2021; Weggelaar-Jansen et al., 2018).

Further, organizational resources influenced nurse managers' support for dashboard
data. In our study, nurse managers mentioned collaborative departments, such as Quality and
IT, that affected their ability to receive dashboard data for unit QI work. These departments
provided dashboards or data that managers needed to monitor their unit quality indicators.
For example, participants shared the IT department helped create reports; however, one
participant shared that when organizational resources were reduced, she could not obtain the
necessary data and was informed what metrics to monitor due to IT resource availability.
Additionally, managers of specialty units, such as obstetrics and rehabilitation, relied on their
educators' or unit staff members’ assistance to gather unit-specific quality dashboard data.
These findings suggestive of supportive organizational environments and resources,
including financial and human, are consistent with the literature as key influencers to
accessing and implementing effective hospital or unit-based quality dashboards (Buttigieg et al., 2017; L. Jeffs, Lo, et al., 2014; Jones, 2017; Wilbanks & Langford, 2014).

Dashboard data contributed to the supporting tools in the nurse managers' work environment. Our findings demonstrated that nurse managers perceived data quality, usefulness, and availability as factors impacting quality dashboards for unit QI. Nurse managers voiced concerns about the reliability and timeliness of dashboard data, which are barriers to dashboard use reported in the literature (Alvarado et al., 2021; Taber et al., 2021; van Deen et al., 2019). The lack of data quality was perceived to stagnate QI progress as managers needed to trust quality dashboard data as the source of truth for decision-making. Additionally, dashboard data had to be useful so managers could extract important information requiring immediate attention. A dashboard with irrelevant quality indicators or data without meaning was perceived to lack value. This finding reinforces perceived usefulness as a key predictor of technology adoption and use (Davis, 1989) and aligns with perceived usefulness as a main indicator in dashboard evaluation studies (Alvarado et al., 2021; Daley et al., 2013; Laurent et al., 2021; Wu et al., 2019). Our study further revealed new findings that the amount of available data influenced dashboard use. Leveraging a lot of data or using multiple dashboards benefited some managers in advancing unit QI work while others felt deterred without guidance or focus. This finding suggests all relevant dashboard data should be available to nurse managers but streamlined to include direction and attention to what, when, or which dashboard(s) to use.

Available dashboard technology within the organization was also perceived to both facilitate and hinder dashboard use. Managers described technical features that facilitated dashboard use as easy-to-use, easy-to-understand, one-page summary views with interactive
features. These desirable characteristics help managers review unit performance at a glance and allow for further analysis, which is consistent with the literature that dashboards should be presented in simple, familiar, and well-organized displays so data can be comprehensible, useful, engaging, and actionable (Al Ghalayini et al., 2020; Noël et al., 2017; Reeder et al., 2020; Sander et al., 2015; Tiase et al., 2021; Zwijnenberg et al., 2016). Automated data feeds and the ability to notate on the dashboard were additional features that were not available but preferred. While existing dashboards with desired characteristics facilitated dashboard use, interestingly, managers created their own unit dashboards by manually combining multiple dashboard data. This finding represents a work around that may seem like a positive feature with evidence of ingenuity tailored to the unit manager’s needs; however, workarounds can be problematic if tailoring circumvents an important feature of the technology (Boonstra et al., 2021; Fraczkowski et al., 2020). Thus, there is a need to explore dashboards developed for nurse managers to ensure that their needs are met without compromising critical features of the technology. Dashboard usability studies, which use user-centered design, involve users throughout the creation and evaluation of user-desired features to assess whether dashboard technology fits user needs (Fischer et al., 2020; Reeder et al., 2020; van Deen et al., 2019; Williams et al., 2021). Applying these principles, hospitals should consider engaging nurse managers during the design and evaluation of simple, usable, useful, and interactive dashboard solutions to minimize manual efforts of customizing dashboards for unit QI work.

Finally, hospital nurse managers' inherent characteristics, knowledge, and capabilities were mentioned to influence dashboard perceptions and use within their work environment. In our study, nurse managers rated feeling more comfortable using dashboard data compared to navigating through a dashboard but still needed understanding and familiarity with how to
use dashboards, what the dashboard data represented, and the availability of dashboards for their role. This finding aligns with the literature that nurse managers rate feeling competent in using technology (Warshawsky et al., 2020), as more than half of bachelor's and graduate-level nursing programs include courses in informatics (Bove, 2020). However, there are additional opportunities for nurse manager education and preparation programs to include technology use in organizational professional development plans (Gunawan et al., 2018; Ullrich et al., 2021; Warshawsky et al., 2020) so they feel competent in effectively using available quality dashboards within their organization. Additionally, managers in our study shared varying levels of knowledge and experience with data and dashboards, which is consistent with the literature when healthcare professionals were presented with information on dashboards (Dowding et al., 2018; Lopez et al., 2016; Noël et al., 2017; Zwijnenberg et al., 2016). This further supports the need to consider differences in knowledge, experience, and numeral and graph literacy levels when designing dashboards for the use and understanding of quality information.

In addition to educational needs identified in the personal factors influencing dashboard use, our study added new findings of personal characteristics, such as data-driven, competitiveness, confidence, and optimism, that influenced nurse managers' perceptions of dashboard use. For example, those stating as data-driven discussed needing additional dashboard data to analyze the problem while those who were competitive used dashboards as a motivator to outperform others. Thus, nurse managers’ personal qualities in addition to their knowledge levels need to be considered when integrating and developing quality dashboards for unit QI work.

**IMPLICATIONS**
This study has important implications for hospital nurse managers using dashboards for unit quality and performance improvement. Dashboards need to be available, accessible, simple, and easy to use so nurse managers can perform QI work and share unit performance data with staff. Dashboard data should be useful, understandable, engaging, and relevant so nurses can identify opportunities and successes. Hospital nurse managers should be able to make decisions based on accurate and timely dashboard data that align with regulatory and leadership expectations supported by organizational resources. In addition to these dashboard characteristics, varying personal factors and levels of knowledge should be considered when developing quality dashboards to meet hospital nurse managers’ needs. Hospitals need to consider nurse manager education or competency training plans that include dashboards and data so nurse managers can effectively use dashboards for unit QI.

LIMITATIONS

There were several limitations to this study. First, transferability to other settings was limited since participants were sampled from one health system. Second, because participants chose to be in the study, there was a risk of self-selection or volunteer bias. Those choosing to participate could be more comfortable with dashboards and QI. Diversity was also limited despite recruiting in a health system within a geographically, racially, and ethnically diverse setting. Additionally, recruitment was challenged as four hospitals were undergoing leadership changes. Third, due to the organizational policy where the study was conducted, dashboard sharing and observations were not allowed. Thus, questions about dashboard displays relied on participant descriptions and perceptions. Fourth, one researcher recruited, interviewed, and analyzed the data; however, a second researcher was consulted throughout the study to ensure the rigor and trustworthiness of the findings.
CONCLUSION

Dashboards remain important tools for nurses engaging in quality and performance improvement initiatives. This study adds to the literature by identifying hospital nurse managers’ perceptions of quality dashboards, including the influencers associated with dashboard use. Hospital nurse managers need access to relevant, accurate, useful, and simple dashboard solutions so they can perform QI work and engage the care team throughout the QI process. Factors nurse managers can and cannot control within themselves and their work environment, however, need to be considered when encouraging dashboard use for unit QI. Future research should evaluate dashboard designs that are desirable to this population, and nursing leaders should consider incorporating dashboard, data, and technology education into the nurse manager role.
References


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https://doi.org/10.1142/S0219467815400057


https://doi.org/10.1016/j.jbi.2017.05.024


https://doi.org/10.1177/1525822X05279903


https://doi.org/10.1016/j.jcjq.2017.05.010

https://doi.org/10.1075/idj.23.1.11noe

https://doi.org/10.1097/01.NUMA.0000724940.43792.86

https://www.healthypeople.gov/2020/topics-objectives/topic/healthcare-associated-infections#1

https://doi.org/10.1136/bmjopen-2014-005055

https://doi.org/10.1097/01.NUMA.0000733660.62672.8e

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7153077/


### Table 1

**Influencing Factors** (Mashinchi et al., 2021)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational</td>
<td>This factor includes organizational characteristics in the decision to adopt new technology, including its implementation and use. Examples include the hospital’s norms, expectations, or culture, the need for the dashboard, and compatibility of information technology infrastructure, and resource commitment.</td>
</tr>
<tr>
<td>User</td>
<td>This factor refers to the users' capabilities and characteristics that affect their perception and beliefs of the dashboard. Examples include literacy (graph, numeral, visual), previous knowledge and experience, enthusiasm and confidence, and education level.</td>
</tr>
<tr>
<td>Technology</td>
<td>This factor refers to the dashboard, such as the visual interface or design, interactivity with the data to answer questions, real-time access to data, quality of information, and support available for users.</td>
</tr>
</tbody>
</table>
Table 2

Participant Demographics

<table>
<thead>
<tr>
<th>Measure</th>
<th>Item</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
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<td>10</td>
<td>91%</td>
</tr>
<tr>
<td></td>
<td>Black</td>
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<td>9%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
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<tr>
<td>Ethnicity</td>
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<tr>
<td></td>
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<td>0%</td>
</tr>
<tr>
<td>Gender</td>
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<td>82%</td>
</tr>
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<td></td>
<td>Male</td>
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</tr>
<tr>
<td>Age Group</td>
<td>Millennials (26-41 years)</td>
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<td></td>
<td>Gen X (42-57 years)</td>
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<td></td>
<td>Baby Boomer (over 58 years)</td>
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<td>Years as RN</td>
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</tr>
<tr>
<td></td>
<td>1-2 years</td>
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<td>0%</td>
</tr>
<tr>
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<td>0%</td>
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<td>6-10 years</td>
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<td></td>
<td>11-15 years</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>&gt; 15 years</td>
<td>9</td>
<td>82%</td>
</tr>
<tr>
<td>Years as Manager</td>
<td>&lt; 1 year</td>
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<td>9%</td>
</tr>
<tr>
<td></td>
<td>1-2 years</td>
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<td>18%</td>
</tr>
<tr>
<td></td>
<td>3-5 years</td>
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</tr>
<tr>
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<td></td>
<td>&gt; 15 years</td>
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</tr>
<tr>
<td>Highest Level of Education</td>
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<tr>
<td>Unit Type</td>
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<tr>
<td></td>
<td>Obstetrics</td>
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<tr>
<td></td>
<td>Emergency</td>
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<td>9%</td>
</tr>
<tr>
<td></td>
<td>Rehabilitation</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Oncology</td>
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<td>9%</td>
</tr>
</tbody>
</table>
Table 3

Summary of Themes, Subthemes, Categories, and Select Quotes

<table>
<thead>
<tr>
<th>Themes</th>
<th>Subthemes</th>
<th>Categories</th>
<th>Sample Quotes</th>
</tr>
</thead>
</table>
| Manager as QI Leader | Supporting Unit Performance | (N/A- No category) – Includes: Monitoring QI interventions, identifying patterns or areas of opportunities, benchmarking, decision-making | • “They’re [dashboards] so intertwined in my work, probably because I choose to look for data to support pretty much everything that I do. It’s probably easier to say, like how don’t we use them [dashboards] because I very much want data to support the decisions that we make on the unit, whether it be for quality, patient experience, patient safety, you name it. I try to have quality and dashboards and data associated with it.” (P10)  
• “I think for me as a manager trying to better understand whether it’s to verify or challenge things. I personally like having the ability to be able to weave in and out of <EMR> [dashboard].” (P3)  
• “I think it’s our duty to support the staff by tracking any trends or increases or decreases in our quality metrics. So for instance, when we’re looking at our falls per 1000 patient days, we can break that down as to where, when, how that fall happened to really drill down to the root cause in order to find those trends to build better structure or process improvement according to that data.” (P8)  
• “Well, so there is like if it’s 100%, it’s green, if it’s under 100%, there’s a color. And then if you’re really bad at it, it’s red. And then for the Falls Dashboard, if it’s a positive, like for example, they weren’t using any of our fall standard work then I’m I’ve got some different colors in that to help. So I can look at it quickly and say like, oh alright, we’re really falling out and we’ve got a lot of red, we’re not using the yellow fall band or something.” (P5)  
• “So with those metrics, I look at what do we have control over in our department? What are the things that we can impact? So right now with stroke, looking at our door to CT time, I’m looking at our TPA documentation to make sure that we’re providing the safe environment for our patients and as well as our dysphagia screen. So my current process right now is try to figure out where we have the gaps, what are the gaps. So...kind of the quality...” |
process, you look at your problem and then you start looking to see what your barriers are and how you can break down each one of those barriers and look at the process pieces and implement them to see if it impacts the outcome.” (P6)

<table>
<thead>
<tr>
<th>Increasing Visibility of Unit Performance</th>
<th>Communicating Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“I see myself as that person who brings the numbers to an operational level so that staff understand the why so that they can support [QI work]” (P3)</td>
</tr>
<tr>
<td></td>
<td>“Absolutely super transparent. I think I’ve learned over time if you focus on the negative that doesn't work, if you focus on the positive, it makes people feel good, but you don’t get results. I think the only way to do it is just be fully transparent. You share everything. You give lots of kudos and say hey, what do you think about this? What, How can we change this number? (P7)</td>
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<td></td>
<td>“I share with them on the unit actually print it out and then I share with them like the processed information, I don’t share all of the nitty gritty, but the processed information, yes, I share with them...it’s everywhere. The conference room, the break room, it’s everywhere. It’s in the e-mail. It’s everywhere.” (P2)</td>
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<td></td>
<td>“So we have to make sure that we can tell the story through our data and show improvement so it keeps everyone driven to continue the work... Mainly the dashboard is to tell the story, so it just depends on what story we’re trying to tell.” (P9)</td>
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Engaging the Team

|                                          | “We form subgroups and try to involve the frontline staff and then others, whether it's my clinical nurse specialist, whether it's different departments, whether it's physical therapy, for example. Like if we're talking about falls, we're all-inclusive. So a lot of times they'll say, like do you think this is possible? What do you think about this? So they do include me in the conversation, but at the end of the day, I'm not always the one coming up with the plan.” (P1) |
|                                          | “I might do some of the pre-work to kind of set maybe the guardrails for what is possible and what is not possible, setting that in scope, out of scope, but as often as possible, we try to bring things to the team for solutioning...A good example of this is we were looking at patient engagement scores. And they're good, but we want to be better. So we |
brought to the team and saying, what are some other ways in which we could improve the patient experience? And it was actually the team that came with an idea of celebrating patient birthdays.” (P10)

• “I definitely try to encourage my team to do the actual implementation or designing of the process improvement because you get more buy in if you actually have direct members that are going to be implementing the changes involved in the process development... and then it’s [dashboard] also a conversation starter. So if we do start to see a couple boxes that are red for a couple months, the staff will actually bring up concerns of ‘why are we headed the wrong direction? What can we do as a team to improve them?’ So...we can look at the dashboard to kind of do a deeper dive as to how we can improve?” (P9)

Influencers of Dashboard Use

- External Regulatory/Standards
  - “We’re a Commission on Cancer accredited program, they have metrics and there’s 30 some standards that we need to meet as a program. And there are metrics within that program with dashboards that we follow.” (P4)
  - “So we’re unique, we’re a different kind of hospital than other places. So we actually fall into a different CMS rating...have to look at different measures, so we look at length of stay or transfers out within 24 hours...So we have measures that we have to track. So those are more regulatory measures that we keep on dashboards.” (P9)
  - “So we do have specific service lines. An example... neurology stroke program have certain metrics we need to meet to be able to maintain the quality of those service lines, so those metrics we’re looking at and tracking and trying to improve on because they impact our ability to maintain those service lines and to increase our patient population in those service lines.” (P11)

Organizational Expectations

- “I think the leadership that’s in place...they’re teaching all of the managers that really this [dashboard] is a great resource and tool to try. I think historically we did a lot of storytelling and now it’s like no really, that’s OK, so that may identify a problem, but let’s look at the data and what else we can do to kind of connect those two to make it stronger and to help find more opportunities...And I do think that <using data / dashboards> is an expectation within the organization.” (P7)
<table>
<thead>
<tr>
<th>Organizational Resources</th>
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<tr>
<td>“I rely on like &lt;quality leader&gt; and other people in other departments that are leading different initiatives to bring to send me the data.” (P1)</td>
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<tr>
<td>“I have a whole team that helps with it [data in dashboard]. So I have a perinatal data specialist, I have an education coordinator, I have 3 perinatal data specialists who help with the job and I have an education coordinator who is also very excellent and I have a few other nurses who help out as well.” (P2)</td>
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<tr>
<td>“Infection prevention. I’ve been working very closely with our liaison from that department. In the ICU…we’re doing the CAUTI initiative, which is one of our paper kind of internal documents that we’re tracking and we’re working with them on that data and improving our outcomes.” (P11)</td>
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<thead>
<tr>
<th>Personal Characteristics</th>
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<tr>
<td>“I tend to be a little bit competitive…So I tend to like to be in the green as a leader and so I am constantly worried about how we’re doing” (P1)</td>
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<tr>
<td>“I’m very analytical, so I’m very strategic. I am futuristic and for me to be futuristic, I need my numbers.” (P2)</td>
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<tr>
<td>“I’m very black and white. I’m very ‘these are the rules. We don’t deviate from the rules. This is what I was told to do. So this is what we’re going to do.’ I’m like a total rule follower. And that’s why I like the data because the data is telling me what’s going on and if I’m understanding it, it feels like it’s the truth.” (P5)</td>
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<tr>
<td>I’m very optimistically driven. I look for the positive in things. I’m always going to be looking for the positive in the data. And I have to be more objective.” (P8)</td>
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<tr>
<th>Understanding and Familiarity</th>
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<tr>
<td>“It’s great to have these dashboards and stuff, but if we don’t understand it, we can’t share it. We can’t teach our teams what we need them to do differently or celebrate.” (P1)</td>
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</table>
• “It’s the same thing with the dashboards. It’s just another tool for us to use. If we get familiar with it and we use it routinely, it is not laborious, and you learn shortcuts and can quickly kind of incorporate the data into your workflow where if you’re not comfortable with it and it feels bulky and time consuming to find what you need, or if you open up a dashboard and you’ve tried three times to find something you need and you can’t find it, you’re never gonna open that dashboard again because it doesn’t do anything for you.” (P11)
• “So it’s also learning. I guess there’s a certain aspect of using a dashboard in that where do I get the information to even know. It’s like I don’t know what I don’t know type of thing.” (P4)
• “It’s lacking in education, and it’s assumed that everybody knows what the dashboard means and a lot of people may, if they’re really data-driven. They may instantly know it. I like data and I like using data, but that doesn’t mean that I always understand what it’s telling me.” (P5)

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<th>Data Availability</th>
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| “There’s a lot of reports. I know that it can become very overwhelming with the amount of reports we have coming at us, especially with the quality portion of being a manager and the operations part of being a manager can really become very overwhelming because there’s so much data coming at you all the time and trying to balance and figure out what’s important right this second versus stuff that I can look at later and do something about can really become stressful.” (P4)
| “I think with any dashboard, somebody could always look at it and still want more data.” (P6)
| “With the dashboards that I look at there’s multiple. So I look at the Falls dashboard, I look at the pain, the violent restraint... CAUTI and CLABSI...HAPI.” (P5)
| “Every dashboard that’s made, even if it has some overlap, they were all made with a purpose, right? And sometimes the data that is presented to you in a dashboard is being presented because the creator wants you to be in this frame of mind or looking at a problem from this direction. Right? So I have like a falls dashboard and I know what I’m looking at, it’s all falls data, but the falls dashboard goes into more detail than mine does. It has more points of data about my unit, whether it be falls or falls with injury that I might not otherwise
Data Quality

- “I just might validate it [data]. I don’t know if I question it [data]” (P1)
- “Your dashboard is only as good as the data that is given to you to populate it. And sometimes if you have multiple hands managing a dashboard...maybe Quality is inputting data into a dashboard at the same time that managers might be at the same time that Infection Prevention might be sometimes. Because they’re live documents the data gets altered mistakenly and no one catches it, and you’re looking at falsified data.” (P9)
- [regarding data accuracy] “There’s times when the numbers don’t make sense and that’s where all the questions come in. Is this a sample? Is this an all? What are they looking at?... [Regarding timeliness] Things go on pause and then you don’t really know where you are because you don’t have access to the data for that amount of time that things are getting figured out. So that’s where it goes back to the process where you hope you put the right process in place at the beginning to get the outcomes that you wanted while you’re waiting for the data to support it or not support it.” (P7)

Useful Data

- “As a leader, I think the items on there [dashboard] have a lot of meaning to staff. When I talked to them about the number of hospital-acquired pressure injuries that we had last year compared to this year, when we’re reviewing that information they’re tracking they understand. And so I think for me that’s really helpful because it’s organized in a way that makes sense to people of varying knowledge, skills and ability.” (P3)
- “One is the ability to tell stories because data in and of itself is only meaningful if you understand the story that data is trying to tell you. So you can look at any data and come to a conclusion, but if you don’t understand what’s happening on your unit or your department or your community, it’s not going to be meaningful, right?” (P10)
- “I just ignore the ones that I don’t feel are pertinent to my practice or that I don’t currently need to operationalize something. It’s very possible that a dashboard that has zero value to me this year will be extraordinarily impactful look at. So I just understand that when I’m looking at different dashboards, the intent of those could be slightly different and that’s important. I don’t think you could ever just have one dashboard that tells all stories or all problems or all opportunities or successes. That just doesn’t seem feasible.” (P10)
next year. So I just try not to overburden myself... if nothing is broken, I don't really need to track it and try and fix it. So I try to keep my focus on the areas of opportunity and I don't really look at dashboards that tell me that I don't have a problem because I already know there's not a problem in that area if I'm operating well.” (P11)

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<thead>
<tr>
<th>Technology Features</th>
<th>Dashboard Displays</th>
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<tr>
<td>• “Because it's [dashboard] easy, it's simple. It's very basic...And it does the job” (P2)</td>
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<tr>
<td>• “I think it's very easy to use and I like it. It's helpful for organizing...it's colorful, it's organized, it has tabs. You can see where you need to click to go into another section. When someone writes you a note back on something, it shows up on your dashboard. It's easy to find.” (P4)</td>
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<tr>
<td>• “[Dashboard] is easy to get to, like quick link, click it on, look at it, understand it, and then move on to something else.” (P5)</td>
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<th>User Interaction</th>
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<tr>
<td>• “We were able to filter down, so we’re able to look at each one and figure out, OK, so where is this number coming from? So where is this number coming from?” (P2)</td>
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<tr>
<td>• “I had three cost centers, so I was able then to drill down the specific cost centers...to kind of like weed down the data, it is super helpful to have those filters on there.” (P1)</td>
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<tr>
<td>• “If we could drill down on it and open up a box to see where we are doing good or not doing good or who is or isn’t or whatever, that would be great to drill down.” (P5)</td>
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<th>Customizations</th>
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<tr>
<td>• “I fill on my dashboard to my own specification, like this is what I want on there so this is what helps me better [understand the data or dashboard].” (P2)</td>
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<tr>
<td>• “So unfortunately, it's the data is pulled from various sources, so it is manually updated either biweekly or monthly depending on the data.” (P9)</td>
</tr>
<tr>
<td>• “I pull data from other spots and then I plug it in.” (P5)</td>
</tr>
<tr>
<td>• “If every scorecard could be like &lt;data warehouse&gt; that pulled the metric depending on what it was and we could just open it up and it’d be there. That would be fabulous.” (P1)</td>
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CHAPTER 5: DISCUSSION

Implications for future research

Summary and Synthesis of Findings

Dashboards are tools that summarize large amounts of data into information for decision-making (Wilbanks & Langford, 2014). Nurses can benefit from using dashboards to monitor dynamic unit performance, as dashboards provide nurses with patient-centered data that can inform improvement work intended to influence patient outcomes (Ruppel et al., 2022). This study aimed to understand hospital nurse managers’ perceptions related to dashboard use and factors influencing dashboard use for quality and performance improvement. Chapter 1 provided a background of dashboards published in the literature, this study’s research questions, and the theoretical model used to guide this study. Chapter 2 was a systematic review of literature focused on dashboard displays related to patient and/or dashboard evaluation outcomes. Chapter 3 summarized the study’s methods. Chapter 4 reported the study’s findings. This chapter provides the implications for practice and directions for future research.

Findings from this study align with the published literature that dashboards can be effective tools used to monitor and benchmark performance, communicate information, and recognize areas of opportunity (Bucalon et al., 2022; Buttigieg et al., 2017; Iftikhar et al., 2019; Wilbanks & Langford, 2014). As decision-making and visibility tools, dashboards were used by hospital nurse managers to regularly discuss and review unit performance with staff so managers can support and drive unit quality and performance initiatives. This study also revealed that hospital nurse managers value using dashboards to celebrate unit achievements so staff are engaged in quality and performance improvement work.
Further, in alignment with the adapted TAM that guided this study (Mashinchi et al., 2021), factors identified as influencing hospital nurse managers’ perceived dashboard use were categorized as external, personal, data, and technology features. External, which is a superset of the organizational factor from Mashinchi et al. (2021), included regulatory and organizational expectations, as well as available organizational resources such as consulting departments. Data and technology features, which included components from the technology factor from Mashinchi et al. (2021), involved nurse managers’ need for accurate, available, timely, and useful data, as well as desirable dashboard characteristics that facilitated ease of use and usefulness for QI work. Personal, which is a superset of the user factor from Mashinchi et al. (2021), described the manager’s knowledge level and personal qualities influencing dashboard use. This study concluded that when characterizing hospital nurse managers’ perceptions of quality dashboards, considerations need to include how factors outside and within a manager’s control and work environment contribute to dashboards used for communicating performance, engaging staff, and performing QI work aimed to improve unit patient outcomes.

**Practice Implications**

This study has important practice implications for hospital nurse managers using quality dashboards. As leaders of their unit(s), hospital nurse managers can benefit from using dashboards to make decisions, as well as to communicate and engage staff in quality and performance improvement. To support this work, however, dashboards need to be available, accessible, simple, easy-to-use, and useful so hospital nurse managers can understand their unit’s story and share opportunities and achievements with staff. Nurse managers can also benefit from education and awareness of existing organizational dashboards for unit QI work through hospital onboarding or competency programs, as well as
from structured graduate-level courses in informatics and quality. Furthermore, facilitators and barriers affecting quality dashboard use, such as regulatory requirements, leadership expectations, supporting organizational resources, and the managers’ characteristics should be considered when designing quality dashboards that align with hospital nurse managers’ needs.

**Strengths and Limitations**

**Strengths**

There are strengths and limitations to this study. For strengths, to the best of our knowledge, this study is the first to describe how hospital nurse managers use dashboards and the factors influencing dashboard use, which is a gap in the nursing literature. A few research studies on quality and clinical dashboards in the nursing profession have been published (Dowding et al., 2019; L. Jeffs, Beswick, et al., 2014; Opsahl & Horton-Deutsch, 2019; Tan et al., 2013) but did not focus on the hospital nurse managers’ perspectives of quality dashboard for QI use. Second, a qualitative design allowed for an in-depth understanding of participant perceptions, thus lending further insight into real-world situations since observations and screen sharing of dashboards were not permitted by the organization where the study was conducted. Third, due to the lack of research in this area, a descriptive qualitative design was an appropriate first step in revealing any gaps that can guide future mixed-methods or quantitative research studies. Finally, qualitative designs allow for fluidity in research theory frameworks. Since a TAM for dashboard use in nursing does not exist, using Mashinchi et al. (2021) as a guide allowed for flexibility when framing interview questions and generating themes. This design also encouraged capturing a range of
perceptions so multiple viewpoints could be included to frame how hospital nurse managers use dashboards and the factors influencing dashboard use.

**Limitations**

Despite these strengths, there are limitations to this study. First is the limited transferability to other settings. Participants were sampled from one health system so findings may not apply to other organizational or hospital settings. Most participants were from Magnet-designated hospitals, which require nurse managers to have a minimum of a bachelor’s degree in nursing (American Nurses Association (ANA), 2019). Thus, all participants held a minimum of a bachelor's degree. This is atypical of the United States’ national average for nurse managers’ most common degree, which is 32% Associate’s, 45% Bachelor’s, and 14% Master’s degree (Zippia, Inc, 2021). Therefore, the sample represented a more educated workforce.

Second, recruitment was challenging as four hospitals at the time of recruitment were undergoing leadership changes with new managers onboarding to their roles. Along with recruitment challenges were the consequences of self-selection bias due to voluntary response. An email flyer was sent to hospital nurse managers a few times due to a lack of response, and participants chose to take part in the study. This may suggest those who were more comfortable with dashboards for QI were more inclined to participate as reflected by the high self-reported scores with comfort level using data and dashboards. Further, the sample was limited in diversity, such as individuals of different ethnic and racial backgrounds, which was somewhat surprising given the diversity of the metropolitan city and surrounding suburbs of the health system. However, the age, race, and ethnicity demographics reported in this study were similar to the average nurse manager profile in the
United States, which is over 85% women, 60% White, and the average age being 46 years, or in the Generation X category (Zippia, Inc, 2021). Yet, despite limitations in diversity and self-selection bias, qualitative studies are not intended to generalize but to understand and develop information-rich data that could be representative of the population (Merriam & Tisdell, 2009). Future studies can consider maximum variation sampling or sampling not restricted to a geographic location.

A third limitation was the inability to view dashboards either through direct observation or screen sharing during the interview. Due to the health system’s compliance policies, video recording was not allowed. Rich, descriptive findings had to rely on participant perceptions and responses. This limited additional documentation sources that could have been used to triangulate the results and further assure rigor in the study findings.

Lastly, because this was a dissertation study, only one researcher completed the interviews and data analysis, which is subject to researcher bias. The researcher did bracket her perceptions before beginning the study and consulted with her advisor throughout the data collection and analysis process to verify findings; however, qualitative research is subjective and open to interpretation. Steps to assure trustworthiness were carefully followed.

**Future Directions**

This study revealed two main opportunities for hospital nurse managers using dashboards for quality and performance improvement. First, education is needed for new nurse managers so they can efficiently and effectively navigate dashboards designed to support QI. Study participants held higher degrees compared to the national average, but voiced needing the education to understand and analyze dashboard data, as well as how to use the dashboards and the available dashboards within the organization. This further
amplifies the importance of educational or training preparation for nurse managers with dashboard use for the general nurse manager population. Second, managers created and manually populated data into their own dashboards because existing dashboards did not meet their needs. Some also expressed additional desirable features not existing on current dashboards that would facilitate dashboard use. This finding suggests opportunities in designing and evaluating dashboards to fit nurse managers’ needs for unit QI initiatives.

Future research can build from these findings. First, exploring how staff nurses, directors, chief nursing officers, and nurses in administrative roles (e.g. educators, quality staff, etc.) would be beneficial in gaining a broader perspective of how the nursing profession uses dashboards and the factors influencing dashboard use. For example, bedside nurses may use dashboards differently from their managers, which may also differ from a director or chief nurse due to their role, needs, and expectations within the organization. Nurses also practice outside hospitals and acute care settings, such as in clinics or in the community. These nurses may participate in quality and performance improvement and may use dashboards in these settings. Second, although this study described how nurse managers use dashboards in QI, how the use of dashboards influences patient outcomes remains unclear. More research is needed to evaluate nurses’ use of dashboards with QI outcomes, which was a gap identified in the systematic review (Young & Vogelsmeier, In Press). Third, participants voiced opportunities for dashboard design that would better facilitate dashboard use. While the systematic review revealed variations in dashboard characteristics associated with positive patient outcomes and end-user evaluation responses, there remains no one-size-fits-all dashboard, particularly for supporting hospital nurse managers in unit QI (Young & Vogelsmeier, In Press). Therefore, future studies should utilize exploratory mixed-methods
designs to address this gap by determining nurse managers' needs, followed by designing prototypes that are then evaluated by the same or larger group of nurse managers. These types of studies employ human factors and user-centered design, which have been studied in the dashboard literature for addressing usability, usefulness, and satisfaction (Dowding et al., 2019; Holden et al., 2022; Lewis & Sauro, 2021; Reeder et al., 2020; Schall et al., 2017).

**Conclusion**

Dashboards have been used in healthcare for many years to improve the efficiency and quality of patient care. Dashboards used for quality and performance improvement, however, have been understudied in the nursing population, particularly their use by nurse managers in hospital settings. Understanding how hospital nurse managers perceive dashboards in quality and performance improvement work can provide directions for optimizing quality dashboards as tools used to improve unit patient outcomes at the bedside. This study highlighted the pivotal role nurse managers hold as unit leaders who use dashboards to make decisions and increase information sharing with staff to drive quality and performance improvement initiatives. Their dashboard use, however, is influenced by external, personal, data, and technological factors. Future research should build on these findings through the development and evaluation of dashboards that address these influencing factors so hospital nurse managers can optimize quality dashboards to influence HACs and patient outcomes.
References


Comprehensive References


decision support interfaces. *Journal of Nursing Care Quality*, 31(2), 124–130.

https://doi.org/10.1097/NCQ.0000000000000149


https://doi.org/10.24251/HICSS.2021.446


https://doi.org/10.1227/NEU.0000000000000265


https://doi.org/10.1016/j.jcjq.2017.05.010


https://doi.org/10.1186/2046-4053-4-1


https://doi.org/10.1016/j.outlook.2021.02.008


Appendix A: Screening Survey for Potential Participants

Thank you for your interest in participating in my study entitled “Factors Influencing Hospital Nurse Managers’ Perceived Use of Quality Dashboards for Performance Improvement.”

This is a screening questionnaire to determine if you meet eligibility criteria. Please review the questions below. If you answer “yes” to all questions and still wish to participate, please proceed to filling out this form. If you answer “no” to any of the questions, please close out of this window.

1. Are you 18 years or older?
2. Do you oversee a patient care unit, where those who report to you are registered nurses and/or patient care technicians providing direct patient care?
3. Have you been a nurse manager for at least 3 months, either in your current role or at another hospital/organization?
4. Have you participated, either currently or in the past, in any form of quality or performance improvement initiative?

The following questions will provide an understanding of participant demographics. These questions are optional and will not affect your participation in the study.

A. Hospital
B. Unit type oversight (*select all that apply*): Medical/Surgical, Critical Care, Emergency Department, Obstetrics, Surgery, Ambulatory procedural, other: specify
C. Years of Experience as a nurse manager: <1 year, 1-2 years, 3-5 years, 6-10 years, 11-15 years, >15 years

Lastly, please provide your contact information, which will be used to schedule your interview over Microsoft Teams.

D. Name
E. Email
F. Best days and times to schedule a 60-minute interview.

Submission Page:

Thank you for your submitting your information to participate in the study. The researcher will contact you through the email you provided.
Appendix B: Participant Profile

DEMOGRAPHIC DATA COLLECTION:

Race: Black or African American, White, Asian, American Indian/Alaska Native, Native Hawaiian/Other Pacific Islander, Other Race

Ethnicity: Hispanic or Latino, Not of Hispanic/Latino(a)/Spanish origin

Gender: Male, Female, Other

Age Group based on generation as of 2023: <25 years old (Gen Z), 26 to 41 years (Millennials), 42 to 57 years (Gen X), over 58 years (Baby Boomers)

Years as a registered nurse: <1 year, 1-2 years, 3-5 years, 6-10 years, 11-15 years, >15 years

Highest level of education: Associate’s, Baccalaureate, Master’s, Doctorate

How comfortable are you with using (unit-level performance) data from dashboards? (Select one):
- Very uncomfortable (1)
- Uncomfortable (2)
- Neither uncomfortable nor comfortable (3)
- Comfortable (4)
- Very Comfortable (5)

How comfortable are you with navigating through a dashboard? (Select one):
- Very uncomfortable (1)
- Uncomfortable (2)
- Neither uncomfortable nor comfortable (3)
- Comfortable (4)
- Very Comfortable (5)

Questions that were asked in the screening questionnaire and to be included in the participant profile:

Years of Experience as nurse manager: <1 year, 1-2 years, 3-5 years, 6-10 years, 11-15 years, >15 years

Unit type oversight (select all that apply): Medical/Surgical, Critical Care, Emergency Department, Obstetrics, Surgery, Ambulatory procedural, other: specify

Hospital: ___________________ (each hospital will be assigned a number)
Appendix C: Semi-Structured Interview Guide

Good morning/afternoon. Thank you for taking the time to interview with me today. I am doing a research study to understand how you (as a nurse manager) use dashboards and what you think influences your use of a dashboard for quality and performance improvement. You may hear me referring to these dashboards as “quality dashboards”, which is a visual display of quality indicators/measures or patient outcome data that is usually on one screen or page displaying your unit’s data. An example would be the dashboards that show infection or fall rates for your unit.

Before we begin, I will need verbal consent to audio record this interview so it can be later transcribed for data analysis. To ensure only audio is captured, please do not turn on your camera or screen share during the interview. If you feel you don’t want to continue in the study, let me know and we will stop the interview and recording. Any data collected will be deleted.

There are no right or wrong answers. I want you to feel comfortable sharing your honest feelings and thoughts. Anything you share with me today will be confidential. Your name or any identifying information will not be shared, and participating in this study will not affect your job. Please also do not discuss any personal information or protected health information (PHI).

After the study has concluded, I may use direct quotes from the interviews. There will be no identifying information with these quotes. Do I have permission to use any quotes from your interview?

Do you have any questions before we get started? Thank you.

INTRODUCTION QUESTIONS

Tell me a little about yourself.
How did you get into nursing?
Describe your path to becoming a nurse manager.

INTERVIEW QUESTIONS

So first, I’d like to learn more about your role as manager.
1. Describe your role in quality and performance improvement.
   A. Tell me about a recent or current quality improvement initiative or project.
   B. Describe any tools you used to help you in that initiative or project.

2. Now, focusing on data and dashboards.
   A. How do you use a quality dashboard?
1. What do you measure?
2. How often is it used?
3. How is the data shared?
4. How does it help you in your role with quality/performance improvement work?

So now I’d like to further understand what influences your use or (non-use) of these dashboards for quality and performance improvement.

Let’s start broad and think about the ORGANIZATION, so the health system and your hospital.
3. What are the expectations for quality/performance improvement? (like from your leadership or as part of the hospital’s culture)
   A. How do the expectations compare to previous experiences with other organizations? (if applicable)
4. How does using a quality dashboard fit into those expectations of quality improvement?
5. What IT resources or support do you have for using quality dashboards?
6. How are these dashboards created?
   A. What was your involvement in the design or selection of quality indicators?
   B. How does being involved (or not being involved) influence your use of the dashboard?

PERSON: Now, focusing more on you, such as experience, understanding, and comfort level with data and dashboards,
7. How does your impression (whether that be understanding, comfort with using, experience) influence your use of a quality dashboard?
8. Are there certain personal qualities that you think helps you (or not help you) with using the dashboard?
   (Probe – interpreting the information, not feeling overloaded with the content, finding the information you’re looking for)

TECHNOLOGY: The last piece I want to focus on is the dashboard itself. You can refer to any dashboard that you use. It can be one you use most often or one for a specific project. I want to emphasize again to please not share screens, any personal information, or protected health information (PHI).

9. Briefly describe the dashboard.
   A. Probe: What indicators are you measuring?
   B. Probe: What graphics or visuals are used?
   C. Probe: What level of interactivity do you have with the dashboard?
10. What do you like about the dashboard?
    A. Probe: What is easy to use? What is useful?
    What do you not like about the dashboard?
    B. Probe: What is not easy to use? What is not useful?
C. **Probe: What is frustrating that you would like to change about them?**

11. Describe your perfect/ideal dashboard.

12. As we close, do you have any final thoughts about quality dashboards and what influences you to use (or not use) them for quality and performance improvement?

13. And do you have any questions for me?
## Appendix D: Codebook

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subtheme</th>
<th>Category</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Managers as QI Leader</strong></td>
<td><strong>Supporting Unit Performance</strong></td>
<td>N/A</td>
<td>Benchmarking performance</td>
<td>comparing performance against a standard or with other comparison groups; color-coding visuals to benchmark</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Data to enhance job performance</td>
<td>Using dashboards to get data/quality metrics for decision-making, efficiency, streamlining processes, advocating for resources</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Frequency with reviewing data</td>
<td>Interacting or reviewing data daily, weekly, monthly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Identification of unit-specific issues</td>
<td>Identify problems or patterns based on dashboard data for the unit, with staff or independently</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>QI interventions</td>
<td>Next steps after reviewing data and improvement area identified. (E.g. Reviewing policies, creating standard work, educating staff, auditing processes, drill downs and root causes, implementing change)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Review of quality metrics</td>
<td>Monitoring data, looking for trends, analyzing data, identifying patterns and areas that need improvement.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Role in QI - accountability of outcomes</td>
<td>Manager’s perception of being responsible for unit outcomes; knowledge of what those outcomes are</td>
</tr>
<tr>
<td><strong>Increasing Visibility of Unit Performance</strong></td>
<td><strong>Communicating data</strong></td>
<td></td>
<td>Communicating performance with staff</td>
<td>Data shared via staff meetings, posting dashboards on units, newsletters, etc., communicating outliers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Meetings to review data</td>
<td>Discussion of reviewing data trends/patterns/improvement areas at meetings with leaders, clinicians, other admin staff, etc.</td>
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<tr>
<td></td>
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<td></td>
<td>Reporting structure</td>
<td>Unit committees, hospital-based committees</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Sharing wins</td>
<td>Recognition and celebrations for positive trends and outcomes; sharing learnings with others</td>
</tr>
<tr>
<td><strong>Engaging the Team</strong></td>
<td></td>
<td></td>
<td>Dashboard to internalize ownership</td>
<td>Staff desiring to understand their data and be involved in seeing the outcomes; energized to participate in QI work</td>
</tr>
<tr>
<td>Influencers of Dashboard Use</td>
<td>External</td>
<td>Regulatory/Standards</td>
<td>External stakeholders’ expectations</td>
<td>Regulatory bodies (e.g. CMS), State standards of practice, specialty organization guidelines or best practices, patients &amp; families</td>
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<tr>
<td></td>
<td></td>
<td>Organizational Expectations</td>
<td>Leadership/organization al influences</td>
<td>Leadership expectations (or lack of) for quality metrics / QI work / dashboard use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organizational Resources</td>
<td>Support - external department resources</td>
<td>Collaboration with Quality, Risk, Patient Experience, Finance, IT, Infection Prevention, etc. external to the unit to get dashboard data</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Support - internal department resources</td>
<td>Unit staff to collect data for dashboard (e.g. manual auditing of process metrics)</td>
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<tr>
<td>Personal</td>
<td>Personal characteristics</td>
<td>Organize data - favorites</td>
<td>Saving data/reports/dashboards to folders or favorites to organize</td>
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<tr>
<td></td>
<td></td>
<td>Organize data - long-term job experience</td>
<td>Using repetition to organize data/reports/dashboards</td>
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<tr>
<td></td>
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<td>Organize data - reminders</td>
<td>Using reminders computer, email, sticky-notes to organize data / reports / dashboards</td>
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<tr>
<td></td>
<td></td>
<td>Personal – analytical</td>
<td>Data driven, organized, logical thinking</td>
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<tr>
<td></td>
<td></td>
<td>Personal – flexible</td>
<td>Adapting to staff needs, expectations or rules, or positive perspectives</td>
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<tr>
<td></td>
<td></td>
<td>Personal - strong-natured</td>
<td>Competitive, confident, straightforward</td>
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<tr>
<td>Understanding and Familiarity</td>
<td>Clarify when not understanding data</td>
<td>Not shy, advocating for oneself, wanting to learn more about the dashboard when not understanding something</td>
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<tr>
<td></td>
<td></td>
<td>Complacency with something familiar</td>
<td>Being used to a certain way or routine; can lead to missed errors or difficult to change dashboard work/processes</td>
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<tr>
<td>Confidence with more experience</td>
<td>Increased feelings of confidence with using dashboard more, learning the platforms, doing hands-on work</td>
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<tr>
<td>Education gap - awareness and use</td>
<td>Lack of awareness of available dashboards and not receiving education on how to use dashboards; not having the time to learn</td>
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<tr>
<td>Statistical/analytical knowledge</td>
<td>Statistical/data/technology knowledge is an important skill as a manager to understand and review the data</td>
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<tr>
<td>Understand to share</td>
<td>Need to understand the data on the dashboards to share or present to staff accurately and to make decisions on</td>
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<tr>
<td>Data Technology Features</td>
<td>Data Availability</td>
<td>Access to data</td>
<td>Accessing dashboards or reports when needed, quick and easy</td>
<td></td>
</tr>
<tr>
<td>Dashboard use - situation-dependent</td>
<td>Dashboards are used based on what the the priority is or what needs to be looked at</td>
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<tr>
<td>Department-owned dashboards</td>
<td>Dashboard data owned by the department that mines/supplies the data (includes external departments and internal unit work)</td>
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<tr>
<td>Drill down of outlier in real time</td>
<td>Outliers are reviewed as they are identified rather than when the data becomes available on the dashboard.</td>
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<tr>
<td>Lots of available data</td>
<td>Lots of data can be overwhelming (information overload) or undertilized where there are opportunities to use available data more</td>
<td></td>
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<tr>
<td>Multiple dashboards</td>
<td>Multiple sources of data to gather indicators and information from</td>
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<tr>
<td>Data Quality</td>
<td>Data accuracy</td>
<td>Overall concerns to validate data to confirm dashboard accuracy</td>
<td></td>
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<tr>
<td>Data accuracy - automated</td>
<td>Concern with data accuracy from electronically built reports related to built-in logic and other electronic input of data</td>
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<tr>
<td>Data accuracy - consequences</td>
<td>Inaccurate dashboards result in non-use; interventions on pause which affects moving interventions forward</td>
<td></td>
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<tr>
<td>Data accuracy - input</td>
<td>Dashboards can be subject to user error due to manual entry of data Data bias – interpreting data based on input and output.</td>
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<tr>
<td>Feature</td>
<td>Requirement</td>
<td>Concern</td>
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<tr>
<td><strong>Timeliness of data</strong></td>
<td>Needing close to real-time data sooner; concern for data lag affecting accuracy and QI intervention work</td>
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</tr>
<tr>
<td><strong>Useful Data</strong></td>
<td><strong>Meaningful/useful</strong></td>
<td>Indicators need to be useful, meaningful, relevant to the audience and serves a purpose - does what it is intended to do</td>
<td></td>
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<tr>
<td></td>
<td><strong>Not useful - additional indicators not applicable</strong></td>
<td>Dashboard contains additional indicators that are not necessary for use</td>
<td></td>
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</tr>
<tr>
<td><strong>Dashboard Displays</strong></td>
<td><strong>Dashboard like - easy to understand</strong></td>
<td>Prefer easy to understand, definitions, colorful visuals that limit cognitive load/processing; information can be easily shared with staff</td>
<td></td>
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<tr>
<td></td>
<td><strong>Dashboard like - easy to use</strong></td>
<td>Prefer easy to use, easy to navigate, easy to learn with little instruction</td>
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<tr>
<td></td>
<td><strong>Dashboard like - simple</strong></td>
<td>Prefer clear, not fancy, one-page summary dashboard</td>
<td></td>
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</tr>
<tr>
<td><strong>User Interaction</strong></td>
<td><strong>Dashboard interactive functionalities</strong></td>
<td>Ability to drill down, filter, comment on dashboard. A desirable feature.</td>
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</tr>
<tr>
<td></td>
<td><strong>Dashboard lacking advanced features</strong></td>
<td>Unable to create graphs, do drill downs, manipulate visuals, or filter from dashboard</td>
<td></td>
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</tr>
<tr>
<td><strong>Customization</strong></td>
<td><strong>Create own dashboard</strong></td>
<td>Creating dashboards, graphs, etc. that work when existing dashboard doesn't meet user needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Dashboard preference - automation</strong></td>
<td>Prefer dashboards to be automated to address manual data entry or to have dashboards automatically sent to manager (via email)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Manual process</strong></td>
<td>Gather data from various dashboards or reports to manually enter into another dashboard</td>
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<tr>
<td></td>
<td><strong>Perceived difficulty with reporting data</strong></td>
<td>Perception that all metrics could not be on one dashboard because indicators are different, so cannot be automated and need manual work to customize and put data together</td>
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</tbody>
</table>
VITA

Lisa Young is a Clinical Quality Leader supporting three hospitals within a large health system in the Chicagoland area. Her role includes partnering with clinicians and leaders to develop, implement, and monitor quality outcomes, particularly in critical care, pediatrics, and behavioral health areas.

Lisa received her bachelor’s in nursing at the University of Illinois at Chicago in 2009 and practiced on the Obstetrics unit as a bedside nurse for five years. During that time, she received her master’s degree in nursing administration from the University of Illinois at Chicago in 2013. She then transitioned to informatics and quality roles in hospital and clinic settings. In 2018, she became the Magnet Coordinator for a small community hospital in the current health system where she works and helped lead the hospital to receive its initial Magnet designation in 2021. During that time, she was involved with nursing quality work where she noticed opportunities for dashboard use in the nursing profession.

In 2019, Lisa began the MSN-PhD program at Sinclair School of Nursing, University of Missouri – Columbia. After returning from maternity leave in 2021, Lisa transitioned to her current role in the quality department. Lisa is also board-certified in nursing informatics.