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Exploring the State of the Science of the Nursing Hand-off Communication

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Miscommunication that occurs during the exchange of information between healthcare providers accounts for approximately 80% of adverse events in the healthcare setting. Nurses devote 10% to 15% of the workday to the nurse-to-nurse hand-off communication. The hand-off itself has remained virtually unchanged for the past 20 years, although the process is prone to errors. The introduction of the electronic health record and mandates to decrease errors and improve patient outcomes has led to an influx of research on the nurse-to-nurse hand-off communication. This article provides a comprehensive synopsis of the hand-off and the state of science on nurse-to-nurse communication using hand-offs. In general, the use and implementation of standardized tools and the nurse's perception of and satisfaction with the hand-off communication have been researched extensively. A standardized hand-off tool increases nurse satisfaction with the structure and consistency of the hand-off. While electronic health record–related forms and devices are not utilized by nurses, communication patterns and communication behaviors can also influence the effectiveness of the hand-off message. The areas of memory, cognition, and content of the hand-off affect the transfer and recall of hand-off information. Continued research on hand-off communication is essential to ensure patient safety.

KEY WORDS: Communication, Handoff, Handover, Nursing, Standardized tool, Systematic review

Approximately 80% of errors in healthcare are credited to miscommunications occurring during the transfer of care.[1] The possible errors that occur as a result of miscommunication during the transfer of care are delayed diagnosis, delayed or omitted treatments including medications, and missed or repeated testing.[2,3] The negative consequences of these errors for the patient are extended hospitalization, increased costs, and actual harm.[2,4] The Joint Commission considers the improvement of healthcare provider communications and timely communication of patient information as National Patient Safety Goals.[5] The transition of patient care has several different labels: hand-off, handover, patient rounding, and change-of-shift report. The transition of care for the purpose of this article will focus on the nurse-to-nurse hand-off communication.

The nurse-to-nurse hand-off communication is defined as the transfer of patient care and responsibility from one healthcare provider (eg, nurse, physician, or nurse practitioner) to another.[6–8] The Joint Commission in 2006 issued a mandate calling for the development and implementation of a standardized hand-off template.[9,10] In 2012, The Joint Commission released a suite of tools to assist with implementation.[1] Currently, several templates have been implemented in various inpatient and outpatient settings with the intent to improve hand-off communication.[2,11–23] Unfortunately, little is known as to patient outcomes as a result of the implementation and usage of standardized templates. We present the results of a comprehensive state of the science of nurse-to-nurse communication using hand-offs.

BACKGROUND

Transferring the responsibility of patient care from one nurse to another can occur multiple times per day. Additionally, 10% to 15% of the workday is devoted to nurse-to-nurse communication.[24] The hand-off occurs at the change of shift, between nursing units (intradepartmental), interdepartmental (test, procedures, and therapies), and when the patient transfers from one healthcare facility to another. The nurse-to-nurse hand-off involves communicating patient data, information, and knowledge to ensure patient safety and continuity of care.[21,25,26] The hand-off communication requires an extensive amount of cognitive awareness and functioning while nurses analyze and synthesize the information.[8] The hand-off traditionally occurs in one of the following methods: taped, verbal at the bedside, or verbal not at the bedside.[4,12,20,27] The hand-off also serves other functions such as socialization, team building, emotional support, and education (teaching and learning).[28,29] The nurse-to-nurse hand-off

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communication is not formally taught in nursing education but is acquired through observation and on-the-job training. The format of the nursing hand-off has changed little over the past 20 years despite evidence of the process being susceptible to miscommunication.

Most adverse events affecting patient outcomes are the result of miscommunication rather than provider competency or skill.[30] Two of the most influential healthcare organizations, The Joint Commission[10] and the World Health Organization,[30] have mandated the implementation of a standardized hand-off. These initiatives have led to the development and implementation of several standardized hand-off tools and checklists,[29] including Situation Background Assessment Recommendation (SBAR), Illness severity Patient summary Action list Situation awareness and contingency planning Synthesis by receiver (I-PASS),[9,23] Introduction Situation Background Assessment Recommendation (ISBAR); Name Unexpected outcomes Tubes Safety scan (NUTS); Record Evidence Enquire Discuss (REED);[18] Presenting information Vital signs Input/output Treatment Admission or discharge criteria and Legal documents (P-VITAL); and Identification of the patient Clinical history/presentation Clinical status Care plan Outcomes and goals of care (ICCCO).[31,32] As demonstrated by this list, no single method or approach has been recommended for widespread implementation. The nursing community has not been able to agree as to the structure or clinical content for a standardized hand-off.[29,33]

Nurse-to-nurse hand-off communication has been researched extensively and emphasized in the literature as an area of importance because of its role in patient safety. The standardized templates provide a structure for the hand-off but do not address content. Even with the increased emphasis on the hand-off communication, many questions are left unanswered. What is the current state of the science of nursing hand-offs? What does the research indicate as best practice? Where should nursing scientists focus future research on nurse-to-nurse hand-off communication?

METHODS

A comprehensive literature review was conducted to identify relevant research studies addressing nurse-to-nurse handoff communication. The literature search was performed to identify studies undertaken from 2007 to 2017 utilizing the following online databases: CINAHL, PubMed, PsycINFO, MEDLINE, and Cochrane Library. The following search terms were used: "handoff," "handover," "communication," "nurse-to-nurse communication," and "nurse." An additional search was conducted to supplement the initial exploration, and the secondary search included the following terms: "cognition," "memory," "handoff," and "handover." The following inclusion criteria were applied: peer-reviewed articles in English, both quantitative and qualitative in nature, that were published within the identified 10-year span from 2007 to 2017. Additional inclusion criteria were a primary focus on nurse-to-nurse communication, cognition, and memory. Exclusion criteria were book reviews, non-English articles, letters to editors, books, commentaries, literature reviews, and abstracts for presentations. The initial search and the supplemental search resulted in 260 articles. The results were reviewed, and duplicates were eliminated. The remaining article abstracts were evaluated for retention based on relevance to the subject and the inclusion and exclusion criteria. A total of 30 articles were retained for evaluation. A comprehensive summary of the articles included in the systematic review is shown in Table 1.

RESULTS

The systematic review was analyzed using thematic analysis methodology to identify themes or categories in the textual data.[45] The following six themes were identified in the nurse-to-nurse hand-off communication systematic review of the research: standardized tools, nurses' perception of and satisfaction with the hand-off, communication and communication patterns, use of electronic tools, hand- off content, and cognition/memory. A majority of the articles (21 of the 30) focused on standardized hand-off tools and the nurses' perception of and satisfaction with the hand-off.

Standardized Hand-off Tools

A standardized hand-off tool, as defined by the literature, is a predetermined form that provides a structured sequence of information for the hand-off communication.[6,13,15,16] The structured sequencing of information also provides consistency to the hand-off process. There are numerous structured models of hand-off tools that have undergone research, including REED, ISBAR, SBAR, and ICCCO.[17,20,24,32] The advantages of implementing a standardized hand-off tool are decreased information overload, increased quality of the information exchanged,[32] decreased risks to patient safety, and improved patient outcomes.[16] Several factors must be considered before implementing a standardized hand-off tool for a nursing unit or medical institution, including current style, purpose, timing, and method of the hand-off.[15,16,24,32,35] In addition, the culture of the unit and organization must also be assessed.[20] A strategic plan that included the staff nurse's involvement in the development and implementation of a standardized hand-off protocol/tool increased the usage and satisfaction of the tool.[2,13,16,35] Interestingly, the use of an educational intervention to promote and increase compliance with using the ISBAR model in one institution was not successful.[17] The standardized hand-off tool must be flexible to meet the various needs of each nurse, nursing unit, healthcare environment, and patient situation.

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Table 1. Summary of the Nurse-to-Nurse Hand-off Communication

Source	Aim or Focus	Method	Major Findings
Anderson-Montoya et al[34] (2017).	• To examine if the healthcare professional uses active or passing process when receiving the hand-off • To examine the relevant experience on running memory	• Sample three groups of healthcare professionals (novice, intermediate, expert) • Quantitative methodology • Participants completed three tasks: running memory, clinical handoff, and air traffic control. Scored for accuracy	• Experienced healthcare professionals use more active processing for the clinical hand-off • Experienced healthcare provider utilized running memory and reorganized the information based on experience • Experience facilitates increased recall and decreases errors
Bruno and Guimond[15] (2017)	• To develop an effective standardized hand-off to assist in the transfer of information	• Convenience sample • Quantitative pilot study using a scoring tool to assess preintervention and postintervention the effective of a standardized checklist on the hand-off	• The use of the standardized checklist reduced the amount of omission errors
Patton et al[35] (2017)	• To identify the safest procedure for transferring the care of pediatric patients focusing on timing and hand-off communication	• Intradepartmental practice project to implement a standardized hand-off tool	• Successful implementation of a standardized hand-off electronic tool (ISHAPED) • Decreased medication errors • Improved nursing satisfaction with the hand-off
Rixon et al[36] (2017)	• To examine the roles and function of questioning in the hand-off • To determine if questioning improves the hand-off	• Ethnographic study using participant observation and immersion into the clinical setting to collect the data	• Questions during the hand-off serve to provide clarification and request more information and confirmation of the information • Questions functioned as a safety check
Abraham et al[33] (2016)	• To examine the communication process and structure of information sharing in the hand-off using the sequential conversational analysis framework	• Sequential conversational analysis, a mixed method: conversational analysis and statistical temporal pattern analysis • Case study using a hand-off tool • Ethnographic observation	• Two conversational patterns were identified: interactivity and collaborative communications
Bruton et al[37] (2016)	• To understand the experience and impact of the hand-off from the nursing and patient perspectives	• Qualitative study on two acute care units • Conducted semistructured interviews with both patients and staff	• There was no consistent format or content for the hand-off • Most nurses viewed the patient role as passive in the hand-off • Patient's view varied from positive to negative
Johnson et al[19] (2016)	• To examine the nurse's perception and satisfaction with the hand-off following implementation of an integrated hand-off system	• Quantitative preimplementation and postimplementation survey • Three focus groups: clinicians, managers, and educators	• Increased satisfaction with the hand-off process
Kitney et al[17] (2016)	• To assess the effect of an educational intervention on ISBAR compliance	• Quantitative pretest/posttest design • Convenience sample	• An educational intervention had minimal effect on ISBAR compliance
Smeulers and Vermeulen[16] (2016)	• To develop a standardized hand-off tool based on input from local nurses and evidence from current literature	• The literature review results combined with the results of two questionnaires given to 20 nurses	• A blueprint for a standardized hand-off tool customized to the local context and culture was developed • The mnemonic NURSEPASS was developed
Smeulers et al[13] (2016)	• To implement a newly developed standardized hand-off	• Pilot feasibility study • Mixed-methods quantitative and qualitative. Interrupted time series design • Measured the quality of the hand-off three times before implementation and three times after implementation	• Improvement in the organization and content of the hand-off

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Table 1. Summary of the Nurse-to-Nurse Hand-off Communication, Continued

Source	Aim or Focus	Method	Major Findings
Small et al[38] (2016)	• To describe the implementation of the bedside hand-off using Kotter's change model • To examine the effects of implementation on nurse compliance, nurse and patient satisfaction, and their perceptions of the process	• Implementation of bedside hand-off using Kotter's model of change • Survey questionnaires administered to patients and nurses	• Patients were satisfied with the bedside hand-off • Nurse perceptions: bedside hand-off reduced errors and improved efficiency
Spruce[2] (2016)	• To provide education on the SWITCH hand-off tool	• Educational article	• Discusses the attributes and rationale for implementing a standardized hand-off
Johnson et al[4] (2015)	• To obtain a clearer understanding of the issues involved with the nurse-to-nurse hand-off communication	• Qualitative study, using short semistructured interviews with nurses from a woman's unit and a medical unit	• The quality of the report depended on the nurse's experience. Inconsistency in the hand-off • The need to have relevant patient information at hand
Kowitlawakul et al[39] (2015)	• To describe the characteristics and barriers in the hand-off process	• Cross-sectional descriptive study • Using a checklist to observe nurses and physicians	• Distractions occur in 50% of the observed hand-offs • Individuals were the most common distraction followed by phone calls and background noise • Nurses relied on memory, charts, paper records, and not electronic tools
Manias et al[6] (2016)	• To examine the perspectives and experiences of different healthcare professionals on the clinical hand-off	• Multisite prospective cross-sectional design using a survey	• Barriers exist in the inclusion of the patient and family in the hand-off • Each individual used some type of hand-off tool (not standardized) • Lack of experienced healthcare professionals modeling the hand-off • Identified the increased risk of adverse events with a poor hand-off
Streeter et al[40] (2015)	• To identify communication behaviors (information exchange and socioemotional) associated with a competent or quality hand-off	• Cross-sectional online survey, quantitative study • Sample N = 286	• Best hand-offs information exchange • The nurses had the opportunity to ask and respond to questions and verify the information (information seeking and information verifying) • Socioemotional: show warmth, trusting relationship, easily understood language
Brown and Sims[41] (2014)	• To obtain a better understanding of the nursing hand-off from the perspective of the nurses	• Neonatal unit • Exploratory, descriptive, prospective quantitative survey with qualitative elements • Used a hand-off survey with both Likert-scale questions and short-answer questions	• Hand-off time is consuming • Staggered shift changes contributed to ineffective hand-offs • The hand-off contained quality information • Inconsistency of the location of hand-off • Barriers: distractions, interruptions, location of the hand-off
Klim et al[14] (2014)	• To identify emergency nurse's perception of the current hand-off practices • To identify what emergency nurses consider as essential components of the hand-off	• Mixed-methods design, survey and group interviews	• Identified areas of omission in the hand-off: medications, vital signs, and nursing care needs • Identified five essential components for an effective hand-off: systematic approach, treatments, use of nursing documentation, location, and efficient communication

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Table 1. Summary of the Nurse-to-Nurse Hand-off Communication, Continued

Source	Aim or Focus	Method	Major Findings
Matney et al[42] (2014)	• To determine if knowledge and wisdom are shared during the nursing hand-off	• Secondary analysis of 93 patient care hand-offs. Using directed content analysis with the data-information-knowledge-wisdom framework	• Only information and knowledge were identified in the hand-offs • Wisdom and data were not identified as being exchanged in the hand-off
Tucker and Fox[20] (2014)	• Explanation of the REED standardized hand-off and a step-by-step implementation of the model	• Provides background on the REED model	• The REED model provides a structure to ensure patient safety and increase effective communication
Effken et al[43] (2013)	• To examine the relationships between the hand-off communication and patient safety, quality, and satisfaction outcomes	• Quantitative study using a communication survey completed by the nurses and a satisfaction survey completed by the patient • Used ORA, a network analysis tool	• Each communication pattern and network have a different correlation or relationship with a patient outcome (safety, falls) • The pattern of the hand-off communication can vary as the communication network changes
Gage[26] (2013)	• To develop an evidence-based best practice audit tool for the nursing hand-off • To identify quality of care and areas of improvement in the hand-off	• Conducted a literature review of best practices for the nursing hand-off • Created an audit tool with both quantitative and qualitative data collection • 47 hand-offs were audited	• The need for a standardized approach to the hand-off • Quality of the hand-off depends on the individuals giving the hand-off • The hand-off improved after implementation of a standardized tool
Jefferies et al[44] (2012)	• To investigate the oral and written communication of patient problems, interventions, and outcomes	• Secondary analysis of an existing data set of written documentation and clinical hand-off	• Both hand-off communication and nursing documentation reflected the patient's pertinent data and information • The hand-off included plan of care, admission, and clinical history. The nursing documentation did not • The hand-off information came from a wide range of sources other than nursing. The hand-off provided a more holistic picture of the patient
Johnson et al[32] (2012)	• To explore the hand-off's content and organization • To provide a structure for an electronic hand-off tool	• Qualitative study using digitally recorded and transcribe hand-offs	• Identified the ICCCO structured hand-off as a guide that can ensure transfer of critical information • ICCCO structure allows for flexibility of use
Staggers et al[8] (2012)	• To explore information management and use of electronic tools during the nursing hand-off	• Qualitative, interpretive, descriptive study • Observations and interviews were conducted	• Communicate only pertinent patient information such as changes in patient status and orders • Did not use electronic devices or electronic forms during the hand-off. Prefer to use personal paper notes
Street et al[24] (2011)	• To identify strengths and limitations of the nursing hand-off • Implement a standardized hand-off process	• Phase 1: cross-section survey given to nurses • Phase 2: audit the hand-off postimplementation of a new hand-off process and standardized tool	• Limitations of current practice: the hand-off varies in duration, method, location, and information exchanged • The flow of communication was difficult to follow, but the nurses were satisfied with the content • No patient involvement in the hand-off • Postimplementation of SBAR: increased patient involvement and use of the SBAR
Kerr et al[28] (2011)	• To describe current hand-off practices • To explore the nurse's perception of the quality of the hand-off	• Quantitative study using a modified version of the Clinical Handover Staff Survey	• The hand-off was completed at various locations using a variety of styles • Lacked patient involvement • Time consuming and lack essential information • Express a reluctance to change the handoff

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Table 1. Summary of the Nurse-to-Nurse Hand-off Communication, Continued

Source	Aim or Focus	Method	Major Findings
Staggers et al[7] (2011)	• To examine how the nurses used an electronic-generated patient summary report or the EHR during the hand-off	• Qualitative exploratory interpretive descriptive study	• The EHR or EHR-generated reports were used minimally during the hand-off • The EHR reports did not provide adequate cognitive support for the nurses
Chaboyer et al[12] (2010)	• To gain a better understanding of the structure, processes, and perceived outcomes of the bedside nursing hand-off	• Descriptive case study of the nursing hand-off	• Developed processes for handling patient privacy at the bedside. Visitors requested to wait the waiting room during the hand-off • Sensitive patient information not shared at the bedside • A standardized hand-off not implemented • Perceived outcomes: improved accuracy and service to the patient and patient centered
McFetridge et al[11] (2007)	• To explore the patient hand-off process between the emergency department and the intensive care unit	• Qualitative descriptive exploratory study • Utilizing focus groups, semistructured interviews, and review of documents	• No structured or consistent approach for the hand-off report • The nurses were unclear as when the hand-off process started (telephone report or face-to-face) • Nurses recognize the importance of the hand-off to patient safety

One objective or outcome of implementation of a standardized hand-off is to improve patient outcomes by decreasing the risk to patient safety. Several studies indicated a reduction in the errors of omission,[15] a decrease in medication errors,[35] and an increase in patient and family involvement in the hand-off.[24] Additional outcomes identified after implementation of a standardized tool were increased nurse satisfaction with the organization of the hand-off and the content of the nurse-to-nurse communication message.[13,24] The research indicated an increase in overall nurse satisfaction with the hand-off process[35] and a perceived increase in the effectiveness in nurse-to-nurse hand-off communication.[20] None of the studies in this systematic review provided direct evidence of improved patient outcomes as a result of implementing a standardized nurse-to-nurse hand-off communication tool.

Satisfaction With and Perceptions of the Hand-off

The literature has defined nurse perceptions of and satisfaction with the hand-off as the nurse's view, interpretation, and judgment of the hand-off communication.[6,12,14,19,28,41] Nurses' perception of and satisfaction with the hand-off communication can influence the content, quality, efficiency, and effectiveness of transferring relevant and pertinent patient information. Several factors were identified by nurses as negatively influencing nurse-to-nurse hand-off communication. The absence of consistency and structure in nurse-to-nurse communication is associated with errors in the hand-off.[4,6,11,37] Environmental distractions such as unit background noise, phone calls, and interruptions disrupted the flow of information during the hand-off.[4,39,41] The time required and allotted for the hand-off was perceived as negatively influencing the process. The hand-off was time consuming,[12,28,41] and insufficient time was permitted for the hand-off,[28] which increased the risk of miscommunicating patient information. The hand-off often contained irrelevant and too much patient information[12] or lacked essential patient information.[4,28] All three factors contributed to miscommunication of pertinent information. Nurses reported that a significant indicator of the quality of the hand-off was the experience of the nurse giving and receiving the report.[4,26] The more experience the nurse had, the quality of information increased and length decreased.[6,26,41] The absence of mentoring and education training for hand-off communication has added to the inconsistencies and miscommunications associated with the hand-off.[6,28]

According to the research, nurses associated the following features with the quality of nurse-to-nurse hand-off communication: a systematic approach, the use of nursing documentation,[14] bedside hand-off,[12,38] efficient communication,[14] and the use of a standardized integrated hand-off tool.[19,26] Nurses perceived that the bedside hand-off improved accuracy and

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efficiency and reduced errors.[12,38] Nurses expressed increased satisfaction with hand-off quality and consistency after the implementation of a standardized hand-off tool.[19,26] Surprisingly, in one study, nurses expressed reluctance to change the hand-off communication style and format despite negative perceptions of and dissatisfaction with the existing hand-off.[28]

Communication and Communication Patterns

The next theme in nurse-to-nurse hand-off communication research focused on communication patterns, relationships, networks, and the source of the communication. In relation to nursing hand-off, communication pattern is defined as verbal exchange and flow of information on a nursing unit, between nurses and between shifts.[43,46,47] Failures in the flow or pattern of communication lead to preventable errors.[3] The primary communication network and pattern used for the hand-off is verbal communication. A nurse providing a verbal hand-off extracts pertinent patient information from a variety of sources other than nursing to provide a holistic picture of the patient.[44] A nursing unit incorporates more than one communication network pattern (eg, day shift and night shift).[43] The pattern of communication between networks during the hand-off affects the safety and quality outcomes of a nursing unit.[43] The pattern of the hand-off communication can vary as the composition of network communication changes.[43] Additional factors that affect communication and patterns of communication are socioemotional behavioral characteristics. Communication behavior is defined as the associated nonverbal cues, such as tone of voice, body language, and ritualistic nature of the hand-off.[3,33,36,40,47] A communication style that projects trust and warmth and uses easily understood language creates an environment that facilitates the exchange of information during the hand-off.[40]

Research has demonstrated that the hand-off communication is an interactive, collaborative process that involves both the giving and receiving nurses.[33] This interactive communication serves as a vehicle for information seeking and verification.[33,40] The use of questions during the hand-off is an example of interactive communication. Questions provide both the giving and receiving nurses the ability to confirm the information, request additional information, and receive clarification of information.[36,40] Ultimately, the utilization of questions during the nurse-to-nurse hand-off functions as a safety check in preventing the miscommunication of information.[36]

Electronic Tool Usage and Memory/Cognition

The research on the use of electronic tools, electronic forms, or electronic health record (EHR)–generated forms is limited. The literature did not identify a specific EHR-generated form, electronic tool, or electronic forms used during the hand-off communication. The literature defines an electronic tool as an EHR-generated form or application on a computer that is used primarily in the hand-off communication.[7,8,39] Nurses typically do not use EHR-generated forms, the EHR, or other electronic tools for the nurse-to-nurse hand-off communication.[8,39] The nurses indicated the EHR and other electronic tools interfered with the flow of the process[7,8] and that the EHR and other electronic devices were not able to provide pertinent information quickly.[8] The nurses relied on memory, paper charts, and paper records[39] and preferred to use personal handwritten notes to give and retrieve patient information.[8]

The functions of memory and cognition are defined as the recall and mental processing of data, information, and knowledge.[34] The nurse-to-nurse hand-off communication is a cognitively intense process with high risk for lapses in the recall of information. The experience level of the healthcare professional does influence the ability to recall pertinent patient information for the hand-off[34]; experienced healthcare providers can recall more relevant information than novices.[34] This capability is attributed to the experienced professional's ability to use running memory and reorganize the hand-off information based on a previous mental model.[34]

Hand-off Content

Content of the nurse-to-nurse hand-off communication is defined by the literature as patient data, information, and clinical knowledge that is communicated from one nurse to another.[6–8,32,42] What is transferred during the nurse-to-nurse hand-off communication? Current research indicates that knowledge, to a certain extent, and information are exchanged verbally[42]; however, this did not include the plan of care, patient goals, or patient education,[42] but of a statement connecting patient status, assessments, interventions, and outcome.[42] Data, which include singular individual items or facts, were not transferred during the hand-off.[42] Information, or connected data points, was the primary form of patient information verbally communicated during the hand-off.[42] Patient information includes patient signs and symptoms and associated interventions.[42] Current nursing research is primarily concerned with the structure of the hand-off and not the actual content of the message.

SUMMARY OF THE RESEARCH

Nurse-to-nurse hand-off communication has been the subject of extensive research subsequent to The Joint Commission's 2006 recommendation to implement a standardized hand-off communication. Research has focused on nurses' perceptions and satisfaction, communication patterns and behavior, electronic tool usage, memory/cognition, content, and standardization of the hand-off. Nurse perceptions of existing processes identified several factors that influence the hand-off communication: environmental distractions,[4,39,41] inconsistency, lack of structure,[4,6,11,37] time consumed,[12,28,41]

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insufficient time allotted for the hand-off,[28] hand-off containing irrelevant information,[12] and the lack of pertinent patient data.[4,28]

The primary method for communicating the hand-off information is a verbal exchange between nurses. The communication network of a nursing unit is composed of multiple nodes (day shift, night shift, nurses, and unlicensed personnel).[43] The flow of communication and information can vary as the composition of the network fluctuates.[43] Additionally, socioemotional and behavioral characteristics negatively and positively affect the communication pattern between nurses.[40] The nurse-to-nurse hand-off communication is an interactive process of information seeking and verification through the use of questions.[33,40]

A general school of thought holds that electronic tools would enhance the hand-off communication and decrease the cognitive load of the nurse. The research indicates nurses are not using electronic tools, EHRs, or EHR-generated forms for the hand-off.[8,39] Nurses prefer to rely on memory, "brain-sheets," and paper charts rather than the EHR.[8] The reliance on memory is a high-risk strategy because of the cognitively intense nature of the nurse-to-nurse hand-off process. The ability to successfully recall relevant information correlates to the individual's professional experience.[34] An experienced professional utilizes running memory to reorganize the hand-off information to recall pertinent patient information successfully.[34]

The research on hand-off standardization focuses on the structure and consistency of the hand-off but not the content. The limited research on hand-off content indicates that both knowledge and information are currently exchanged in nurse-to-nurse hand-off communication.[42] Standardized tools for the hand-off have been implemented with the intent to improve the structure and consistency, decrease information overload, and improve the quality of the information communicated during the hand-off.[32] A strategic plan and an assessment of the culture and workflow of the nursing unit are crucial to the success of implementing a standardized hand-off procedure and tool.[2,13,16,35] The positive outcomes after implementation of a standardized hand-off are a perceived increase in the following areas: effectiveness of the hand-off communication,[20] satisfaction with the hand-off procedure,[35] organization, and overall content.[13,24] There are no studies that can provide a direct correlation between implementing a standardized hand-off tool and improved patient outcomes.

THE FUTURE OF HAND-OFF RESEARCH

In this project, a universal solution for effective nurse-to-nurse hand-off communication was not identified or found. The literature on nurse perceptions of and satisfaction with the hand-off has reached a saturation point. Additionally, the current literature is inundated with research on how and why to implement a standardized hand-off tool. We know nurses are more satisfied with structured, consistent hand-off processes. An identified gap in the research is connecting the use of a standardized hand-off procedure to patient outcomes.

Miscommunications and errors of omission continue to occur despite the multitude of studies on nurse-to-nurse hand-off communication. The nurse-to-nurse hand-off communication system is part of the healthcare sociotechnical system, increasing the complexity of how the message is communicated and the content of the message. The conduit for the hand-off is a complex multichannel communication comprising both human-to-human interaction (verbal) and human-to-computer interaction (electronic tools and the EHR). Currently, there is minimal research on the content of the message being communicated. What is the content of the hand-off message? What is being transferred in the hand-off communication? Additionally, does the message contain too much irrelevant information resulting in a cognitive overload for the nurse? Research on the content of the message can lead to decreased errors in the hand-off communication and thus improved patient outcomes.

The introduction of the EHR has changed the nature of the hand-off from a human-to-human interaction (social ritual) to a sociotechnical system. The concept of technology to assist the healthcare provider in decreasing errors, decreasing cognitive load, and improving patient outcomes has not been evident in the research on hand-off communication. Technology should assist and enhance the nurse's running memory and ability to recall pertinent essential patient information. An area for further investigation is the analysis of how human factors and ergonomics affect the hand-off communication in a sociotechnical environment. Nurses in general are not using the EHR, EHR-generated forms or other electronic tools in the hand-off process.[8] We know nurses prefer to use verbal communication for the hand-off. What we need to know is how to successfully integrate electronic tools and devices and the EHR into the current hand-off procedure to enhance recall of pertinent patient information. Additional research using a cognitive work analysis to investigate how workflow patterns are affected by the integration of an electronic tool or EHR in nurse-to-nurse hand-off communication is recommended.

Continued research on the nurse-to-nurse hand-off communication process is essential to decrease sentinel events related to miscommunication. The review of the research indicates that nurse scientists must challenge themselves and investigate the hand-off communication from a new perspective. We have the technology available to assist in decreasing the cognitive load of the nurse. The research needs to focus on identifying the human factors affecting

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the communication and interventions that can be readily implemented. Nurse scientists have a pivotal role in finding and implementing solutions to improve the nurse-to-nurse hand-off communication. We have attempted to provide clarity and direction on where the nurse-to-nurse hand-off communication research must proceed in the future.

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