



Similarity and accuracy of mental models formed during nursing handovers: A concept mapping approach



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ABSTRACT

Background: Shared mental models are crucial for constructing mutual understanding of the patient's condition during a clinical handover. Yet, scant research, if any, has empirically explored mental models of the parties involved in a clinical handover.

Objectives: This study aimed to examine the similarities among mental models of incoming and outgoing nurses, and to test their accuracy by comparing them with mental models of expert nurses.

Design: A cross-sectional study, exploring nurses' mental models via the concept mapping technique.

Participants: 40 clinical handovers.

Data collection: Data were collected via concept mapping of the incoming, outgoing, and expert nurses' mental models (total of 120 concept maps). Similarity and accuracy for concepts and associations indexes were calculated to compare the different maps.

Results: About one fifth of the concepts emerged in both outgoing and incoming nurses' concept maps (concept similarity = 23% ± 10.6). Concept accuracy indexes were 35% ± 18.8 for incoming and 62% ± 19.6 for outgoing nurses' maps. Although incoming nurses absorbed fewer number of concepts and associations (23% and 12%, respectively), they partially closed the gap (35% and 22%, respectively) relative to expert nurses' maps. The correlations between concept similarities, and incoming as well as outgoing nurses' concept accuracy, were significant ($r = 0.43, p < 0.01$; $r = 0.68, p < 0.01$, respectively). Finally, in 90% of the maps, outgoing nurses added information concerning the processes enacted during the shift, beyond the expert nurses' gold standard.

Discussion and conclusions: Two seemingly contradicting processes in the handover were identified. "Information loss", captured by the low similarity indexes among the mental models of incoming and outgoing nurses; and "information restoration", based on accuracy measures indexes among the mental models of the incoming nurses. Based on mental model theory, we propose possible explanations for these processes and derive implications for how to improve a clinical handover.

What is already known about the topic?

- The nursing handover has been repeatedly acknowledged as an area of significant liability to patient safety due to communication failures.
- Effective communication during handover ensures familiarity of the incoming party with the details of the patient's illness and hospitalization course, and thus can make these transition moments less error-prone.
- The handover was conceptualized as an opportunity for outgoing and incoming nurses to identify, understand, and resolve differences in their mental models, yet empirical research on this topic is scant.

What this paper adds

- Applying mental models theory to examining nursing handovers indicates that nurses face difficulties in developing shared mental models during handovers, and contributes in highlighting cognitive barriers to and facilitators of effective communication.
- Only about one fifth of the concepts emerged in both outgoing and incoming nurses' concept maps, suggesting a Chinese whisper effect.
- Despite this significant information loss, incoming nurses could partially close the gap and retrieve information, when compared to expert nurses' maps.
- Mental models are affected more by the nurse's role as outgoing or incoming nurse and less by the nurse's tenure or expertise.

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1. Introduction

Clinical handover – the transfer of information, control, and accountability for the patient from the departing health professional (or team of professionals) to the incoming one(s) – has been repeatedly acknowledged as an area of significant liability to patient safety due to communication failures (e.g., Cohen and Hilligoss 2010; Drach-Zahavy and Somech, 2014; Rayo et al., 2014; Thomas et al., 2013). Incomplete, inaccurate, or misunderstood handover information can lead to delayed or duplicate treatments or tests, to delayed recognition of deterioration in patients, and to possible physical, psychological, or financial harm to patients (Australian Commission of Safety and Quality in Healthcare, 2012; Drach-Zahavy and Hadid, 2015). Effective communication during handover ensures familiarity of the incoming party with the details of the patient's illness and hospitalization course, thus can make these transition moments less error-prone (Arora et al., 2008). In this vein, authors have recently called to view handover communications not as telegrams, where the outgoing nurse is responsible for delivering the most significant information according to mnemonic tools, but as an active co-construction of understanding by parties with potentially dissimilar mental models (Cohen et al., 2012).

Mental models are organized knowledge structures that allow individuals to explain and predict the behavior of the world around them, to recognize and remember relationships among components of the environment, and to construct expectations for what is likely to occur next (Cohen et al., 2012; Johnson-Laird, 1983). In the context of clinical handovers, mental models about the patient enable professionals to understand patients' status, draw inferences, make predictions, decide which actions to take, and experience events vicariously (Johnson-Laird, 1983). Accordingly, a handover is seen as an opportunity for the outgoing and incoming nurses to identify, understand, and resolve differences in their mental models (Cohen et al., 2012).

This study draws on mental models theory and aims to compare the similarity and accuracy of the mental models of the outgoing and incoming nurses presented at handovers in an intensive care unit (ICU). Similarity of mental models represents the common elements they share, and accuracy – their resemblance to a gold standard (Mathieu et al., 2000). The study also examines the links between nurses' demographic and professional characteristics, as well as the handover duration, and the similarity and accuracy of their mental models.

Despite the growing interest in mental models as mechanisms for constructing mutual understanding of the patient's condition, scant research, if any, has empirically explored individual and collective mental models of the parties involved in a clinical handover. Our findings will therefore help describe communication barriers and reveal ways of streamlining the communication processes among parties during handover. Eventually, these findings could facilitate clinical performance and patient safety.

2. Background

2.1. A cognitive approach to handovers

In the search for ways to improve handover communication, standardization through checklists, mnemonics, and minimal data sets (e.g., Situation, Background, Assessment, Recommendation [SBAR]) has received a boost from many regulatory bodies and professional associations (e.g., Institute for Healthcare Improvement, 2016; The Joint Commission, 2015). With standardization, the “rules” of interaction (e.g., function, process, content, timing, and who is directly or indirectly included in the conversation) are imposed, making communication during handovers more resistant to variation (Cornell et al., 2014; Drach-Zahavy and Somech, 2014; Wentworth et al., 2012). In addition, standardization defines the topics to be covered and their order, thereby facilitating mutual understanding and shared mental models among clinicians (Blom et al., 2015; Haig et al., 2006; Manser

and Foster, 2011). Consistent use of SBAR during handovers resulted in more-focused patient information, increased the volume of information exchanged, and decreased overall time spent giving and receiving reports (Cornell et al., 2014). Yet, very little empirical evidence supports that handover standardization produces noticeable gains in patient outcomes, such as drop in falls, length of stay, or preventable adverse events (Cohen and Hilligoss, 2010; Staggers and Blaz, 2013). Consequently, scholars disagree on how much content standardization is required or even possible, arguing that optimizing handovers for patient safety, narrowly construed, could have serious institutional side effects (Manser and Foster, 2011; Patterson and Wears, 2010; Riesenberget al., 2010).

In a recent systematic literature review, Flemming and Hübner (2013) listed the types of communication errors during handovers that may be detected in handover artifacts and medical records. Errors ranged from missing, redundant, or contradictory information, presumably the responsibility of the outgoing provider, to failures to recognize the clinical significance of a piece of information (e.g., Borowitz et al., 2008) or to understand what went wrong (e.g., Thomas et al., 2013), which are more a result of the interaction between the outgoing and incoming parties. The latter types of errors may shift the attention of researchers from identifying the correct information to transfer in handovers (through handover standardization) to embracing a shared understanding perspective to the study of handover effectiveness (Patterson and Wears, 2010). Accordingly, researchers have recently begun to explore *how* the two parties (the incoming and outgoing providers) develop a common view of the patient's condition (Arora et al., 2008; Cohen et al., 2012; Flemming and Hübner, 2013).

Drach-Zahavy and Hadid (2015) showed how interactive questioning concerning the course of care and discussion among participants decreased the number of treatment errors. Others showed that the active involvement of incoming clinicians improves patient safety by addressing diagnostic momentum and fixation bias (Apker et al., 2007; Greenstein et al., 2013; Manser et al., 2013; Patterson et al., 2004; Patterson and Wears, 2010; Philibert, 2009). Finally, Rayo et al. (2014) found that more experienced nurses and physicians used higher rates of interactive questioning to resolve differences. Yet, previous studies have also showed that such interactive questioning behaviors among parties are relatively rare (Greenstein et al., 2013; Manser et al., 2013). Horwitz et al. (2009) observed that 59% of physician handovers did not include questions at all. Similarly, Drach-Zahavy and Hadid (2015) found that face-to-face verbal updates with interactive questioning occurred in only 55% of nursing handovers. Moreover, most of the questions asked during handover were to clarify information rather than to identify flawed clinical assessments or treatments. Passive listening behaviors such as affirmations or nodding were more common than active listening behaviors such as read-back, note-taking, or reading of written memos (Greenstein et al., 2013; Rayo et al., 2014). Although these studies have merit, they focus on the communication behaviors but ignore the cognitive aspects of a handover (Cohen et al., 2012). This is surprising, given the growing interest in organizational cognition in the past two decades, and its key role in assuring high performance in uncertain and complex environments such as hospitals (Cohen et al., 2012; Dierynck et al., 2016; Weick et al., 2005).

One avenue of research may focus on understanding the different mental models of the outgoing and the incoming nurses presented during a handover, as well as the ways in which differences in mental models are handled. Next, we define and describe the concepts of mental models and shared mental models, and discuss their significance to the study of handovers.

2.2. Individual and shared mental models

According to the theory of mental models, individuals strive to make sense of what they experience by unconsciously forming working mental models (Johnson-Laird, 1983). Mental models are “internal

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