

# Facilitators and Barriers to the Adoption of an Electronic Medical Record System by Intensive Care Nurses

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**Abstract.** Introducing new technology, such as an electronic medical record (EMR) into an Intensive Care Unit (ICU), can contribute to nurses' stress and negative consequences for patient safety. The aim of this study was to explore ICU nurses' perceptions of factors expected to influence their adoption of an EMR in their workplace. The objectives were to: 1) measure psychological factors expected to influence ICU nurses' adoption of EMR, and 2) explore perceptions of facilitators and barriers to the implementation of an EMR in their workplace. Using an explanatory sequential mixed method approach, data were collected using surveys and focus groups. ICU nurses reported high scores for motivation, work engagement and wellbeing. Focus group analyses revealed two themes: *Hope the EMR will bring a new world* and *Fear of unintended consequences*. Recommendations relate to strategies for education and training, environmental restructuring and enablement. Overall, ICU nurses were optimistic about EMR implementation.

**Keywords.** Electronic medical records, Theoretical Domains Framework, motivation, engagement, wellbeing, intensive care, nurses

## 1. Introduction

Nurses are the largest professional workforce in Australian hospitals and are increasingly using different forms of technology to deliver safe high quality care for patients within acute hospital settings [1; 2]. In particular, nurses working in critical care settings such as the Intensive Care Unit (ICU) often use complex technologies when caring for vulnerable patients with complicated health needs [3]. These technologies include invasive and non-invasive monitoring, medical assistive devices such as ventilators and

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intravenous pumps, and physiologic assistance. Nurses also use computers and other healthcare technology such as electronic medical records (EMR) to record, access, extract and interpret patient information, to support and record clinical decisions, and to communicate with the multidisciplinary team [4; 5].

There is ample evidence that the ICU is a stressful work environment for nurses. Contributors include high patient acuity, high workloads, frequent turnover, multiple cognitive demands, unpredictable change or uncertainty about patients and their care, and working with a wide range of multidisciplinary colleagues as well as numerous types of technologies and equipment [6; 7]. The introduction of new or additional demands, such as a new EMR, into a critical care setting can increase stress on nurses leading to potential for negative consequences for nurses' wellbeing, work performance and, consequently, patient safety [8; 9]. Unfortunately, pre-existing high levels of burnout in ICU nurses [6] and reported low levels of ICU nurses' acceptance and perceptions of an EMR [10] are indicative of resistance to change, which may hinder the implementation of an EMR.

This study's aim was to examine factors expected to affect ICU nurses' adoption of the EMR in their workplace. The Theoretical Domains Framework (TDF) [11] provided a comprehensive conceptual model to examine and understand facilitators and barriers to change, and identify targeted strategies to address context specific factors. The objectives were to: 1) measure psychological factors expected to influence critical care nurses' adoption of EMR; and 2) explore ICU nurses' perceptions of barriers and facilitators to the adoption of an EMR.

## **2. Methods**

The explanatory sequential mixed method approach used a cross-sectional survey followed by focus groups at one large public health service with two ICUs in Melbourne, Australia. Low risk ethics approval was obtained from the participating health service and university prior to commencement.

Survey recruitment involved an e-mail sent by managers to 292 nurses working in critical care settings with a link or QR code for survey completion, and researchers visiting these settings at regular intervals to provide staff with verbal information about the study, and distribute and collect paper copies of the survey. The survey included demographic questions, four validated survey tools (Autonomy and Competence in Technology Adoption (ACTA) [12], Utrecht Work Engagement Scale-3 [13], WHO-5 Wellbeing Index [14] and Maslach Burnout Inventory [15]) and global measures of work satisfaction and intention to stay [16]. Strategies to enhance the survey response rate included: completion time of less than five minutes; assurances that responses were anonymous and confidential; and distribution timed to coincide with training to enhance relevance [17]. Survey data were entered into REDCap version 6.14.1, and analysed using IBM SPSS software (version 24).

Nurses were informed about the focus groups within the survey and invited to provide an e-mail address if they were interested in participating. In addition, the researcher provided information about the study during regular visits to the ICU and invited participation. On advice from managers, focus groups were held during lunchtime in local areas of the ICU to facilitate attendance. Focus group data were collected using a semi-structured guide, then audio-recorded and transcribed verbatim for analysis. Participants' demographic data were also collected. Detailed field notes

collected by an observer were used to assist analysis. A coffee card was given to each participant upon completion of the focus group to thank them for their participation. Two stage analyses methods used six steps for inductive thematic analysis [18], followed by deductive analysis mapping coded data to the 14 domains of the TDF [11].

### 3. Results

Survey responses were provided by 143 critical care nurses (49% response rate). Most respondents were female (88.8%) and aged between 22 and 65 years. Almost all had a university degree (94%), 69% had postgraduate qualifications, and 80% had worked as a nurse for more than 5 years. Analyses of the ACTA survey responses indicated that critical care nurses perceived moderate, external control of their motivation to use the EMR, rather than being internally motivated. Most participants (70%) reported high scores (8-10/10) for job satisfaction; and 90% reported no plan to leave their job in the next year. The majority of participants (72%) reported high scores on the WHO-5 Wellbeing Index (reflected by scores between 52-100%). Reasonable work engagement mean scores were reported (out of 7) using the 3-item version of the Utrecht Work Engagement Scale (UWES-3): 3.5 (SD 1.19) for vigour, 4.5 (SD 1.07) for dedication and (SD 1.05) for absorption. Just over a quarter of the participants' scores using the Maslach Burnout Inventory (MBI) tool classified them as depressed (28%).

Four focus groups involved a purposeful convenience sample of 20 ICU nurses who worked at two ICUs; Site A (n=8) or Site B (n=12), one participant worked in another department as well as ICU. These nurses were aged between 22 and 63 years, 80% were female, all had a university degree and 85% had postgraduate qualifications.

Inductive analyses of the focus group data revealed two themes:

1. Hope that the EMR will bring a new world reflects ICU nurses' optimism that the EMR would improve their current work practices, stressing that current documentation practice was time-consuming. They were expecting the EMR to improve documentation legibility and assist them in securing patients' information by preventing loss or misplacement of information.

*"Hopefully, it will be smooth sailing. Yeah. And it will make your job easier, rather than harder"*

*"...and also, hopefully, improve the technology at patient bedside."*

2. Fear of unintended consequences reflects participants' views on the implications of an EMR implementation for workflows, patient safety, and factors that may hinder the implementation of an EMR in ICU.

*"Well, if it wasn't working, and then we needed to document something on the EMR, that can be a problem"*

Deductive analyses of the focus group data revealed seven domains: six facilitator domains and four barrier domains. The facilitator domains were: optimism, knowledge, beliefs about capabilities, beliefs about consequences, social influences and environmental context and resources. The barrier domains were: skills, emotion, social influences and environmental context and resources.

#### 4. Discussion

According to the survey findings, critical care nurses perceived controlled or moderately controlled extrinsic motivation to use the EMR. Similarly, ICU nurses' focus group responses represented the reflective motivation domain of the TDF. This representation is not surprising because during data collection the EMR implementation was inevitable for the healthcare organisation, but not yet implemented. Nurses therefore perceived that strong external factors influenced their adoption of the EMR.

Survey findings showed that 69.9% of nurses had no plans to leave their job in the next year, and 75% reported moderate to high satisfaction (work scores greater than 6/10). These findings were consistent with findings of the focus groups, where nurses expressed their desire to adopt the EMR and intention to stay in their workplace post-EMR implementation. The survey findings were similar to those of a recent study which showed that nurses' satisfaction was very high before the implementation of an EMR [19]; however, there is a lack of research specifically examining critical care or intensive care context nurses' perspectives. The reasonable work engagement scores (measured using the UWES-3 tool) and reported high wellbeing scores (72% participants, using the WHO-5 tool) and were similar to previous studies who reported nurses had high engagement levels pre-EMR implementation [19] and ICU nurses having very high mental wellbeing levels [6]. The reported amount of nurses who were classified as depressed on the MBI tool is higher than a previous study on ICU nurses [20], however it should be noted that the survey participants in this study included nurses from other critical care areas, therefore it was not able to be determined whether results directly related only to ICU nurses.

The facilitators to EMR adoption most commonly identified by ICU nurses related to: reflective motivation, social opportunity, and physical opportunity. Participant responses identified several strategies to enable effective implementation of EMR in the ICU: education, efficient computers, training, 'cheat sheets', simulation, staff support, fantastic champions, motivation, simulation and sufficient computers. Similarities exist between this study's findings and those of previous studies which showed that training, staff support, provision of 'cheat sheets', availability of EMR trainers, user-friendly computers, sufficient computers for everyone and efficient computers were facilitators for EMR implementation in critical care settings [21; 22].

The barriers to EMR adoption that were most commonly identified by ICU nurses related to: physical capability, psychological capability, social opportunity, physical opportunity and automatic motivation. This study identified several factors that may hinder the implementation of an EMR in the ICU, including: skill inadequacy, anxiety, funding, training, staff perception and attitude. These barriers are similar to findings from previous studies which showed that lack of training and training time, poor computer skills, inadequate IT and staff support and inefficient computers were some of the barriers to a successful EMR implementation [21-23].

Four strategies to improve adoption of the EMR by ICU nurses were identified by mapping the focus group data to the TDF: education, training, environmental restructuring and enablement.

## 5. Conclusions

Overall, ICU nurse participants were optimistic about the implementation of a new EMR and were hopeful it would improve their work practices. This may be attributed to their pre-existing familiarity with complex equipment and technologies in their work environment.

This study identified the perceived facilitators and barriers, and specific strategies to improve EMR adoption by ICU nurses in an Australian healthcare context.

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