

## OPTIMISING THE ELECTRONIC PATIENT RECORD: A HUMAN FACTORS AND SYSTEMS THINKING APPROACH

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### Abstract

Recent years have seen a rapid digitalisation of care in Irish hospital settings, with a particular focus on the introduction of an Electronic Patient Record (EPR). While the advantages of EPR over traditional paper health records are well-described in the literature, little consideration has been given to the impact of EPR implementation on clinical team working. Oftentimes, such systems have been introduced in organisations without preliminary understanding of the complex roles and relationships among clinicians, the points of contact in relation to care, and the shared clinical decision-making processes characteristic of multidisciplinary teams in acute care contexts. Human Factors psychology and Systems Thinking principles represent a critical lens through which to view and improve the usability and effectiveness of EPR systems. This mixed-methods doctoral research – to be conducted in a large urban teaching hospital – will incorporate a systematic literature review, anonymous online survey, semi-structured qualitative interviews, and non-participant ward round observations to inform a socio-technical systems analysis. This will be followed by participatory co-design sessions with information technology professionals and clinician (medical, nursing, and health and social care) end users. Findings from these initial studies will inform a small-scale pilot intervention. The ultimate aim of the body of research is to explore the potential for human-centred design methods to refine both the design and implementation of EPR, for the ultimate maximisation of user satisfaction, care quality, and patient safety.

**Keywords:** *Electronic patient record, user-centred design, human factors, socio-technical systems, health information technology.*

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### 1. Introduction

Recent years have seen a rapid digitalisation of care in Irish hospital settings, with a particular focus on the introduction of an Electronic Patient Record (EPR) (Ivanković, Jansen, Barbazza, Fernandes, Klazinga, & Kringos, 2022). While the advantages of EPR over traditional paper health records are well-described in the literature, recent studies have shown that usability of health IT systems remains suboptimal (Carayon & Hoonakker, 2019; Menachemi & Collum, 2011). Moreover, little consideration has been given to the impact of EPR implementation on clinical team working and patient outcomes in acute care contexts, such as ward rounds (Priestman, Sridharan, Vigne, Collins, Seamer, & Sebire, 2018). Ward rounds represent an important example of multidisciplinary care in hospital medicine, with many different types of clinicians working as a group (Morrison, Jones, Blackwell, & Vuylsteke, 2008). However, technology designed for a single user – like most EPR systems – poses challenges to group interaction on ward rounds, which are characterised by hierarchical relationships, diverse points of contact in relation to care, and complex shared clinical decision-making processes. As EPR systems continue to advance technologically – most notably integrating machine learning algorithms and natural language processing models – it is essential that clinical workflow be systematically considered in the design of health IT tools (Carayon, 2019; Mehta & Devarakonda, 2018). As such, Human Factors psychology and Systems Thinking principles, grounded in Socio-technical Systems Analyses, represent a critical lens through which to view and improve the usability and effectiveness of EPR systems.

### 2. Objectives

The overall aim of this doctoral research is to therefore enhance the use of the Electronic Patient Record to support multidisciplinary working on ward rounds in acute care settings. This will be achieved first by working to understand how the Electronic Patient Record is currently utilised to support clinical

functioning across healthcare teams in ward rounds in a major urban acute hospital. This analysis will be guided by Systems Thinking principles, seeking to elucidate the current barriers and facilitators to effective implementation of EPR. Next, a collaborative design approach (i.e., co-design) will be deployed in understanding and conceptualising future iterations of EPRs. Finally, research will explore what opportunities exist for EPR-embedded artificial intelligence systems (AIS) to improve clinical workflow.

### 3. Methods

The first proposed study will consist of a systematic literature review, followed by an anonymous online survey. The literature review will seek to evaluate the use of health information technology tools to support ward rounding in acute care settings. The mixed-methods survey will target medical, nursing, and health and social care professionals to explore EPR use in other acute hospitals worldwide. Following this information gathering, the second study will explore the current use of EPR on ward rounds in a major urban teaching hospital. This will be achieved via non-participant, ethnographic observation of ward rounding. These observations will inform one-to-one, semi-structured qualitative interviews with medical, nursing, and health and social care professionals. Interviews will explore clinicians' needs, attitudes, barriers, facilitators, and preferences in interacting with EPR, as well as perceptions of artificial intelligence and clinical decision support tools. Following this, participatory co-design sessions with clinician end users and healthcare information technology professionals will aim to conceptualise improved EPR systems and implementation support. Lastly, recommendations from these co-design sessions will be deployed within a small-scale pilot intervention in the same hospital.

### 4. Implications

This mixed-methods action research ultimately aims to explore the potential for human-centred design methods to refine both the design and implementation of EPR, for the ultimate maximisation of user satisfaction, care quality, and patient safety. In addition to furthering the body of literature on EPR specifically, this doctoral research will have implications in the fields of human-computer interaction, user-centred design, and Human Factors and Systems Thinking psychology in healthcare.

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