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Modeling factors explaining the acceptance, actual use and satisfaction of nurses using an Electronic Patient Record in acute care settings: An extension of the UTAUT

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ABSTRACT

Background and purpose: End-user acceptance and satisfaction are considered critical factors for successful implementation of an Electronic Patient Record (EPR). The aim of this study was to explain the acceptance and actual use of an EPR and nurses' satisfaction by testing a theoretical model adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT).

Methods: A multicenter cross-sectional study was conducted in the medical–surgical wards of four hospitals ranked at different EPR adoption stages. A randomized stratified sampling approach was used to recruit 616 nurses. Structural equation modeling techniques were applied.

Results: Support was found for 13 of the model's 20 research hypotheses. The strongest effects are those between performance expectancy and actual use of the EPR ($r=0.55$, $p=0.006$), facilitating conditions and effort expectancy ($r=0.45$, $p=0.009$), compatibility and performance expectancy ($r=0.39$, $p=0.002$). The variables explained 33.6% of the variance of actual use, 54.9% of nurses' satisfaction, 50.2% of performance expectancy and 52.9% of effort expectancy.

Conclusions: Many results of this study support the conclusions of prior research, but some take exception, such as the non-significant relationship between the effort expectancy construct and actual use of the EPR. The results highlight the importance of the mediating effects of the effort expectancy and performance expectancy constructs. Compatibility of the EPR with preferred work style, existing work practices and the values of nurses were the most important factors explaining nurses' satisfaction. The results reveal the complexity of this change and suggest several avenues for future research and for the implementation of IT in healthcare.

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1. Introduction

1.1. Implementing information technology in healthcare

Increasingly, information technologies (IT) are being proposed as solutions to the challenges faced in health care systems, for addressing population health issues and encouraging the emergence of new modes of healthcare delivery [1]. Even though the benefits of implementing IT in healthcare have been well documented, too much variance remains in the rates of satisfaction expressed by health professionals [2]. The professional culture of nurses is generally favorable to adoption of innovations such as an Electronic Patient Record (EPR) [3], but affective response remains a critical factor that influences the decisions and behaviors of IT users [4]. The fundamental differences between the paper-based patient record and the EPR as well as significant transformations of clinical practices raise significant questions about IT's impact on the nursing workflow, care delivery and nurses' satisfaction [5]. In principle, an EPR should facilitate access to relevant information, patient evaluation, health promotion, clinical interventions and the organization of services [6]. These functionalities play a key role for nurses, since they make a unique contribution to the health system [7] by integrating information [8] and serving as pivots in the health team [9]. Furthermore, the adoption of an EPR is a complex change that occurs slowly, in a series of stages. Widespread adoption appears to be a prerequisite to achieving the overall benefits for a health system [10]. However, the EPR adoption stage varies from one facility to another, which limits interoperability. It is therefore important to identify and make use of explanatory factors to facilitate this important transition.

1.2. Aims of the study

The aim of this study was to investigate explanatory factors for nurses' acceptance and actual use of an EPR in acute care settings as well as for their satisfaction. More specifically, the research objectives examined: (1) nurses' perceptions of the compatibility of the EPR and their self-efficacy regarding acceptance of the EPR, (2) the actual use of the EPR, and (3) their satisfaction.

2. Theoretical foundations

2.1. Acceptance models and theories

Over the last few decades, many models and theories have been developed and tested in order to identify variables affecting the acceptance and use of IT provided to end-users. Among them, the Technology Acceptance Model (TAM) [11] stimulated one of the most active streams of research to predict intention to use an IT and explain actual use of IT [12]. Based on the Theory of Reasoned Action (TRA) [13], TAM examined the impact of external factors on the cognitive response of individuals (reactions based on values, beliefs, knowledge, etc.), on their affective response (the emotions and feelings generated), on their intention to change a behavior and, lastly,

on their behavioral response, i.e. their actual use of the system. In 2003, the Unified Theory of Acceptance and Use of Technology (UTAUT) [14] synthesized 32 constructs from eight well-known models and theories to study the acceptance of IT. UTAUT advanced several constructs as influencing intention to use and actual use of IT: performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). These constructs focus on users' perceptions of the usefulness of the system in increasing their productivity, of the ease with which they can learn to use the system, of the role played by significant persons in the work environment to influence the end-user's behaviors and, lastly, on the measures taken to support change. These constructs are considered equivalent to the perceived usefulness, perceived ease of use, subjective norm and perceived behavioral control constructs, respectively [15]. However, some links frequently tested in TAM [11] and TAM2 [16] to measure acceptance and use of a system have not been modeled in UTAUT. This is true of the fundamental links between effort expectancy and performance expectancy and between social influence and performance expectancy. Often these links have proved to be significant when measured among the various types of health professionals affected when an IT is adopted [15].

2.2. Selection of the dependent variables

In this stream of research, most studies have measured the behavioral intention to use the system before the system is deployed, considering this variable as a proxy for actual use. An EPR is used by all health professionals for collective health care delivery. Its use is therefore not voluntary. In this sense, there may be limits to measuring the intention to use a system implemented for mandatory use.

Only four studies have measured actual use of a system in healthcare settings [17–20], and often this has been measured in terms of frequency, intensity of use and the scope of the functionalities used in the system [14]. Yet for clinicians using an EPR, such a measure more accurately reflects patients' need for care and professionals' workflows, rather than acceptance of the system. This study seeks to fill this gap by analyzing the nature of such use to support users' activities and sense making of the information. To this end, we employed a multidimensional construct of actual use of a system [21] that focuses on three IT functions: (1) decision support (problem solving and decision rationalization), (2) work integration (horizontal and vertical) and (3) customer service. Until this time, this construct and the self-reported instrument that was developed to measure the nature of the actual use have received very limited attention in the literature.

A suggestion has also been made to replace actual system use by a measure of user satisfaction [22]. To this end, nurses' satisfaction has been measured with respect to the PE and EE constructs [23], but instrumentally rather than affectively. In the TAM, the attitude toward the system construct has often been left out and is not found in UTAUT. Yet many studies have examined the attitudes of health professionals during adoption of an IT [15]. All the studies that measured the relationship between performance expectancy and attitude toward the system found a positive link [18,24–31] and only one, which examined a sample of physicians, found a non-significant link

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