Factors influencing decision support system acceptance

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ABSTRACT

While clinical DSS have many proven benefits, their uptake by GPs (general practitioners) is limited. The purpose of this research was to develop and explore a UTAUT (Unified Theory of Acceptance and Use of Technology) based model of how and why GPs accept DSS. Insight into the reasons why GPs do not use clinical DSS combined with knowledge of why GPs use DSS will allow the development of strategies to facilitate more widespread adoption with consequent improvements across many areas. Depth interviews were conducted with 37 GPs comprising a mix of education backgrounds, experience and gender. The developed model indicated that four main factors influence DSS acceptance and use including usefulness (incorporating consultation issue, professional development and patient presence), facilitating conditions (incorporating workflow, training and integration), ease of use and trust in the knowledge base.

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1. Introduction

Decision support systems (DSS) research has been undertaken for over 35 years with such systems proving useful in supporting semi-structured and unstructured problems [2]. The main aim of DSS is to provide the user with tools that enhance their decision making process, resulting in more informed decisions [2]. However, despite increasing developments in DSS, the usage breadth increase has been modest [4]. DSS are most widely used in corporate functional management fields, such as marketing and logistics, with limited use within non-corporate areas such as medicine [21]. While there has been some research into DSS acceptance in fields such as agriculture [37] and marketing [30], there is little research on the acceptance of DSS within the medical field, despite the potential of clinical DSS to provide improvements in areas such as: the quality of medical care [13]; disease prevention [55]; disease management and drug dosing [59]; management of chronic physical illness [7]; decision variations between practices [51]; and compliance with guidelines [66]. Clinical DSS are knowledge bases which contain the ability to perform inferences on known information based on prior experience or knowledge [16].

Clinical DSS have been developed since the 1990s [41]. However, most of these DSS do not go beyond the trial stage, and are often only adopted by those who created them. Although there are numerous studies that show the benefits of using DSS by general practitioners (GPs) [19,50], their uptake is very low [20]. It is therefore important to identify the factors that influence GPs' acceptance of these systems to facilitate their usage and improve decision making.

A starting point in exploring the reasons for low usage of clinical DSS lies in the area of user acceptance of information technology.

An inventory of DSS in health was created in 2002 as a part of the National Electronic Decision Support Taskforce (NEDST) report [41,53]. This inventory identified 35 DSS that were either in use or in progress at the time. However, this report is now out-dated. Since the NEDST report [41] there has not been an updated report on the status of these DSS or on the possible existence of new DSS.

The NEDST report [41] categorised DSS into four types. Type 1 DSS provide information that then requires further analysis before the user can make a decision. Type 2 DSS provide trend analyses of patients' clinical status and/or clinical alerts. Type 3 DSS use knowledge bases and inference engines to generate recommendations. Finally, type 4 DSS are closely related to type 3, but are equipped with autonomous learning capabilities such as case-based reasoning, neural networks, and discrimination analysis for more advanced decision making support. Applying the categories of DSS and the definition of clinical DSS, NEDST's [41] types 1 and 2 categories do not classify as DSS, with only types 3 and 4 DSS considered to be actual DSS. It was identified in the inventory that only five of the 35 systems were either type 3 or type 4. Type 1 and 2 systems are more like MIS systems that can help in decision making, but are not actually typical DSS. Therefore, for this research, only type 3 or type 4 clinical DSS will be considered DSS.

The area of user acceptance of information technology (IT), not just in the areas of DSS or health, has spawned considerable research. A number of models aim to explain the acceptance and intention to use IT [58,61,65]. For example, Roger's Innovation Diffusion Theory examines the relationship of the characteristics of an innovation (not specifically IT) with the rate of its adoption at an organisational rather than an individual level; as a result, this is found to be

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somewhat limited with regard to individual adoption [11]. The focus of this study is individual adoption, and the Unified Theory of Acceptance and Use of Technology (UTAUT) [65], which supports this perspective, is therefore the model upon which this research will be based. The UTAUT is based on eight IT acceptance models, including the widely researched technology acceptance model (TAM). The UTAUT synthesises these eight previous models based on their unique and significant elements [65]. The UTAUT comprises four main determinants of intention and use: Performance Expectancy, Effort Expectancy, Social Influences, and Facilitating Conditions, as well as four moderating variables: gender, age, experience and voluntariness of use. The UTAUT has explained up to 70% of the variance in behavioural intention, compared to 30–40% for competing models [61,65], and represents a major step in acceptance research [35]. Due to its infancy, the UTAUT has only been incorporated in a few studies to date [8,22,34], which found support for most of the constructs as well as the overall model.

Although technology acceptance research has been conducted for many different types of systems [60,65], its application to DSS is limited. Existing research often uses the TAM [17]. Other studies do not make any reference to a particular acceptance model, but rather examine specific issues [24,43]. DSS differ from other technologies in their ability to provide advice to the user making the decisions, and therefore the factors influencing the use of DSS need to be established. It has been argued that the current technology acceptance models are not suited for more complex, advanced technologies, but are more appropriate for simpler technologies such as email and word processing [5]. Many studies on the adoption and acceptance of technologies have focused on the use of these simpler technologies, and have used university students as subjects. It is therefore important to look at these models using a more complex technology applied within a new context to subjects other than students. This research will hence examine the use of DSS within a health context using general practitioners (GPs) as subjects.

The purpose of this research is theory building in order to develop and explore a theoretical model that will, in future, provide a basis to examine the acceptance of DSS, and perform some preliminary testing of this model. By using the UTAUT as a starting point, this research will add to the area of technology acceptance by further investigating the UTAUT and adapting it to DSS acceptance. Moreover, this research will examine technology acceptance in the context of GPs, who are independent workers who make individual decisions. Thus the research question is: How and why do general practitioners use decision support systems?

The next section will present the initial model developed for this study, followed by a description of the case methodology used to gather data to further develop and test the model. Results are then discussed and the final model developed through this research is presented. The paper concludes with implications for research and practice.

2. Model development

The initial model developed for this research (Fig. 1) is based on the UTAUT with some adaptations. Within the UTAUT, performance expectancy is the degree to which the individual believes that using the technology will help them improve their work performance [65], and has consistently been found to be a significant predictor of usage intention [57,61,65]. Effort expectancy relates to how easy the individual finds using the system [65]. Social influence is defined as the degree to which individuals feel that significant others believe they should use the technology [65], and has been found to have a direct impact on behavioural intention [61]. The final construct of the model is facilitating conditions, defined as the extent to which the individual believes that organisational and technical supports exist to use the system [65]. Previous studies support the inclusion of facilitating conditions in the model [27,65]. In the UTAUT, facilitating conditions do not influence the intention to use, but instead determine actual use behaviour [65]. In some studies, social influence was found not to be significant, especially in professional contexts such as healthcare [9,10,26]. However, these constructs remain in the model to allow further examination of whether they are relevant to the healthcare context, since previous research has identified their significance [57,63].

In addition, the UTAUT has four moderating variables: gender, age, experience and voluntariness, which impact on the relationships of the four constructs (performance expectancy, effort expectancy, social influence and facilitating conditions). The gender of the user is predicted to influence three of the constructs: performance expectancy, which is stronger for men, and effort expectancy and social influence, which are greater for women [65]. The age of the users moderates all four constructs [65]. Experience, which refers to the degree of experience the user has with the system that is to be used, is identified as influencing effort expectancy, social influence and facilitating conditions. Finally, voluntariness, which refers to whether the system is mandatory or voluntary, will only influence the social influence construct [65].

- Professional Development
- Time
- Cost
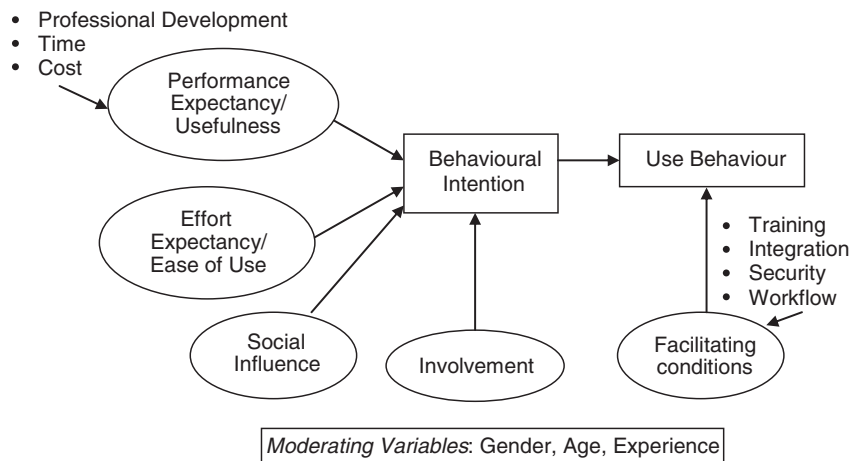
Source: adapted from [65]

Fig. 1. Theoretical model used in this research.