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ANALYSIS AND REVIEW OF PRESCRIBING CLINICAL DECISION SUPPORT SYSTEM WITHIN THE CONTEXT OF NHS SECONDARY SECTOR

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Abstract

Clinical Decision Support System (CDSS) is an important and emerging area of research. Therefore, the study of CDSS form an important field of information technology (IT) used in health care industry. Diagnosis and decision making form an integral part of CDSS. Based on the healthcare data and patient's medical history, CDSS performs recommendation, which helps healthcare professionals to diagnose properly and make clinical decisions accordingly. In this paper, we present analysis and review of prescribing CDSS within the context of the secondary sector of the United Kingdom (UK) National Health Service (NHS). It was observed that prescribing CDSS enhances the safety of patients by reducing medication errors that occur during traditional prescribing (non-electronic prescribing). The reduction of medical errors is due to the efficiency of prescribing CDSS in facilitating health care providers with a holistic view of patient health records and any drug allergy or drug-drug interactions. This study showed that successful adoption of CDSS within the NHS secondary sector faces challenges such as physician acceptance, training, and interoperability.

Keywords

E-Prescribing, CDSS, NHS, Secondary Sector, Safety, Training, Interoperability

1. Introduction

During the last five decades, Clinical decision support systems (CDSS) have emerged largely as tools that assist clinicians, mainly doctors, with a number of standard decision tasks, such as formulation of a diagnosis, prescription of a medication, interpretation of a diagnostic result or therapy planning (Belard et al., 2017; Larburu et al., 2017). CDSS also constitute an application of the idea of knowledge management in the context of healthcare sector to manage information transfer between the correct persons at the correct time (Peleg and Tu, 2006; Zheng, 2017). This is fulfilled by equipping health care providers with the information they require in order to assist them in the decision making process (Woosley, Whyte, Mohamadi, & Romero, 2016).

In this paper, we will discuss the electronic prescribing (e-prescribing) method of CDSS in order to examine the process of e-prescribing within the setting of NHS secondary care (Ahmed, McLeod, Barber, Jacklin & Franklin, 2013). Examining prescribing CDSS is particularly necessary as, despite the UK government continuously supporting the adoption of technology in the NHS, CDSS within the context of NHS secondary health care is still limited (Ahmed et al., 2013; England NHS, 2013).

The study presented in this paper argues that the process of managing medical information through prescribing CDSS leads to improved safety amongst health care receivers due to minimisation of the number of medical errors that occur (Bouidi, Idrissi & Rais, 2017; Eiermann et al., 2010). Nonetheless, this study argues that a successful implementation of CDSS must ensure physician acceptance of the system, training, and interoperability (Al-Badarneh, Najadat & Yabes, 2017; Nee et al., 2008).

2. The Role of CDSS in Reducing Medication Errors and Improving Patient Safety

The safety of patients is a common aim of practitioners within the context of secondary health care in the NHS (Garfield, Jani, Jheeta & Franklin, 2016). However, there is stark contrast in the pattern of prescribing between primary healthcare specialists on the one hand, and secondary healthcare practitioners on the other (Ahmed et al., 2013; Car et al., 2008). As such, while the former has ubiquitously adopted prescribing CDSS, its application by the latter is still patchy and slow (Garfield et al., 2016).

It may have negative impact on the safety of patients in the following ways: the centres of secondary healthcare gather an immense amount of electronic clinical data, such as

issues related to patient hospitalisations, demographic characteristics of healthcare receivers, their diagnosis, medical history, lab tests, previous and current drug prescriptions, and medical insurances (Moja et al., 2016; Moja & Kwag, 2015). Dismissing the adoption of computerised prescription will lead to medical irregularities, as doing so will hinder the ability of health care providers to obtain a comprehensive view of each health care receiver when carrying out clinical decision-making (Dowding et al., 2015). Thus, the clinical safety of the patient will not be properly shielded during prescription and monitoring of treatment, as well as during transcribing and administrating of medical cases (Moss & Berner, 2015).

Negative consequences due to prescription error also known as Preventable Adverse Drug Events occur because of errors in identifying the correct drug or/and the required dosage of the drug (Taylor, Loan, Kamara, Blackburn and Whitney, 2008). In other words, due to a lack of knowledge about the situation of the patient, healthcare providers will not be adequately informed about patient's health records (Taylor, Loan, Kamara, Blackburn and Whitney, 2008). Hence, the risk of prescribing drugs that cause allergic or other serious side effects is increased (Tan, 2006).

Prescribing CDSS is appropriate for the enhancement of outcomes when facing systematic challenges relating to clinical knowledge concerning the health records of patients (Kuperman et al., 2007). This method enriches the clinical knowledge of secondary care health providers through two steps (basic and advanced) (Afzal et al., 2015). In detail, the basic step is as follows; practitioners will be able to check the allergy as a side-effect of a drug, guidance regarding the dosage, interactions between various given drugs, and scrupulously examine the issue of duplicate therapy (Ungar et al., 2008). This basic knowledge is essential for clinical decision makers as it minimises medication errors by up to 64 percent, as indicated by Fortescue et al. (2003).

After considering the basic support delivered to decision makers by prescribing CDSS, clinical practitioners also have access to advanced decision support (Chang, Kao, Wu & Su, 2016). This covers issues such as support and checks for medication dosage amongst elderly patients, renal incapacity, pregnant women, contradictions between drug and disease, and guidance for lab tests. Advanced prescribing CDSS leads to 83 percent reduction in medication errors, as reported by Fortescue et al (2003).

Within the domain of prescribing, the most commonly occurring medical mistake is drug-dosage error (Axelsson, Spetz, Mellen and Wallerstedt, 2008). CDSS can properly tackle this issue through providing decision makers with the following essential information (i.e. dosage tolerance that is suitable for patients, identifying a suitable initial level of drug

dosage, substantially reducing variability of dosage, and giving recommendations about frequency of dosage) (Baiardini, Braido, Bonini, Compalati and Canonica, 2009; Kaushal et al., 2006; Sard et al., 2008). The benefit of prescribing CDSS's with the aforementioned information can be seen in the enhanced patient outcomes and improved health care provider performances (Sintchenko, Coiera and Gilbert, 2008).

In addition to the issue of dosage, prescribing CDSS plays a significant role in highlighting the issue of adverse interaction between drugs prescribed currently and those prescribed previously (Ekbia, and Hara, 2008). Nonetheless, the alerting role of prescribing CDSS regarding issues of medical interaction and allergy should be of use to the practitioners; otherwise, the warnings will likely be dismissed (Hughes and Blegen, 2006). Alerting practitioners to the presence of the aforementioned factors during the prescription process needs to be specific (Rodriguez-Loya & Kawamoto, 2016).

Specification in warnings means introducing fewer alerts; but, providing more significant, better detailed medical warnings in the alerts that are given (Oh, et al., 2015). Indeed, a large number of alerts can lead to practitioners discarding overlooking significant warnings, side-lining them with the numerous non-significant warnings (Yu, 2015). This crystallises a negative attitude amongst practitioners towards prescribing CDSS which, consequently, results in its dismissal for its perceived low credibility (Eslami, de Keizer and Abu-Hanna, 2008).

Thus, using prescribing CDSS, medical errors due to over reliance on inadequate medical data will be reduced (Maldonado, Leija & Vera, 2015). Therefore, the quality of healthcare in the NHS secondary sector will be enhanced due to an improvement in practitioner performance.

However, this study considers that the optimal implementation of prescription might be impeded by a number of issues such as the negotiation of obstacles facing physician acceptance and training, as well as the issue of interoperability, as will be discussed in the following sections.

3. Physician Acceptance and the Need for Training

Generally, if organisations are unable to customise the currently employed information system to fit with the strategies being used, then the result would be unfavourable performance, wasted resources, and lost opportunities (Galanter, Hier, Jao and Sarne, 2010). More specifically, CDSS faces challenges regarding its implementation in

sectors that significantly rely on team–based tasks, such as the NHS secondary care sector (Nicolini, Powell, Conville and Martinez-Solano, 2008). Amongst these challenges is the fact that a broad level of autonomy is given to clinicians within NHS secondary care, accompanied by an absence of roles that force clinicians to adopt prescribing CDSS leads to establish resistance to prescribing CDSS (Sintchenko, Magrabi and Tipper, 2007). Therefore, CDSS implementation would require considerable effort and a high level of commitment to unite medical team members, because differences in disciplines, cultures and organisation could lead to related challenges within the healthcare setting (Nevo, and Chan, 2007).

Moreover, from the technological perspective, since CDSS is a computerised program, the written guidelines into computer executable codes is found to be disadvantageous (Sirur, Richardson, Wishart and Hanna, 2009). Despite the development of tools for simplification of the processes, CDSS would however then require the best use of specialised skills and expertise in medicines and informatics to be successfully applied (Baig, Hosseini & Lindén, 2016).

These challenges are not exclusive, and are committed by vendors, doctors and physicians tasked with accomplishing the standards of interoperability (Fatima et al., 2015). Solving these challenges will certainly support the successful implementation of CDSS in secondary healthcare in correspondence to UK government efforts in developing and encouraging the adoption of informatics in secondary healthcare (Main et al., 2010). Tackling this issue requires the running of regular training courses in order to keep practitioners informed and updated about the latest developments in CDSS (Subramanian et al., 2007). However, training courses require both sufficient time and adequate budget, either of which might not necessarily be available (Khalifa & Alswailem, 2015).

4. Interoperability

Interoperability is referred to as an attribute of any service or system like CDSS; the interfaces of systems are completely understandable and involve exchanges between a range of products and a wide range of vendors in the improvisation of any system (Marcos, González-Ferrer, Peleg & Cavero, 2015). Interoperability increases the ability of IT practices, systems and software applications to exchange data and utilise information about patients in order to provide the best possible care services (González-Ferrer & Peleg, 2015).

CDSS introduces a number of services, such as a model for managing and storing clinical data, a method to warn health care providers of complex and problematic cases, and

several decision making tools to support practitioners (Parra-Calderón, 2015). In all decision support operations of the CDSS, there is a need for the application to be efficiently and easily integrated within other information system applications used in the health care setting (Chang et al., 2016).

For instance, within the context of NHS secondary care, CDSS should be properly integrated with the Electronic Health Records (EHR) system (Marcos, Maldonado, Martínez-Salvador, Boscá & Robles, 2013). Nonetheless, the level of interoperability is still shallow in the case of CDSS and EHR which, in turn, adversely impacts the safety of patients (Marcos et al., 2013). In detail, CDSS should provide correct, complete, and current data to the decision makers when they are carrying out the prescription process (Yourman, Concato and Agostini, 2008). These data are retrieved from the EHR of patients. However, according to Rodriguez-Loya & Kawamoto (2016), CDSS does not properly exchange data with EHR due to the existence of heterogeneous templates and keywords. Furthermore, there is a lack of availability of standardised reference models that have terminological binding (Peleg, and Tu, 2006).

Therefore, to assert the availability of correct, complete and current data for clinicians, there is a practical requirement for enhancing the issue of interoperability (Woosley et al., 2016). Currently, however, there is a tendency to increase the level of interoperability amongst various computerised health models (Zhang, Tian, Zhou, Araki & Li, 2016).

5. Conclusion

The NHS secondary care service relies on sharing information and effective communication as a way of fulfilling team based medical tasks. Accordingly, the adoption of CDSS as a knowledge management strategy helps in the decision making process within the context of health care, as it facilitates doctors with suitable information at the correct time.

This study showed that using CDSS for prescribing would improve the safety of the patients through its ability to reduce medication errors resulting from human factors. However, this study indicated that there is a need to examine the issue of physician acceptance to CDSS, training, and interoperability in order to assert efficient implementation of the CDSS. These findings are in conformity with other studies (e.g. Marcos et al., 2013; Subramanian et al., 2007). In order to increase the level of physician acceptance to the system, this study

referred to the importance of providing effective training courses. However, these courses need to be funded by the NHS secondary service.

In this paper, we have shown that CDSS has low level of interoperability with other health informatics programmes such as EHR, meaning clinical decision makers might be hindered in their ability to adequately obtain correct, complete and current data when carrying out their prescriptions.

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