Chapter 1
Intelligent Risk Detection in Healthcare Contexts of Hip and Knee Athroplasty and Paediatric Congenital Heart Disease

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ABSTRACT

Rapid increase of service demands in healthcare contexts today requires a robust framework enabled by IT (information technology) solutions as well as real-time service handling in order to ensure superior decision making and successful healthcare outcomes. Contemporaneous with the challenges facing healthcare, we are witnessing the development of very sophisticated intelligent tools and technologies such as Business Analytics techniques. Therefore, it would appear to be prudent to investigate the possibility of applying such tools and technologies into various healthcare contexts to facilitate better risk detection and support superior decision making. The following serves to do this in the context of Total Hip and Knee Arthroplasty and Congenital Heart Disease.

INTRODUCTION

For some diseases, surgery is not always a final cure and it result in a considerably high rate of disabilities, as well as the possibility of co-morbidities (Goossens, Apers, Gewillig, Budts, & Moons, 2013; Tabbutt et al., 2012); for example, types of cancer and even the development of bowel diseases. Naturally, this also has a direct adverse impact on patients and their families (Landolt, Buechel, & Latal, 2011). Hence,

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decision-making regarding major surgery is multi-faceted and complex (Noyes, Masakowski, & Cook, 2012; Sox, Higgins, & Owens, 2013).

To facilitate the surgical decision making process, we suggest the application of real time intelligent risk detection decision support would be beneficial. We proffer a suitable solution which combines the application of data mining tools followed by Knowledge Discovery (KD) techniques to score key surgery risk levels, assess surgery risks and thereby help medical professionals to make appropriate decisions.

The aim of this chapter is to outline how it might be possible to improve the outcomes and benefits of surgical interventions and support a healthcare value proposition of excellence for patients, their families, providers, healthcare organizations and society by developing an intelligent risk detection framework to improve surgery decision making processes. While such strategies have been used in other industries (i.e. banking and finance) (Bhambri, 2011; Pulakkazhy & Balan, 2013), it appears that this is one of the first studies focused on healthcare contexts. We focus on the contexts of Total Hip and Knee Arthroplasty and Congenital Heart Disease (CHD) in children to illustrate the potential of this approach.

BACKGROUND

Clinical Decision Support Systems (CDSS) are computer driven technology solutions, developed to provide support to physicians, nurses and patients using medical knowledge and patient-specific information (De Backere, De Turck, Colpaert, & Decruyenaere, 2012). Decision Support systems can be found in widely divergent functional areas. However, in e-health contexts, key features such as intelligent timing, multidimensional views of data and calculation-intensive capabilities become important features given the need for real time outcomes and the multi-spectral nature of care teams (Wickramasinghe, Chalasani, & Koritala, 2012). Hence, systems for healthcare must give advice and support rather than decision making replacing that of clinical staff.

Studies have already proved that CDSS enhance quality, safety and effectiveness of medical decisions through providing higher performance of the medical staff and patient care as well as more effective clinical services. A variety of CDSS programs designed to assist clinical staff with drug dosing, health maintenance, diagnosis, and other clinically relevant healthcare decisions have been developed for the medical workplace (Haug, Gardner, Evans, Rocha, & Rocha, 2007). On the other hand, patients' demand for participation in medical decisions has been increasing (Kuhn, Wurst, Bott, & Giuse, 2006). Therefore, to be respectful of patients and parents/guardians participation and decisions, shared decision-making (SDM) between health care professionals, patients, parents and guardians is widely recommended today (Lai, 2012). SDM is defined as the active participation of both clinicians and families in treatment decisions, the exchange of information, discussion of preferences, and a joint determination of the treatment plan (Barry & Edgman-Levitan, 2012; Charles, Gafni, & Whelan, 1997; Légaré et al., 2011; Makoul & Clayman, 2006).

Although SDM is supported in many disease management domains, some concerns and issues still remain regarding the adoption of SDM solutions such as a perception among some practitioners that the ultimate responsibility for treatment should remain under their authority (Edwards & Elwyn, 2009; Schauer, Everett, del Vecchio, & Anderson, 2007). Moreover, client capacity to participate in decisions (O'Brien, Crickard, Rapp, Holmes, & McDonald, 2011), identifying the SDM components (Sheridan, Harris, & Woolf, 2004; T. van der Weijden et al., 2011) as well as SDM user acceptance (Scholl et al., 2011)are main issues to promote this type of CDCS in the healthcare contexts. However, SDM also