


Chapter 23

Using Intelligent Tools to Support Clinical Decision Making: The Case of Hip and Knee Arthroplasty

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ABSTRACT

Intelligent tools and collaborative systems can be used in healthcare contexts to support clinical decision making. Such an approach is concerned with identifying the way in which information is gathered and decisions are made along specific care pathways. This study develops a real-time collaborative system using an intelligent risk detection model (IRD) to improve decision efficiency in the clinical case of patients undergoing hip or knee arthroplasty. The benefits of adopting this improved clinical decision-making solution include increasing awareness, supporting communication, improving the decision making process for patients and caregivers while also improving information sharing between surgeons as key collaborative parties in the research case. This in turn leads to higher levels of patient and clinical satisfaction and better clinical outcomes.

INTRODUCTION

Leading healthcare organizations are recognizing the need to incorporate the power of a decision efficiency approach, driven by intelligent solutions (N Wickramasinghe, Bali, Gibbons, Choi, & Schaffer, 2008). The primary drivers for this include the time pressures faced by healthcare professionals coupled with the need to process voluminous and growing amounts of disparate data and information in increas-

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Table 1. The Key Objectives

Objective	Description
Reducing the burden of hip and knee arthroplasty	This will be achieved by supporting the prediction of the surgery results to identify patients at risk during surgery and thereby, enabling better planning and appropriate measures to be taken in the design of an appropriate treatment protocol. Ideally this includes risk identification preop, periop and postop.
Improving the treatment and management of hip and knee arthroplasty	This will be achieved by supporting better, informed collaborative decision making which will in turn allow for more appropriate/successful treatment choices to be made.
Gaining an even better understanding of the consequences of hip and knee arthroplasty	This will be achieved by developing an initial repository for analysis and to discover and extract hidden knowledge (patterns and relationships) associated with surgeries and other treatments from historical data to detect important surgery risk factors which will not only lead to a better understanding of critical and potentially confounding aspects to recovery but also facilitate more tailored and appropriate treatment regimens in the specific context. In addition patient reported outcomes will be considered.
Developing preventative measures to reduce side effects of hip and knee arthroplasty	This will be achieved by developing important KPIs (key performance indicators) as a set of metrics and then using these to design and develop more suitable protocols and recommendations which when applied can result in measures to reduce side effects.

ingly shorter time frames yet making accurate and suitable treatment decisions. These decisions have a critical impact on successful healthcare outcomes and far reaching implications for the lives of their patients (Gibbons, Bali, & Wickramasinghe, 2010; N Wickramasinghe et al., 2008).

This paper directly examines the benefits of an Intelligent Risk Detection (IRD) Model (F. Moghimi, Wickramasinghe, & Zadeh, 2011; H. Moghimi, Zadeh, Schaffer, & Wickramasinghe, 2012) to support and facilitate superior decision making in the context of hip and knee arthroplasty. An important, unique feature of the IRD Model is the integration of the three well established IT [information technology] solutions [Knowledge Discovery, Decision Support Systems and Risk Detection], which have proved to be very successful in providing collaborative decision support in complex, high risk decision making scenarios in various business contexts (Pulakkazhy & Balan, 2013).

The aim of this paper is to present the initial outcomes of the study conducted in one of the biggest private hospitals in Melbourne, Australia to develop and then investigate the benefits of using the IRD Model to design a collaborative system for supporting surgical decision making in the context of Hip and Knee Arthroplasty. The research question is:

How can key tools and technologies of today's information age be designed, developed, and adopted to support clinical decision making in the context of hip/knee Arthroplasty?

Table 1 below lists the key objectives of this study.

To answer the research question and thereby achieve the stated aims a Design Science Research Methodology (DSRM) is adopted to design and develop a prototype of the IRD Model in the chosen research case. This paper focuses on identifying the problem and specific motivations in the case of hip and knee arthroplasty and then identifying requirements towards design and develops the IRD application by using on-line survey and an expert focus group.

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