A Clinical Decision Support System for Needs-driven Telemedicine Technology Development

MJ Treurnicht[a], Lvan Dyk[a], J Fortuin-Abrahams[b], NF Treurnicht[a], M Blanckenberg[c]

[a] *Department of Industrial and Systems Engineering, Stellenbosch University, South Africa*
[b] *South African Medical Research Council, Tygerberg, South Africa*
[c] *Department of Electrical and Electronic Engineering, Stellenbosch University, South Africa*

Abstract

A telemedicine workstation was installed as pilot project at the Grabouw CHC in 2004/2005 to enable the communication of diagnostic information between CHCs and hospitals. Part of the eventual suspension of the pilot implementation of the telemedicine workstation at Grabouw CHC could possibly be attributed the fact that the technology-push phase was not preceded by a formal needs assessment. The paper presents the rationale and design behind a Clinical Decision Support System (DSS) to enable in future a needs-driven telemedicine workstation development.

Keywords:

Telemedicine, Telemedicine workstation, Clinical decision support systems

Introduction

The purpose of this project is to support decision making with respect to the future development of telemedicine workstations, based on the clinical needs, hence following a *clinical-pull* approach with respect to the introduction of telemedicine workstations.

Methods

To accomplish the goal of this project, a clinical decision support system (DSS) is developed. Figure 1 shows the framework for this system. This is a culmination of the respective DSS and data warehouse design frameworks by Turban and Kimball respectively. It is specifically adapted to describe the approach and outcomes of this project.

As shown on the right hand side of this figure the adoption of telemedicine technology is influenced by decisions by policy makers, medical practitioners, patients as well as technology developers. The focus of this project to help technology developers to base support decision on patient needs. They are concerned about the usage trends as well as the cost of the technology, as addressed by the respective data analysis approaches shown in Figure 1. The data input for these analyses are taken from a data warehouse, which is populated by data that was extracted, transformed and loaded (ETL) from physical patient files and other transactional systems, as shown on the left hand side of Figure 1.

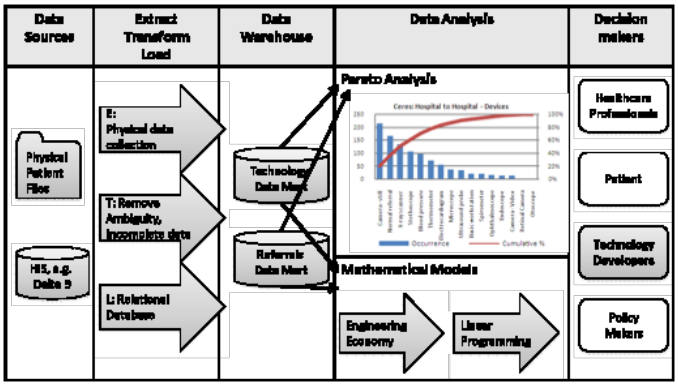

Figure 1-Clinical decision support system

Extraction, transformation and loading

Data were primarily extracted from physical hand-written patient files primary healthcare facilities in the Western Cape. A secondary data source is selected data captured by hospital information systems (HIS), in this case Delta 9. As part of the data transformation process, firstly data were cleaned in order to eliminate ambiguity and incomplete or incorrect entries. Furthermore, to protect the anonymity of patients, data that could reveal the identity of patients were removed.An MS-Access database was developed to contain the *referrals data mart*.

Data Analysis and Results

The output of the DSS can guide decision making with respect to the positioning of technology within certain healthcare facilities. The telemedicine needs at a DHC differs from the health care needs of a tertiary hospital.

Mathematical Models

The combined outputs from the *Referral Data Mart* and *Technology* data mart are used to help decision making related to the time value of money, buy-or-lease options and cash flow implications. The Fixed Charge Mixed Integer Programming problem is a specific LP application that is suitable to support decisions with respect to the selection of equipment and components. By linking these mathematical models to the data warehouse, this clinical DSS could be used to support decision making towards the needs driven development and implementation of telemedicine.