Utility of a Technology Allocation Matrix for Optimizing Telehealth Services: A Case Study of Telemonitoring in Congestive Heart Failure

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ABSTRACT

Information exchange in telehealth ultimately comprises basic activities such as measurement, storage, analysis, distribution, presentation and monitoring of relevant text/image/audio/video data. A systematic technology mapping matrix is a sensible and cost-effective approach to enable the scientifically sound deployment of appropriate telehealth technologies. This paper takes the example of congestive heart failure (CHF) telemonitoring and applies elements of the matrix to illustrate its utility. Though CHF is a global problem with grave implications for public health and society, morbidity and mortality remains high. Despite clinical similarities that may exist among patients in different parts of the world, telemonitoring may not be feasible everywhere; and even when it is, significant modifications in approach would be needed to accommodate available infrastructure, funding mechanisms and patient/clinician preferences. For the success of any telehealth program, in addition to incorporating appropriate technology there must be focus on end-user needs and incorporating viable sustainability models.

Keywords: Congestive Heart Failure (CHF), Information Communication Technology, Technology Allocation Matrix, Telehealth, Telemonitoring

BACKGROUND

Conventional mechanisms of care delivery typically demand proximity of the patient, doctors, nurses and equipment thereby raising the cost and complexity of healthcare. In recent years there has been great enthusiasm to adopt information communication technologies (ICT) for promoting efficient and cost-effective health care delivery. Telehealth has been much heralded as a promising ICT intervention to reduce the need for proximity and thereby help in bridging the gap between the demand and supply of health care personnel. Unfortunately,
in reality there have been significant problems across the board with technology selection, scalability and sustainability. Growth in tele-health has often been driven by governments or vendors, looking at the issue of telehealth implementation and design from a biased view, laced with liberal doses of wishful thinking. Real-world implementations have struggled due to lack of focus on the end-users and the absence of a viable financial model. Sadly, the global landscape is therefore littered with the remains of defunct telehealth programs that could not survive past the period of the start-up funding. This paper focuses on one element of this complex problem—the question of choosing the right technology for a given health issue, keeping in mind usability, communications infrastructure, and the existing workflow of health care delivery.

Current mechanisms of health care delivery reflect a highly complex map of intertwined dependency factors. Efforts to employ a common ICT infrastructure model across these diverse environments may lead to significant delay, confusion and reluctance in the user community. A conceptual approach we have presented elsewhere (Ramkumar & Babu, 2010) attempts to break down a given healthcare context into a workflow of transactions and map the nature of related information flow on the basis of content, size, urgency in provisioning the data and the type of user interaction (Figure 1). The resulting matrix should help in assessing cost-effective technology approaches for a given health program as well as revealing the program structure which is optimal given existing infrastructure and end-user need.

This paper extends our concept to map out the requirements for telehealth in the context of a specific disease and target demography. An important area where telehealth has been evolving is in management of chronic diseases such as congestive heart failure (CHF), asthma and diabetes where the patient is monitored remotely while at home, and necessary management changes are made utilizing a telelink, typically a telephone line. We will consider the example of congestive heart failure and review in detail the process of telemonitoring, highlighting important findings from the literature and applying a technology application matrix

**Figure 1. Process to map the nature of information exchange in care cycle**

![Diagram: Break down a care scenario into activities, Identify transactions within the activities, Identify nature of information exchange required in various transactions, Map information exchange requirement to infrastructure requirement]
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