

## Chapter 7.17

# Multicriteria Models for E-Health Service Evaluation

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### ABSTRACT

The use of advanced telecommunications and information technologies has been investigated for several decades as an effort in improving healthcare services. Over the last ten years, in particular, efforts have been centered on telemedicine, which has become an increasingly attractive field of research in healthcare service delivery. This chapter discusses multiple criteria evaluation of electronic healthcare (e-health) services, a branch of telemedicine, with both users' and practitioners' (service provider) perspectives. The proposed approach integrates several analytical decision making techniques and can be helpful in increasing the flexibility and efficiency of e-health service planning. Several different discrete alternative methods, namely AHP, Borda Count, LINMAP, and PROMETHEE are utilized to prioritize different e-health services and to evaluate preferences of both users and practitioners.

### INTRODUCTION

Quality of healthcare service delivery has been one of the major issues facing healthcare providers, employees, employers, and government agencies. Healthcare delivery is mainly constrained by geographical location and economic status of intended receivers and operational efficiency at service providers. As a result, the healthcare community has faced challenges in distributing healthcare resources, providing healthcare equally to all socio-economic segments of the population, and controlling healthcare costs. One way to efficiently handle these limitations is to incorporate innovative information technologies (IT) in healthcare service delivery. Telemedicine has been proposed as a multifaceted IT based response to solve the above mentioned problems (Bashshur, 1997). American Telemedicine Association (ATA) defines telemedicine as the use of medical information,

exchanged from one location to another via means of electronic communication, to improve health status of patients (ATA, 2006). The objectives of telemedicine, and of electronic health (e-health) which is an implementation of telemedicine, are to enhance patients' equality in the availability of various medical services despite geographical and economic barriers (McConnochie et al., 2006), reduce direct and indirect costs (loss of production or income) to patients and to healthcare industry (de Toledo et al., 2006), save travel time for both practitioners and patients (Samii et al., 2006), reduce waiting time and cut lines in healthcare institutions (MacFarlane et al., 2006) and improve consultation and co-operation among geographically distributed healthcare units by bridging the distance between practitioners and specialists (Harrison et al., 1996).

Telemedicine continues to become a facilitator in healthcare delivery. A recent article by Samii et al. (2006) describes a telemedicine application in Parkinson treatment. They used telemedicine to conduct follow up controls of 34 patients at several regional centers located 67 to 2,400 kilometers away from a main healthcare facility. They report cost, time and travel savings amounting up to \$37,000, 1,500 patient hours and 100,000 kilometers. McConnochie et al. (2006) comment on benefits of telemedicine in the treatment of childhood illnesses. They tested the effectiveness of two practices: patients actually visiting physicians and patients treated via telemedicine. They found out that about 85% of cases were suitable for treatment via telemedicine and that telemedicine provided the same service effectiveness as personal visits. de Toledo et al. (2006) report a telemedicine service that delivers home care to chronic obstructive pulmonary disease patients. They tested the service during a period of one year and reported the improvements through telemedicine implementation. One of their major findings was that the telemedicine services resulted in up to 51% increase in the number of patients that were not readmitted and required low

implementation costs. MacFarlane et al. (2006) report telemedicine applications in Ireland and provide some comments from actual practitioners and users of these services. They argue that reducing patient traveling and removing isolation from professionals for people in rural areas are among the significant benefits of telemedicine. Several other publications report successful telemedicine applications worldwide, including in Canada (Jennett & Andruchuk, 2001), Europe (Lareng, 2002), Nigeria (Adewale, 2004) and eastern Asia (Chen et al., 2001; Kasitipradith, 2001).

Surprisingly, despite the increasing popularity of telemedicine, published work in telemedicine service assessment is limited. One reason behind this scarcity is the lack of extensions of well developed brick-and-mortar service quality models to electronic services (e-services). Particularly, most of the e-health service evaluation literature is at the level of conceptual work (e.g. Bedini et al. (2006) and Giansanti et al. (2007)). A few papers addressing the issue via analytical approaches also exist. For instance, Bilsel et al. (2006) proposed a ranking method to evaluate hospital websites and presented an application in Turkey. They argued that telemedicine service assessment should be based on several evaluation criteria and proposed a multicriteria decision making (MCDM) scheme. They teamed up with actual decision makers (DMs) in their study and modeled their verbal judgments as fuzzy numbers for integration in the MCDM framework.

This chapter fills the service assessment gap in research on telemedicine service delivery evaluation by proposing MCDM methods and applying them to evaluate e-health applications. We study e-health services with both users' and practitioners' perspectives. Our aim in this separation is to bring a broader view to e-health service evaluation by acknowledging potential differences between what users are looking for and what practitioners are seeking to offer. Criteria of the problem are grouped in two sets in a way to reflect expectations of both parties and their understanding of

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