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Clinicians' view of tele-glaucoma[☆]



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Abstract

Although recent advancements in technology have led to major transformations in healthcare services, the use of tele-monitoring in patient care is yet an emerging occurrence. This study examines factors that affect the adoption of video based remote treatment of senior patients in a tele-glaucoma project in a large hospital in Greece. Several themes emerge from the study encapsulating technical, usability, process, institutional, ethics and privacy, clinicians' behaviour and patients' demography related factors. The findings of the study showed that while the benefits of tele-monitoring service adoption were of foremost importance for doctors, usability and connectivity for enabling remote services was critical for its success.

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Introduction

Glaucoma is the principal source of irreversible blindness worldwide [1] and the number of people suffering from it is expected to increase from 64.3 million in 2013, to 76.0 million in 2020 and 111.8 million in 2040 [2]. The sight loss is preventable for patients diagnosed with glaucoma and most patients can expect to maintain their sight as long as they follow the treatment [3]. However, there are numerous reports showing that patient adherence to glaucoma treatments is poor [4-7] and/or clinicians are concerned over the improper administration of the treatment by patients [8].

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This could lead to worsening the symptoms and even to sight loss [8]. By measuring the intraocular pressure clinicians are not able to determine whether the patient is adhering or not to the treatment [9] making it difficult for clinicians to determine whether the treatment is inefficient or improperly administered [4]. This often leads to a change in therapy even for patients to which the given therapy could be effective if the treatment is followed correctly resulting potentially in further decline in adherence if the treatment is more complex [10]. Therefore, it is useful to have a way by which clinicians could monitor how their patients continue to administer the treatment at home and intervene where necessary to guide them in properly administering the medication [11].

On the other hand, senior citizens are more prone to be affected by glaucoma [12]. These patients are likely to have lower mobility and sometimes require to be accompanied to hospital which could be an impediment considering that glaucoma requires frequent consultations [13]. In this

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context, using a tele-glaucoma system would allow these patients not only to save on transportation costs but also to be independent for a longer period of time therefore improving their quality of life. In addition, it is considered that using remote monitoring will not only help improve the quality of treatment and reduce patient burden, but also the workload on already overstretched health services [14]. This is especially the case for countries in which healthcare is free and is aimed at offering high quality health services to an ever increasing and ageing population. Countries in Europe such as Greece, where this study took place, are also affected by budget cuts to healthcare, thus adding further strain on resources.

Despite the potential tele-monitoring in glaucoma patients, tele-glaucoma has not been as extensively used and there are only few studies evaluating the use of tele-glaucoma [14]. The purpose of this article is to determine what factors affect the use of high definition video for tele-glaucoma on a large scale.

Adoption and evaluation frameworks

Adoption and evaluation frameworks have been extensively researched in information systems with the aim of determining factors that affect the long-term use of ICT. Numerous studies have proposed frameworks focusing on why the users accept or not a certain technology. According to [15] the most prominent models for technology adoption are: Theory of Reasoned Action (TRA) [16], Technology Acceptance Model (TAM) [17], Motivation Model (MM) [18], Theory of Planned Behaviour (TPB) [19], Combination of Technology Acceptance and Theory of Planned Behaviour models (combined TAM - TPB) [20], Model of PC Utilisation (MPCU) [21], Innovation Diffusion Theory (IDT) [22] and Social Cognitive Theory (SCT) [23]. Unified Theory of Acceptance and Use of Technology (UTAUT) [24] unifies the above models into a single adoption framework, which was subsequently extended into Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) [25], in order to adapt the original framework to the consumer context. UTAUT2 [25] is further extended better evaluate services that make use of high definition video-to-video communication. To this extent, the new model includes also constructs from the IS success model [26] and includes information regarding the perception of information privacy [15].

In healthcare [27] proposes another model for evaluating the video-to-video communication but in this case focusing on emergency services. This model considers the technical, user, application and process requirements. Currie [28] proposed an integrative model for health technology assessment, TEMPEST-which stands for technology, economic, market, political, evaluation, social and transformation and is an integrative model for health technology assessment. However, not all of the studies performed in healthcare have proposed new frameworks for evaluations. Some studies have used existing adoption models to evaluate their ICT research (e.g. [29,30]), extended an existing technology acceptance model (e.g. [31] extended TAM by trust beliefs to study patient acceptance of e-health services) or have focused on evaluating the relevance of certain adoption models in healthcare [32]. For example, [32] evaluates the

usage of TAM in healthcare and concludes that it is important for the model to be adapted to the healthcare context. In the context of this research, we considered an exploratory approach being more accurate in providing a better picture of the factors, which might affect the adoption of tele-glaucoma services, as focusing on an existing framework could potentially lead to ignoring factors, which do not map to the framework.

Factors affecting video communication for tele-applications

Several researchers have proposed indicators for evaluating user satisfaction with existing tele-applications. These indicators have been extensively studied both in healthcare [27] and outside this field: in education [33,34]; museum settings [35], or in entrepreneurs' communication with local municipality services or with potential clients [36].

In education there are several studies that have looked into what factors affect the usage of video communication [33,34]. Morse [34] presents experience in using videoconferencing for learning over a period of 14 years. He has found several challenges in the process: technical failures, organising and planning the classes, different school years in different locations, different time zones and daylight saving time, security, and variation in the equipment quality and nature. The study presented by Weerakkody et al. [33] presents the results of several focus groups with Irish and Greek teachers in order to determine what factors affect videoconferencing adoption in education. They have classified the results across two main categories (user and technical) each of them further on dividing into two other sub-categories. The main user factors were student experience and pedagogical factors (e.g. improvement in student knowledge after a videoconferencing session) and the technical factors were grouped across application (reliability, security, video quality) and network (quality of the network communication).

A four-category classification of the factors that affect usage of video in entrepreneur services was proposed in a study by Molnar et al. [36]: technical factors, cost factors, service improvements factors and risk factors (privacy, different communication expectations, reticence of the entrepreneurs in using the service). Popleteev et al. [35] looks at what factors should be included in evaluating video-to-video communication between the visitors of two different museums. These factors have been grouped into three categories: technical indicators (multimedia quality and network latency), user indicators and process indicators. Across most of these services, network connectivity, quality of the video communication, reliability and usability of the application are highlighted as one of the main issue, whereas other factors are mostly application specific.

In healthcare, a four-category framework for evaluation is proposed also for the usage of emergency services [27] by combining the factors found in the literature regarding video communication. The following requirements are identified: technical requirements (related mostly to network parameters for ensuring a good connectivity), application requirements (focus on the technical issues on the application side such as support for codecs and hardware

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