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A Review on Home Telemonitoring Healthcare Systems

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***Abstract*— The telemonitoring or tracking of ailments that are channeled from residences is perceived to be a potential method in managing patients. It provides precise and consistent dependable data, an enabler to patients, affects their mind-sets and actions and shows promise in the progress of the medical situation. Thus telemonitoring from homes embodies a multitudinous method of management pertaining remote tracking of patients. The current study explicates an examination on the characteristics and size of the effect that are related to telemonitoring with regard to four categories of ailments; hypertension, diabetes, cardiovascular diseases and pulmonary conditions. Further studies should engage in evidence-based research pertaining clinical outcomes, the positive effects in terms of costing, how it affects the utilisation of services and the reception of healthcare providers towards it.**

***Index Terms*— telemonitoring, Healthcare, utilisation of services.**

I. INTRODUCTION

The worldwide life expectancy has been enhanced through the constant advancement in science and technology, combined with the broad spectrum of progress in social situations and environmental conditions. Consequently this led to the ageing in the global population. Through the last five decades, there has been an increase of three folds of people aged 60 years. And there is an anticipation that by 2050, the longevity in the age of the world population will triple yet again to approximately two billion . A region that has been forecasted to experience an amplification in terms of its ageing population is China; with a projection to indicate a 22.7% in 2050 from a 6.9% in 2000. The impact of longevity is tremendous as it bears huge significance and effects on the whole spectrum of human life with the inclusion of matters pertaining to health and the healthcare sector[1]–[3].

There will be a continuous rise in incidences of persistent (chronic) diseases such as Chronic Obstructive Pulmonary Disease (COPD), diabetes and cardiovascular diseases. The fatality in most countries are the result of chronic diseases, with an approximation of 60% of deaths caused by these diseases towards the end of 2005. The bias and imbalance in healthcare costs are due to the pervasiveness in chronic diseases. In a majority of the delivery systems, 50% of the costs incurred are borne by the patients. The economic encumbrance caused by chronic diseases are great, making up 46% of the world troublesome load caused by diseases. The calculated approximation of incurred losses in national income (in international dollars) worldwide in 2005 in China was $18 billion, in Canada was $1.2 billion and in the United Kingdom was $1.6 billion; which were caused by diabetes, heart disease, and stroke [4]. At the national level in the United States of America, 78% of incurred medical costs constitutes patients with chronic ailments. Thus, due to the worrying encumbrances caused by chronic diseases on expenditure and healthcare resources; these factors were strong reasons towards finding resolutions in providing healthcare to patients [5], [6]. The problems are made complicated by the healthcare demand and supply curve. There exist a paradoxical situation when there is a dearth in healthcare providers amidst the intense rise in the chronically ailing patients[1], [7]. In addition, there is also a severe scarcity in nurses in numerous developed countries, inclusive of Canada, United Kingdom, Australia, and the United States, with a bleak hope of inverting or avoiding the state of affairs in the future[8]–[10]. Moreover, certain countries need to manage the declining numbers of persons joining the nursing and physician profession, and this trend is expected to persist many years to come.

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II. HOME TELEMONITORING: A DEFINITION

In the Information Technology domains, the key applications in the healthcare segment comprise of home telecare from residences and telemedicine. Telemedicine is a two-pronged technology that serves both the patient as well as the healthcare service providers [8], [11], [12]. Firstly it is defined as the provider of clinical or medical care, which includes the remote diagnosing, caring/treating or consultation for patients who resides at a distant through telecommunication systems. It encompasses a spectrum of services related to care of patients such as teledermatology, telepsychiatry, teleophthalmology and teleradiology.

Its main purpose is the provision expert consultation services to remote commune instead of the provision of tools for autonomous management of chronic diseases [11]. On the second prong is home telecare; which is a fast-paced developing domain that is centred on the provision of care at home, with the principle objective of assisting and sustaining the patient instead of the health professionals. Thus home telemonitoring in terms of telemedicine is specific and constitutes the utilisation of audio-video systems alongside additional telecommunications technologies in tracking patient condition remotely [13]. In the current research, we signify home telemonitoring as a procedure which is automatic, that transmits information from a patient's home with regards to a patient's condition to the specific healthcare provider. Thus in this case, the sending of information is from the patient's home by the patient or members of the patient's family and not handled by the healthcare professionals from the patient's residence.

III. General Overview

The study on the effects of home telemonitoring programs were found in a totality of 65 studies in scientific writings between 1991 to 2006. A majority of the studies amounting to 46% were implemented in the United States and 38% in Europe; with over half of these were accounted and documented in the past six years. In the studies, the cohort of sampling under study involved the telemonitoring of case and diseases specific medical conditions, such as hypertension, diabetes and cardiac diseases. Pulmonary diseases are exempted from these disease specific cases as they involve a variety of medical conditions. The cohort of sampling involved subgroups of the populace such as children, pregnant women and the elderly. In general, there are a number of parallel studies that examined the home telemonitoring programs pertaining four types of chronic ailments, comprising of Diabetes (17 studies), Hypertension (14 Studies), Pulmonary conditions (18 studies), Cardiac Diseases (16 studies). However the time frame. Length of study and design differs amongst the four groups. On the whole, over half of the recorded researches on home telemonitoring did not engage in randomization, minus a control group; and with 8% of the studies were nonrandomized with a control group. Most of the studies on telemonitoring related to diabetes (70%) engaged in randomized or randomized cross-over designs in contrast to telemonitoring initiatives involving pulmonary cases.

IV. Discussion

Through the application of techniques that are objective and focused in the implementation of information gathering and synthesis of information derived from primary researches; in which a methodical and well organized review can act as a repository pertaining a particular concern, the direct prospective research[14], and provision of a firm foundation for medical resolution and the planning of policy could be engaged in. Explicitly, the objective of this review is to compile and significantly assess the documented researches and content on home telemonitoring on persistent (chronic) conditions; and incorporating the prevalent knowledge in this matter. The novel currency of the area of discipline, which can be traced back to the start of 1990s, makes it crucial to emphasize the extensive researches (65 studies) that has commenced and been implemented in homes and residences. The home telemonitoring has been applied to ailments such as cardiac diseases, diabetes, hypertension and pulmonary cases [15]. Through documented contents of studies, researchers at the global level; including from the United States and various European countries are concerned in investigating the advantages, utilization and prospect of home telemonitoring as a method in managing patient care. From the studies, important data were discovered; which emphasized the main discoveries pertaining the results of telemonitoring implemented on patients, their medical states, and the entire healthcare practice.

It was ambiguous through the investigations of the researches, whether they implicate that the progress in the clinical state of patients was due to the telemonitoring procedures, or was due to additional methods implemented such as increased sessions with providers. Further potential studies should focus on the evaluation of effects of various promising mediums or situations on the results examined [16]–[18]. Moreover, there is a dearth of examinations implemented pertaining the consequences of telemonitoring on health care providers. Their reception towards the method, and their issues concerning it; which are crucial concerns to be taken into account in prospective researches. In order to obtain a more lucid insight on the impacts of the methodology on the tasks and responsibilities of providers, there should be further significant studies on the disparity between the added on-the-job time used by healthcare providers and the time they utilized to attend to aggravated incidences and problems, that could have otherwise be reduced through the implementation of telemonitoring.

Finally, it was observed in the documentations of literatures that there might be discrepancies in the advantages of telemonitoring depending on the geographical settings (town/countryside), the phase of the ailments, and the accessibility of healthcare experts. Evaluating these possibilities have the potential to assist in arriving at solid conclusions pertaining the telemonitoring programs.

V. Conclusion

Thus far, notwithstanding the novel currency of home telemonitoring, there exist a considerable pool of knowledge development which are being availed to policymakers and clinical practitioners. From the outcome of the review, the telemonitoring of persistent/chronic ailments from home projects was found to have positive and promising possibilities in patient management practice. This in turn will provide precise and trustworthy dependable data; enabling patients towards mobilization of actions, have impact on their stance and actions, and possesses the possibility and capability of enhancing their medical states. Nonetheless, further studies are necessary pertaining this subject matter as to develop a pool of extensive knowledge related to clinical outcomes, efficiency in managing costs, the effect of using healthcare services and the reception of healthcare providers. It is crucial to exhibit the viability of home telemonitoring at the level of the populace; in order for insurance companies and the various governments to decide potential support for this type of patient management methodology, and the ensuing compensation for the provision of services. Further intensified thorough and meticulous researches should be executed on home telemonitoring to develop robust substantive facts that would direct the transformation in the application and administration of the mentioned chronic ailments such as hypertension, diabetes, cardiovascular diseases and pulmonary conditions; the reception of financiers and providers; and its potential incorporation in the overarching healthcare procedures.

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