



Research Article

Could Remote Patient Monitoring (RPM) be Effectively Used with Elderly COPD Patients Without Limitations?

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Abstract

Background: The resurgence of Remote Patient Monitoring (RPM) in the COVID era brought a heightened awareness to the usefulness of RPM systems in the management of chronic diseases outside of in-patient hospital settings. Telehealth along with other digital health systems run on the wheels of technology. In today's world, technology is as fast-paced as it is huge, with several ramifications. "Big data", a feature of today's technology, with associated dehumanizing propensities, impacts digital health services. So is Artificial Intelligence (AI), an emergent technology which has also become an integral part of telehealth interventions (TIs). AI is noted to have a tendency to foreshadow the essential principles of health care delivery. The gains of RPM interventions, especially with the elderly, continue to be impacted by several limitations in the conception, design- architecture and implementation of RPM systems, as well as ethical issues in healthcare. With a propensity to catch up with the fast pace of technological growth, the true essence of patient care is relegated to other considerations. This study explored the effectiveness of RPM interventions in elderly Chronic Obstructive Pulmonary Disease (COPD) patients, alongside identified limitations in their use with the elderly population. **Method:** A Literature search was done on Remote Patient Monitoring for elderly COPD patients, covering the period from March 2018 to February, 2023. Articles retrieved consisted of elderly population, mostly males, above the age of 65 years, with diagnosis of COPD. Remote monitoring refers to existing and emergent technologies utilized in-monitoring patients outside of conventional clinical settings. Interventions in the articles were used to reduce exacerbation of COPD symptoms in the stated population. Search engines used included Google Scholar, MEDLINE (PubMed), CINAHL (Cumulative Index to Nursing & Allied Health Literature), Cochrane Library, EMBASE and Web of Science for 20 articles that met the selection criteria. **Results:** The results of this review study showed that while acknowledging the potential of RPM technology to facilitate COPD self-management and improve efficiency of care delivery, several factors forestall the full benefits of RPM. A study analyzed barriers to effective management from both the providers' and patients' perspectives. On the patient-side are poor digital literacy as well as impersonal care delivery and fear of being controlled by tele-monitoring data. On the side of healthcare providers are increased workload, lack of technology interoperability with existing health systems, lack of funding, and lack of dedicated and trained manpower. Additional factors impacting effectiveness are the novelty of the systems currently in use and associated dearth of research on ways of improving existing systems. Of significance are ethical considerations that mostly impinge on patient autonomy, patient confidentiality and ownership of private health information. Older adults appear to prefer unobtrusive ATs-designed to protect their dignity and independence. **Conclusion & Implications:** The gains of RPM interventions, especially with the elderly, continue to be impacted by several limitations in the conception, design- architecture and implementation of RPM systems, as well as ethical issues in healthcare. With a propensity to catch up with the fast pace of technological growth, the true essence of patient care is relegated to other considerations. With the aforementioned identified barriers, it is therefore, obvious that the full potential of reaping the benefits of RPM is stalled. Hence, future studies are to fine-tune existing and emerging telehealth technologies with a view to addressing the complexities of healthcare delivery, while prioritizing the needs of the patient. For the older population and, perhaps for all patients, the focus should be to design systems with easy usability as well as incorporating in design-architecture clear and concise policies that would address data ownership, transparency and increased trust.

Keywords: Remote patient monitoring; Telehealth; Digital health interventions; Chronic obstructive pulmonary disease; Acute exacerbation of COPD

Background

Telemedicine has been in use in the United States since the 1960s [1] Remote Patient Monitoring, an accessory of Telehealth care is not a novelty either. The advent of Remote Patient Monitoring (RPM) has been traced farther back to the 1800s [2]. The technology was utilized in the management of several diseases worldwide and in the United States, as far back as the late 1950s and early 1960s, when two Nebraska-based Psychiatrists first used RPM as a tool of neurological examinations, through a closed-circuit television link [2].

The term Telemedicine is interchangeably used with Telehealth. However, they are not the same. While telehealth has a broader connotation that stretches beyond patient-clinician encounters, Telemedicine addresses the “use of remote health care technology to deliver clinical services” [3]. Remote Patient Monitoring, an offshoot of Telehealth is a system whereby healthcare providers monitor patients outside of traditional care setting using digital medical devices [4]. Although, Telemedicine is known to have been in use as a healthcare technology for over a century. it was the Covid pandemic which took the entire world and the whole spectra of global health by surprise in late 2019, and the United States in early 2020, that gave Telemedicine and Remote Patient Monitoring a new and heightened focus.

A considerable number of caregivers and patient population benefitted from Remote Patient Monitoring technology during the pandemic due to technological advances. At a time, when the Covid 19 pandemic presented a huge challenge in the field of medicine and care giving, telemedicine provided a veritable mode of patient care. Telemedicine served in the treatment of patients considered to manifest less severe symptoms and those who did not require in-patient care advanced medical interventions such as ventilator-support. Telemedicine was impactful at a time, when the huge clinical burden of patient care negatively impacted both care givers patient outcomes. Sad memories persist of nurses and physicians dying from contracting Covid or abandoning family and making their cars and hospital examination rooms their homes, for fear of transmitting Covid to their family members. Research on vaccinations were still in the clinical trial stages at the time while scientists continued relentlessly to search for ways of caring. Therefore, it was the distress of the initial era of Covid 19 that came a new awakening and an increased interest in remote monitoring of patients. Remote Patient Monitoring comes with various advantages such as early and real-time detection of illnesses, ability to continuously monitor patients. Other benefits are prevention of worsening illnesses and untimely deaths, cost

reduction in hospitalizations, as well as obtaining more accurate readings while permitting usual daily activities for patients [5].

Covid 19 and COPD) are both pulmonary system diseases, but they differ in their pathophysiology. While Covid is a solely viral disease, exacerbation episodes of COPD could trigger bacterial or viral infections, requiring antibiotic treatment. The former usually presents as an acute illness that would in some cases affect other body systems, as in “Long Covid”. The latter is a debilitating progressive disease that is chronic in nature, and if untreated, could cause lung cancer, pulmonary hypertension and heart problems, among other ailments. While Covid infects individuals across the age spectrum, COPD, because of its progressive nature affects mostly the elderly population. However, both diseases are known to have fatal prognoses, if not managed properly.

In 2019, over 200 million prevalent cases of COPD were reported globally, with the diseases causing 3.3 million deaths and 74.4 million disability adjusted life years [6]. In the United States, COPD affects over 15 million Americans, while more than 150,000 Americans die of COPD each year, which sums up to 1 death every 4 minutes. Not unrelated to this fact is that in the elderly, complications from multiple comorbidities increase the mortality rate of COPD in elderly people. Persons aged 80-84 years presented the highest numbers of deaths related to COPD [6]. In comparing and contrasting the two diseases, the composite human death toll and devastation on the economy caused by Covid is as enormous and unprecedented as it was episodic. COPD, on the other hand, though, not a communicable disease continues to take an enormous toll on human lives and on the economy; even as the condition is preventable and manageable. Unlike Covid 19, with its sudden emergence, COPD’s longer tenure as a health condition that has been in existence, has since enabled the formulation of effective management strategies through evidence-based technological interventions for patients’ care.

As a chronic disease, exacerbations of the condition are what drive individuals to hospital emergency rooms to seek treatment. Exacerbations are associated with significant rates of hospitalization and an acceleration of disease progression [7]. As stated in the study, COPD exacerbations can be managed on an outpatient basis with the use of bronchodilators, antibiotics and oral steroids. The new and enhanced spotlight on remote healthcare technology is that majority of COPD exacerbations can be managed on an outpatient basis with the use of bronchodilators, antibiotics and oral steroids, using RPM interventions [7]. RPM interventions present possibilities for continuous monitoring of patients during normal daily activities for the prediction and early detection of exacerbations and life-threatening events. Equally, patients could be monitored during home treatment of mild

exacerbations, assessment of oxygen therapy while at rest and engaged in daily activities.

Therefore, researchers are justified in their acknowledgment of the benefits of RPM. In a study with Covid 19, disease, continuous remote monitoring of hospitalized patients treated in general medical settings not only improves outcomes, but when integrated into the electronic health record, it increases accuracy and decreases the burden of obtaining and repeatedly documenting patient's vital signs [8]. This attribute of automating tasks that are usually performed several times a day, with benefits for overburdened staff, is as equally true about COPD patients monitored outside of hospital settings. Advances in technology and scientific research have continued to favor longevity in the aging population. However, with more people aging, more people are suffering from chronic conditions requiring health maintenance and management. Remote Patient Monitoring Technologies stand to fill in gaps in the health needs of the increasing aging population. At a time when staff shortages in the health care system hamper effective delivery of care, remote patient monitoring reduces the burden of sole dependence on the human work force to deliver patient care.

Study Significance

Several factors have contributed to the possible gains of Remote Patient technology, especially with the elderly population. However, associated ethical considerations about health privacy laws and the degree of ownership of information patients have to their health data continue to undermine some benefits of RPM [9]. Limitations to the success of RPM technology are inherent in the degree of its acceptance by COPD patients who are mostly elderly. The technology, as it is used today, is fairly new and therefore has its challenges. While data acquisition and processing systems continue to evolve, elderly COPD patients accustomed to face-to-face provider-patient interactions may find the whole process of RPM an inconvenience. With more evidence-based data continuing to be harnessed about this re-emerging technology, it is practical and equitable use in a healthcare system already impacted by health disparities remain an issue of concern, especially to the Family Nurse Practitioners whose services primarily cover the treatment of chronic diseases such as COPD. Hence, the aim of this study is to answer this research question, "Could Remote Patient Monitoring (RPM) be effectively used with elderly COPD patients without limitations?"

Method

A Literature search was done on RPM for elderly COPD patients, covering the period from March 2018 to February, 2023. Population/disease refers to elderly COPD

patients, mostly males, above the age of 65 years, with diagnosis of Chronic Obstructive Pulmonary Disease (COPD). Remote monitoring refers to existing and emergent technologies utilized in-monitoring patients outside of conventional clinical settings. Intervention is reducing exacerbation of COPD symptoms in the stated population. Search engines include Google Scholar, MEDLINE (PubMed), CINAHL (Cumulative Index to Nursing & Allied Health Literature), Cochrane Library, EMBASE and Web of Science.

Keywords used include Chronic Obstructive Pulmonary Disease, COPD, Remote Patient Monitoring, Elderly COPD patients, Telemedicine, Telehealth, Mobile health, Limitations, Barriers. Overall, thirty-three articles were reviewed, with a sample selection of twenty-seven articles. In the selection of relevant articles, focus was placed on Peer-Reviewed articles, as are usually repositied in the listed search engines. These articles were screened for biases from possible research funding interests; declaration of conflicting interests, and for general ethical committee approvals. For health statistical information, attention was placed on sourced and cited information from accredited organizations and authorities such as World Health Organization (WHO), Centers for Disease Control (CDC), the Agency for Healthcare Research and Quality (AHRQ). Exclusion and Inclusion criteria included articles published between 2019 and 2023, with most of the articles having undergone analysis with Amstar-2 tool- a critical appraisal instrument for systematic reviews including randomized and non-randomized studies of healthcare interventions for elderly COPD patients, with remote monitoring services. Other inclusions are studies on assistive technologies for older adults living independently, that may not be easily integrable in activities of daily living.

Exclusions include articles published before 2019, and articles on the use of remote monitoring interventions of elderly COPD patients, not backed with Evidence-Based Medicine (EBM). Articles on technological assistive technologies used in-patient hospital settings and in rehabilitation centers were excluded. Also excluded are articles with overt or implicit commercial sponsorship undertones, relating to specific RPM devices. It is expected that this systematic review will, while acknowledging new and expected benefits of remote patient monitoring technology, further identify emerging limitations, even as there continues to be a heightened awareness about utilizing remote patient monitoring services in today's healthcare technology.

Results and Discussion

The results of this study showed that varying degrees of the articles, substantiate the advantageous role of mobile technology and telehealth services, including Remote Patient Monitoring (RPM) in diseases management. This was particularly evident in the success of both Mobile health (mHealth) and telehealth, including RPM interventions in the therapeutic management of Covid 19 patients and in Covid 19 infected-COPD patients sheltered- in-place, during the pandemic [10]. At the time, telehealth was identified to be a promising approach in reducing clinical visits and improving Health Related Quality of Life (HRQoL) [10].

Integrated Care: The success of RPM is not solely inherent in the systems themselves, but also in their co usage with other evidence-based aspects of traditional healthcare interventions. While not wholly minimizing the effectiveness of RPM interventions, a considerable number of the studies posit that success of RPMs interventions is guaranteed when interventions are integrated into other aspects of therapeutic patient care. In a study conducted on participants with age range of 60 to 78 years [11], this study enunciates that positive outcomes for elderly COPD patients are assured in dual treatments that include health coaching, especially with regards to promoting self-management skills.

However, the success of RPM interventions may be undermined by poor organizational support and lack of compatibility of Digital Health Interventions (DHIs) with current health systems. According to Ramachandran, et al. [12] organizational-support, along with synchronizing the workability of systems is crucial for a measurable return in investments at the patient, healthcare provider, and system levels in the healthcare industry. The investigators were reflective and cautious in the perceived magnitude of reported success of RPM in facilitating proactive disease management and postulated that effectiveness varies within and between populations. The authors recommended a “patient-centered approach” to care. Also, effectiveness of RPM systems is tied to several factors including the age of the patient, comorbidities, patients’ socioeconomic status as well as accessibility to quality healthcare.

Barriers

Significantly, an appreciable number of the studies indicated a paucity of evidence to prove the degree of effectiveness of RPM interventions in managing elderly COPD patients [13-15] were emphatic in their position that their study shows low quality outcomes of RPM interventions in COPD patients. More barriers to effectiveness of RPM interventions in the elderly population are usability and acceptability of new technologies such as Artificial Intelligence (AI). Furthermore, a problem posed to the elderly COPD population is the erosion of traditional tenets of provider-patient physical closeness, as was expressed in decreased face-to-

face visits, which accounted for increasing chronicity of disease [16]. Another study on elderly COPD patients living in rural areas identified barriers in what they considered an infringement of trust and rapport in-patient-provider relationships [17]. The study pointed to cultural influences as having a negative impact on the uptake of telehealth services. An example was given with a cultural belief among the Appalachians referred to as the “Appalachian pride”. Also, listed as a hinderance was lack of internet access, especially in rural areas.

Other barriers associated with effective use of RPM interventions in the elderly population are poor digital literacy, impersonal care delivery and fear of being controlled by telemonitoring data [12]. Also, worth mentioning is the type and architecture of Remote Home Monitoring (RHM) systems. Regardless of whether they are wearable, contact or contactless devices, their usability among the elderly population impacts the effectiveness of interventions. Older adults appear to prefer unobtrusive Assistive Technologies (ATs) designed to protect their dignity and independence [18]. Ethical considerations in RPM healthcare delivery present a huge concern. This concern primarily centers on privacy issues relating to patient autonomy, patient confidentiality and ownership of private health information. With elderly patients, some of who may not be accepting Telehealth, these ethical concerns are more pronounced and could present a deterrence to effective utilization of RPM services, examine the clinical ecosystem of data collection, relay, retrieval and documentation, while noting the legal and ethical implications of regulations regarding patients’ access to their health information [9].

Recommendations in the use of RPMs

Across patient-populations, data retrieval methods, as well as the promptness of care providers to retrieve real-time data from remote systems and act on them impact effectiveness of RPM interventions. Equally, the potential of RPM systems to empower patients with self-management skills is actualized when there is an efficient feedback loop between providers and their patients [14]. As with general healthcare delivery, there is a correlation between individualizing care and positive outcomes as highlighted [13]. For RPM intervention to be effective, it must be tailored to individual patient needs [16]. It is not uncommon for elderly patients to present with comorbidities that impact their overall wellbeing. Hence, no gainsaying that the special needs of the aging population should be factored in, in all aspects of design and implementation of RPM services, if care is to be effective.

Limitations

Limitations include a paucity of population targeted research on the effectiveness of RPM services on elderly COPD patients.

This accounted for a small sample size of relevant research studies, which in turn impacted the objective of this research. The fast pace of technological growth, with its implications on currency of studies affected the outcome of this study.

Future Research

Future research recommendations, therefore, include studies on health organizational involvement in the design of systems that support the traditional core concepts of patient care. This, for the older population and, perhaps for all patients, entail designing systems with easy usability as well as incorporating in design-architecture clear and concise policies that address data ownership, transparency and increased trust [18]. Generally, there is need for continuing investigations on the effectiveness of telehealth among populations [19].

Conclusion:

From the studies reviewed, RPM interventions is not effectively used in the elderly population to achieve optimal results, due to limitations in both the system and implementation. Clearly, the concept of managing diseases remotely has gained wide acceptance. Telehealth will continue to dominate healthcare in the present time and in years to come. The future direction is to fine-tune existing and emerging telehealth technologies with a view to addressing the complexities of healthcare delivery, while prioritizing the needs of the patient.

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