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Review

New Technologies for Elderly Healthcare: A Review of Recent Evidence

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Abstract: The ever-increasing information and communication technology advances in all areas, especially healthcare, are remarkable. New technologies can provide useful opportunities to improve elderly healthcare. We aimed to investigate the latest technologies used in elderly healthcare. This study was a review conducted in 2024. We searched databases such as PubMed, Scopus, and Google Scholar to access similar articles using keywords such as technology, healthcare, and elderly. We have included only free full-text original articles published in English. A review of identified articles has shown the main types of technologies, including telemedicine, clinical decision support systems (CDSS), electronic health records (EHR), electronic vital sign monitoring systems, and smart bracelets. The technologies considered in this system have been related to care, dental, and cardiovascular services, which have examined the issues of care and quality of life of the elderly. The present study's findings showed that new technologies lead to timely monitoring, better use of financial, physical, and human resources, improved quality of care, and improved decision-making processes for the elderly. Information technology can facilitate the care of the elderly. Also, the quality and speed of health services to the elderly will increase with the use of new technologies. More studies are suggested to investigate the impact of various technologies on elderly healthcare.

Keywords: technology; smart home; elderly; care; healthcare; old people

1. Introduction

The global population is aging rapidly. The United Nations projects a substantial increase in the number of individuals aged over 65, exceeding 1.5 billion by 2050 [1]. This demographic shift presents significant opportunities for healthcare systems worldwide. To address the complex healthcare needs of the aging population, information and communication technology (ICT) has emerged as a pivotal tool [2]. Beyond delivering medical services, ICT offers a comprehensive approach to elderly care. This approach encompasses health monitoring, communication, and support for daily living activities [3,4].

Telemedicine has been instrumental in transforming healthcare delivery for older adults, particularly during the COVID-19 pandemic [5,6]. Its applications extend from managing chronic conditions like type 2 diabetes mellitus [7] to creating virtual care environments [8]. This paradigm shift in elderly care has spurred the development of innovative health technologies to meet the growing demand for continuous health monitoring. Internet of Medical Things (IoMT) refers to leveraging devices to connect real-life objects to the Internet [9]. Wearable devices, capable of collecting real-time health data, have become essential IoMT in managing and detecting various conditions such as arrhythmias [10], stroke [11], and falls [12] among older people. In recent years, IoMT also has been used to introduce a framework for establishing smart homes to support the elderly daily lives [13].

Several technologies have been developed to improve communication between older adults and caregivers using interconnected sensors, videophones, and a telecentre [14,15]. These platforms facilitate information sharing, real-time interaction, and remote monitoring, enabling caregivers to provide timely support and assistance. Innovative healthcare monitoring systems, such as wearable digital technology, can be used for improved clinical decision-making and are efficient and cost-effective [16]. On the contrary, adopting these technologies can be challenging for older adults. These obstacles include insufficient knowledge, physical limitations, feelings of isolation, and communication issues [17]. Personal factors like the desire for control and independence [18], as well as external elements such as user-friendliness and cost, also impact technology adoption among this population [19].

The evolution of information and communication technology has significantly transformed the healthcare sector. The elderly population stands to benefit immensely from these advancements. This study aims to explore the latest technological applications in elderly healthcare and examine their potential to enhance care delivery, improve quality of life, and allocate resources.

2. Methods

A rapid review was conducted in 2024 to investigate the potential of recent technologies in managing elderly healthcare. PubMed, Scopus and Google Scholar databases were searched using keywords such as Technology, Smart home, Elderly, Care, Healthcare, and older adults. Related articles published from 2019 to 2024 were included in the study after quality assessment.

We have included only free full-text original articles published in English. The exclusion criteria were the following:

1) Non-original studies, including reviews, systematic reviews, meta-analyses, or non-original letters

2) Lack of access to the full text

3) Abstracts or any other studies without full texts

4) Lack of relevance to the research topic

5) Non-English language

The following data were extracted from related studies: first author, type of study, aim of study, sample size, gender, age, type of disease/disability, type of technology, the benefits of intervention/technology, and other findings. Two authors extracted and prearranged the results in Table 1.

3. Results

We found 66 related articles from the search databases. Then, after the initial review of the retrieved articles, 19 cases were excluded due to a lack of inclusion criteria, and the remaining 47 articles were reviewed. After the final evaluation, 29 articles were removed (Papers with the lack of experimental data (n = 8), Other Study Types (n = 4)), and finally, 18 articles met the inclusion criteria and were included in the final review.

In the review conducted, there were Cross-sectional study (n = 5), Randomized Clinical Trial (RCT) (n = 3), Qualitative study (n = 3), Prospective observational study (n = 1), Clinical Trial (CT) (n = 2), Cohort study (n = 1), Survey study (n = 1), Retrospective analysis (n = 1), and Mixed-methods study (n = 1) in the type of study. The sample size in this review was 2442 elderly people and older adults (Table 1).

The technologies considered in this system are mostly related to the care of chronic diseases [7, 20–23], dental [24] and cardiovascular services [25], psychology [26,27], and public and hospital services [8, 28–31] which examines issues of care and quality of life for the elderly. A review of identified articles has shown the main types of technologies, telemedicine, clinical decision support systems, electronic health records, electronic vital sign monitoring systems, smart bracelets, and smart home. In the overall review of the studies, timely monitoring, better use of financial, physical, and human resources, improving the quality of care, and improving clinical decision-making processes were mentioned. More details are given in Table 1.

Table 1. Description of the findings reported in the included studies.

ID	First Author (reference)	Type of Study	Aim of the Study	Sample Size	Gender	Age	Type of Disease/Disability	Type of Technology	The Benefits of Intervention/Technology	Other Findings
1	Benitez-Lugo, M.L. [26]	RCT*	Investigating the effectiveness of technology based on feedback of physical and cognitive capabilities in the elderly.	46	N/A	Mean: 73	Depression	Protocol using feedback-based technology. Nintendo® Wii video game console and the Wii-Fit© video game.	Significant differences were found in all physical variables and only in the memory, "Difference-MEC" and "Difference-TR Oddball" cognitive variables.	N/A
2	Cheng, X. [20]	RCT	Investigating the effectiveness of auto microscopy combined with auto endoscopy of tympanic membrane repair with the help of two lens technology on elderly patients with chronic purulent otitis media.	120	Female: 54 (45%), Male: 66 (55%)	Mean: 65.57	CSOM*	Photomicroscopy. Double-Lens Technology.	Compared with single-use otomicroscopy, the operation time, intraoperative blood loss, hospitalization time, patient's dry ear condition, degree of surgical pain, clinical efficacy, adverse reaction rate, hearing improvement rate, and patient's incision satisfaction of the double-lens technology are better.	Compared with the single-use otoendoscopy, the operation time, clinical efficacy, and hearing improvement rate of the double-lens technology are better.
3	Dinakrisma, A.A. [32]	Cross-sectional study	Examining the role of digital mobile technology in the management of elderly health among healthcare workers in terms of knowledge, attitude, and performance.	134	Female: 81 (60.4%) Male: 53 (39.6%)	Mean: 37	N/A	Digital mobile technology. Messenger application and/or through conventional short message service or telephone calls.	N/A	The current healthcare system has entered the period of using information and communication technology in providing health services for elderly patients.
4	Fatyga, E. [7]	Cross-sectional study	Telemedicine survey in elderly patients with type 2 diabetes.	86	Female: 52 (60.4%) Male:34 (39.6%)	Mean: 72	Type 2 diabetes	Telemedicine. Semi-structured telephone interview.	Telemedicine can improve glycemic control and reduce anxiety in patients with type 2 diabetes during the COVID-19 outbreak.	Identifying factors that influence glycemic control in elderly patients with type 2 diabetes during the COVID-19 pandemic helps to

										develop targeted psychological interventions.
5	Heidi Snoen Glomsås [28]	Qualitative study	To explore elderly service users' experience of user involvement in the implementation and everyday use of welfare technology in public home care services.	16	Female: 11 (68.75%) Male: 5 (31.25%)	65 to 95 years	Public home care services	Welfare technology (telecare, telehealth, E-health). Day-to-day provision of home care services.	Participants feeling of safety gave them and because it could help them to continue to live an independent life at home. A reduction in the number of physical visits by health professionals to some participants.	User involvement must be facilitated and implemented in a gentle way, highlighting autonomy and collaboration, and with the focus on respect, reciprocity and dialogue. User involvement is only to a limited extent an integral part of public home care services for the service users.
6	Massimiliano Greco [29]	Prospective observational study	To assess whether wearable devices can identify patients at risk of postoperative complications.	31	Female: 9(29.03%) Male: 22 (70.96%)	Mean: 76.1	High-risk patients undergoing two-hour surgeries under general anesthesia.	Wearable electronic devices. Data collection (include: average walked steps per day, maximal oxygen , HR* data, activity intensity, energy expenditure, and calories). To track patient home activity over several days before surgery.	Low-cost wearable devices are a promising tool for the evaluation of cardiopulmonary fitness.	-The first study to evaluate wearable devices as preoperative evaluation tools. -There is a strong association between 6MWT*, preoperative scales, and WD* data.
7	Tae Hee Jo [33]	CT	To investigate the elderly's perception of the ISHS* by comprehensively	9	Female: 9 (100%)	68 to 87 years (mean: 78 years)	Elderly people	Smart home, Internet of Things. Monitoring daily activity.	Based on a literature review, essential benefits of smart home systems for the elderly are as follows:	-For a better adoption of an ISHS, sufficient awareness

			evaluating its possible benefits and negative responses.						fall detection, healthcare monitoring, ADL* recognition, iAQ* monitoring, and energy consumption monitoring.	regarding its benefits and the development of elderly-friendly smart home sensors that minimize negative responses are required. -Identified four popular factors of influence (perceived comfort, perceived usability, perceived privacy, and perceived benefit) that were applied as the guideline criteria for our focus group interview design, which was conducted to investigate the elderly participants' perceptions of ISHS.
8	Ko S.Q. [8]	Retrospective descriptive cohort.	To evaluate the safety and outcomes of patients under the Virtual Ward care, and describe the utilization of teleconsultation, home visits, and vital signs monitoring.	238	Female: 138 (58%) Male: 100 (42%)	Mean: 62.5	COVID-19 inpatient	A chatbot sent an online reporting form to the patient's (or caregiver's) mobile. Tele consults & tele monitoring.	Virtual Wards are a scalable, safe, and patient-centered strategy to care for high-risk COVID-19 patients at home.	N/A
9	Lee E.J. [34]	Survey study	An online survey to compare and analyze the level of access to an SHS*	250	Female: 148 (59.2%)	20 years or older	N/A	SHS	Compared to other age groups, the elderly preferred services that	To propose 15 prioritized services, along

			for biophilic experience for the elderly and the sense of preference among other age groups.		Male: 102 (40.8%)				were mainly attributed to factors such as 'Immersion and interaction with nature', 'Management of well-being and IEQ*, and 'Natural process and systems'.	with their sensor and device configurations, in consideration of service provision regarding the elderly's preferences and universality.
10	Lima R. [35]	Cross-sectional, descriptive study	Evaluate a three-dimensional educational gerontechnology for the prevention of falls in the elderly at home.	30	Female: 18 (60%) Male: 12 (40%)	17 (56.7%) were aged between 60 and 69 years old, and 13 (43.3%), were between 70 and 79 years old	Elderly people	Educational gerontotechnology. Prevention of falls.	Gerontotechnology was considered fit to be used in the prevention of falls in the elderly.	Educational gerontotechnology to contribute with the identification of fall risk inside home, either for the elderly or for the general population.
11	Liu S. [24]	CT	To evaluate and analyze the clinical effect of CBCT* imaging technology on the restoration of upper anterior teeth of the elderly.	36	Female: 18 (50%) Male: 18 (50%)	Elderly patients	Upper anterior teeth loss	CBCT imaging technology. Implant restoration using CBCT imaging technology.	-CBCT imaging technology significantly reduced the deviation of implant placement. -Shortened the adjustment time of initial wearing. -Improved the success rate of axial gingival recession. -Enhanced patient satisfaction with the restoration.	-The neck offset and root offset of the implants were significantly lower in the CBCT group compared to the curved tomographic restoration group. -The initial wearing adjustment time was significantly less in the CBCT group. -The success rate of axial gingival recession was higher in the CBCT group.

										-The restoration satisfaction rate was significantly higher in the CBCT group.
12	Liu X. [25]	Retrospective analysis	To explore the diagnostic value of multimodal cardiovascular imaging technology coupled with biomarker detection in elderly patients with CHD*.	411	Female: 154 (37.4%) Male: 257 (62.5%)	N/A	CHD	Multimodal cardiovascular imaging technology (including coronary computed tomography angiography and echocardiography) and biomarker detection (including small dense low-density lipoprotein, lipoprotein a, and gamma-glutamyl transferase). Combined use of multimodal cardiovascular imaging and biomarker detection for diagnosis.	The combined diagnostic approach showed higher diagnostic efficacy than individual techniques, marked by better accuracy, higher sensitivity, and higher AUC* values.	-The CHD group had significantly higher levels of maximum area stenosis, total plaque volume, total plaque burden, and fibrotic plaque volume compared to the non-CHD group. -The CHD group exhibited higher levels of small dense low-density lipoprotein, lipoprotein a, and gamma-glutamyl transferase. -Multimodal cardiovascular imaging technology combined with biomarker detection can distinctly improve the accuracy of CHD diagnosis in elderly patients.
13	Shagerdi G. [30]	Qualitative study	To identify opportunities for using various health information technologies	33	N/A	N/A	The study focused on the general challenges faced by elderly patients	Various health information technologies, including clinical	-Better use of financial, physical, and human resources.	-No specific workflow for elderly care in

			for elderly care in the emergency department.				in emergency departments, not specific diseases.	decision support systems, vital signs monitoring systems, computerized physician order entry, electronic health records, telemedicine, and electronic documentation methods. Health information technology interventions to improve elderly care in emergency departments.	-Improved staff performance. -Reduced workload, readmissions, and hospitalization. -Improved access to data. -Better collaboration between different specialties.	emergency departments. -High workload in emergency departments. -Insufficient involvement of geriatricians in the care process. -Current information systems are not designed specifically for elderly patients. -Need for more research to evaluate the effectiveness of technology in this area.
14	Shagerdi G. [31]	Mixed-methods study: review and qualitative study	To explore the applications of the emergency department information system and clinical decision support systems in elderly care.	57	Female: 38 (66.6%) Male: 19 (33.3%)	N/A	Elderly care in emergency departments.	-Emergency department information system. -Clinical decision support system. -Electronic health records. -Telemedicine. -Personal health records. -Electronic questionnaires for screening. -Other technologies such as PACS*, electronic vital	-Improved data collection processes. -Enhanced quality of care. -Better access to elderly health data. -Improved treatment outcomes. -Reduced mortality. -Supported emergency care services. -Improved clinical decision-making processes. -Accelerated care processes.	-The conceptual model was reviewed and finalized using the Delphi technique. -The study found that the application of health information technology in geriatric emergency departments is beneficial and can support care plans for the elderly.

								sign monitoring systems, etc. -Development of a conceptual model involving health information technology applications in geriatric emergency departments.		
15	Sun X. [21]	Cross-sectional study	To examine the current state of Internet use among the elderly in China, the factors influencing this usage, and the demand for digital health technologies among this demographic.	669	Female: 437 (65.3%) Male: 232 (34.7%)	60-69 years: 56.2% 70-79 years: 34.1% 80 years and above: 9.7%	Chronic diseases	-Smart bracelets. -Emergency callers. -Telemedicine. -Online health consultation. -Online appointment registration. -Online payment of medical expenses. The study did not specifically outline interventions but assessed the demand and usage of various digital health technologies.	The study highlights the importance of Internet use in enhancing the quality of life, providing health information, and addressing psychological issues like loneliness among the elderly. Internet use is associated with better quality of life and psychological health.	-Internet use was more frequent among females than males. -Factors like gender, age, education, monthly income, quality of life, number of friends, and social participation significantly influenced Internet use. -The favorite online activity was chatting (74.2%), followed by reading news (59%) and watching films/listening to music (32.7%). -Only a small percentage (13.1%) used the Internet for

										disease-related information.
16	Yu J. [22]	Qualitative study	To understand and describe the service experience in the process of adopting and using smart technology in the home care environment of the elderly and to explore the influencing factors of their long-term adoption or abandonment of the technology.	26	Female: 11 (42.3%) Male: 15 (57.7%)	71.2 ± 6.7	Participants had various chronic diseases. Six participants required only daily life care, eleven required skilled care, and nine required long-term health monitoring services at home.	Smart eldercare platforms, emergency buttons, wearable or IoT devices (e.g., smart bracelets, body monitoring devices), and partner or nursing robots. Use of smart technology for home care, including emergency buttons, wearable devices, and IoT devices to assist with daily living, professional care, and health monitoring.	-Standardized Management: Improved reliability by integrating scattered information into a complete data chain and providing standardized service processes. -Enhanced Service Experience: Facilitated access to professional care and health monitoring, allowing for better management of home care services.	Three main themes identified in elders' long-term adoption and abandonment behaviors of smart technology in the home care environment: direct effectiveness, long-term usability, and possible collateral damage.
17	Zhao R. [23]	RCT	To explore the impact of VR* training on anti-fall ability and BMD* among elderly patients admitted to a healthcare institution.	50	Female: 29 (58%) Male: 21 (42%)	Mean age for the VR group: 72.16 ± 3.64 years Mean age for the control group: 73.36 ± 3.25 years	Osteoporosis	VR VR rehabilitation training system for the VR group, and traditional fall prevention exercise for the control group.	The VR training improved anti-fall ability and increased femoral neck and lumbar spine BMD, effectively preventing and reducing the risk of injury among elderly people with osteoporosis.	No significant difference in lumbar spine and femoral neck BMD between the two groups 6 months after the intervention. -Significant improvement in BBS*, TUGT*, and FGA* scores in the VR group compared to the control group after 12 months.

										-No significant difference in the incidence of adverse events between the two groups.
18	Zhou C. [27]	Cross-sectional study	Investigate the factors influencing the intention of elderly users to adopt smart home products.	200	Female: 147 (73.5%) Male: 53 (26.5%)	60-74 years old: 132 participants (66.0%) 75-90 years old: 65 participants (32.5%) Over 90 years old: 3 participants (1.5%)	Not specified directly in the article, but it discusses the aging process and its impact on cognitive functions, memory, and attention in the elderly.	Smart home technology. Questionnaire survey and data analysis using SPSS* and AMOS software.	The study suggests that smart home technology can help elderly users by adapting to their decreasing abilities, improving their quality of life, and providing convenience.	-Educational background influences the ability to use smart home devices. -The lack of user awareness is a key barrier to the adoption of smart homes. -Good relationships and close family ties can encourage the elderly to try new technologies. -The study used a reliability test (Cronbach's α = 0.907) and validity test (KMO* = 0.909) to ensure the data's reliability and suitability for factor analysis.

* RCT: Randomized Clinical Trial, CSOM: Chronic Suppurative Otitis Media, HR: Hearth Rate, 6MWT: 6-min walking test, WD: Wearable devices, CT: Clinical Trial, ISHS: Integrated Smart Home System, ADL: Activity of Daily Living, iAQ: Indoor air quality, SHS: Smart home services, IEQ: Indoor environmental quality, CBCT: cone beam CT, CHD: Coronary heart disease, AUC: Area under the curve, ECG: Electrocardiogram, DTH: Digital twin healthcare, PACS: Picture archiving and communication systems, VR: Virtual reality, BMD: Bone Mineral Density, BBS: Berg Balance Scale, TUGT: Timed up and go test, FGA: Functional gait assessment, SPSS: Statistical Package for the Social Sciences, KMO: Kaiser-Meyer-skin.

4. Discussion

Technology has been playing a vital role in improving human life for ages. Discoveries and innovations in the field of technology have made it easier for us to deal with various kinds of health problems around us. The older population is the most fragile group in society as they need more care and support than the younger population. Many studies have been done to highlight the role of technology in the care of the elderly population. Our review identifies some literature that reports that newer technologies have alleviated the quality of life and health care of the elderly population, improved the clinical-decision making, allowed better use of financial, physical, and human resources, and timely monitoring of elderly health status.

A survey-based cross-sectional study, which includes 200 old people of age more than 60 years in this review suggests that smart home technology devices can help them to easily adapt to their decreasing abilities, improving their quality of life and providing convenience [27]. Similarly, Facchinetti et al. also suggest in a systemic review that Smart homes have a high impact on older people's daily living and activities in terms of promoting physical activity and a sense of security that are fundamental to reducing hospitalizations and admissions to residential structures [36].

However, educational background and lack of user awareness were the key barriers to the adoption of smart home devices [27]. Bertolazzi et al. have also reported in a systemic review that the impact of educational level on technology use appears to be more consistently supported by the literature. Well-educated older adults seem to have an advantage in adopting various technologies, whereas poor education limits their use and acceptance [37].

Our review reports the significant association of the internet with better quality of life and psychological health. The majority of the participants in the study were found to be using the internet for chatting with others, addressing the psychological problems in the elderly, such as loneliness and depression, in turn improving their quality of life and psychological health [21]. Duplaga et al. suggest in a cross-sectional study that the use of the Internet was consistently associated with a lower prevalence of chronic conditions and disability, as well as less frequent visits to healthcare facilities [38]. Moreover, other reports also suggest that the use of the Internet was significantly associated with better self-rated health [39], higher life satisfaction [40,41], better quality of life [42], improved general or psychological well-being [41], decreased perceived loneliness [43], lower depression and/or anxiety [39–41]. Actions for widespread use of the internet in this population can help health systems cope with psychosocial problems in elderly populations.

The most emergent and preventable situation in elderly people is the risk of falls due to various medical and non-medical causes. Preventing such incidents can increase the quality of life and avert early disabilities and dependence. After reviewing recent literature, we have found that new technologies can solve this problem. For example, a study shows that VR training improves anti-fall ability and increases femoral neck and lumbar spine BMD, effectively preventing and reducing the risk of injury among elderly people with osteoporosis in comparison to the control group with conventional anti-fall exercises [20]. Therefore, assisting older people this technology can be used to decrease the risk of falls in them. It can reduce the enormous burden of public health systems in dealing with

geriatric fractures and the independence of older patients. Similarly, educational technology is considered fit to be used in the prevention of falls [20].

New technologies like wearable smart devices are useful in the timely monitoring of older patients. Also, the affordability of low-cost wearable devices can attract public health policymakers to tailor policies for ensuring the use of this technology to achieve better outcomes in improving the quality of life and health care in the older population. This review indicates that low-cost wearable devices that track patient home activity over several days before surgery are a promising tool for the evaluation of cardiopulmonary fitness in high-risk patients undergoing two-hour surgeries under general anesthesia [34]. It also reports a strong association between 6MWT, preoperative scales, and WD data.

Technological interventions and techniques have been reported as very useful in terms of enhanced diagnostic efficacy and clinical outcomes in certain diseases in an elderly population. A study shows that multimodal cardiovascular imaging such as coronary computed tomography, angiography, and echocardiography combined with biomarker detection, including small dense low-density lipoprotein, lipoprotein a, and gamma-glutamyl transferase, can distinctly improve the accuracy of CHD diagnosis in elderly patients in comparison to individual techniques [7].

Another study reported that CBCT imaging significantly improved the clinical outcomes of the restoration of upper anterior teeth restoration in the elderly population in terms of successful axial gingival recession and patient satisfaction with restoration in comparison to the curved tomographic restoration group [24]. Cheng, X et al. investigated the effectiveness of auto-microscopy combined with auto endoscopy of tympanic membrane repair with the help of double lens technology; they found it to be better in comparison to single-use Oto-endoscopy in terms of the operation time, clinical efficacy, and hearing improvement in elderly patients with chronic suppurative otitis media [20]. Adapting these innovations to current guidelines for managing chronic conditions can lead to accurate diagnosis and increased patient satisfaction.

Telemedicine grew very swiftly during the COVID-19 pandemic, and literature reports that virtual wards are a scalable, safe, and patient-centered strategy to care for high-risk COVID-19 patients at home [8]. Our review also indicates that during the COVID-19 pandemic, telemedicine improved glycemic control and reduced anxiety in type 2 diabetic patients [7]. Use of Telemedicine tools such as online health consultation, online appointment registration, and online payment of medical expenses are found useful in terms of reducing the burden of health systems by conserving human resources. Also, these technologies will speed up the provision of health care to older patients. Moreover, telemedicine can be a safe option in dealing with communicable diseases particularly in pandemic situations to conserve physical and human resources and prevent the widespread of communicable diseases. According to recent reviews, telemedicine increases access to specialized medical services, bridging healthcare gaps for isolated groups, including those in rural areas, nursing homes, and correctional facilities [44,45]. Public health policies can be tailored to ensure the enhanced and widespread utilization of these tools specifically in the older population to achieve better health outcomes.

Emergency care in the elderly population is very crucial to provide care and enhance the quality of life in the older population. The application of health information technology in geriatric emergency departments is beneficial and can support care plans for the elderly. Various health information technologies such as; clinical decision support systems, vital signs monitoring systems, computerized physician order entry, electronic health records, telemedicine, and electronic documentation methods can have potential implications in public health policy to improve elderly care in emergency departments. These technologies improve staff performance and access to data, allow better use of financial, physical, and human resources, and better collaboration between different specialties, also reduce workload, readmissions, and hospitalizations in emergency settings [30,35]. Integration of these technologies in the current health system by designing specific information systems for the elderly population is essential to have an effective public health policy and resource management.

This review points towards the daily monitoring of the elderly population, which is essential for maintaining the well-being of old people. This can be effectively achieved by using smart technology for home care, including emergency buttons, wearable or IoT devices (e.g. smart bracelets, body monitoring devices), and partner or nursing robots to access professional care, daily living, and health monitoring, allowing for better management of home care services [26]. Moreover, a study suggests that daily monitoring of patient mobility, posture, and sleep disorders, has made it possible to implement specific interventions for the prevention and management of accidental falls, by creating an external warning system [36].

Public health policies can be tailored specifically for elderly people to provide smart home devices conveniently available and assistance provided to make these new technologies user-friendly as well as encourage the older populations to use them to gain benefits from features like fall detection, healthcare monitoring, ADL recognition, iAQ monitoring, and energy consumption monitoring to achieve desired outcomes in the provision of healthcare to the elderly population. Facchinetti et al., report that a smart home, through its sensors and its map-based visualization techniques, helps in the detection of patients' ADL which is crucial due to the chronicity and complications that characterize older patients, to intervene and improve health behaviors [36]. However, the better adoption of an ISHS, sufficient awareness regarding its benefits, and the development of elderly-friendly smart home sensors that minimize negative responses are required.

5. Conclusion

Newer technologies are reported to have a positive impact on better provision of healthcare services and improvement of quality of life in the older population. Healthcare providers can utilize smart home services as a tool to regularly monitor the health status of the elderly. Moreover, the data received from these tools can be shared with healthcare providers and health systems for timely interventions to evade undesirable outcomes of aging. Specific policies can be designed and implemented to provide easy access to the

Internet at cheaper or discounted rates for older people to promote the enhanced use of the Internet.

The use of information technology can facilitate the care of the elderly. It is found to improve staff performance and allow better use of financial, physical, and human resources, it also reduces workload, readmissions, and hospitalizations. Integration of health information technology specific to the older population in the current health system can improve the quality and speed of health care in emergency departments. One of the major barriers to proper utilization of these technologies such as smart home devices, wearable devices such as smart bracelets, and VR technology was the adaptation of older people to these new sophisticated technologies. The ability to use smart home tools is influenced by the educational background of the users as it is suggested that well-educated older adults seem to have an advantage in adopting various technologies, whereas poor education limits their use and acceptance. Moreover, the lack of user awareness is a key barrier to the adaptation of smart homes. On the other hand, good relations and close family ties can encourage the elderly to try new technologies. Therefore, with sufficient assistance, awareness, and encouragement provided by healthcare providers and family members, it is possible to help the older population using these newer technologies with great ease. By sharing our findings, we aim to inspire concerted efforts from researchers and industry leaders to advance smart home technologies, addressing the pressing needs of the aging community through scalable solutions.

Many of these new technologies are not yet validated and few studies present enough level of evidence. Therefore, further research is needed to investigate the role and use of emerging and novel technologies in elderly health care for attaining the safe application of these tools in improving health care and greater clinical outcomes. Also, experimental research is required to validate these technologies in terms of the efficacy of novel technologies. The study's outcomes have far-reaching implications for healthcare technology development and implementation. Caregivers, policymakers, and technology developers can leverage this research to better understand and address the technology needs of the aging population.

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