Health related technology for elderly

Introduction

This report provides an AI-based analysis of the most representative topics related to Health related technology for elderly, identified based on the search criteria. The references were directly extracted from scientific databases, while the summaries were constructed based upon the abstracts of the references using AI. By leveraging an extensive database of scientific sources, the report delivers reference-based results. While this report is based on scientific data sources, users should exercise caution in interpretation, given the inherent complexities and evolving nature of AI-based analysis.

Table of topics

1. Social robots for elderly care

Social Robots for Elderly Care are being increasingly considered as a solution to address the challenges posed by the aging global population, which is expected to reach 2.1 billion people over 60 years old by 2050. These robots, known as Socially Assistive Robotics (SARs), aim to enhance the quality of life (QoL) for seniors by providing necessary assistance and alleviating the shortage of manpower in elderly care. Studies have shown that tailoring the characteristics of SARs to meet the specific needs of the elderly is crucial for their acceptability and effectiveness. Examples of such robots include Pepper and Nao, which have been proposed for different care scenarios. Research has also focused on optimizing the assignment of robots to elderly individuals to maximize efficiency and minimize caregiver stress, as seen in the ENRICHME project. This project emphasizes the importance of long-term interaction and monitoring to support the independence of older adults with mild cognitive impairment. Additionally, focus group discussions have highlighted the need for thorough planning, pre-training, and customization of robots to address user characteristics, functionality, and barriers to adoption. Social robots are also being developed to conduct cognitive stimulation sessions, either autonomously or in collaboration with therapists, to support active aging in both home and daycare settings.

References

- [Robots for Elderly Care: Review, Multi-Criteria Optimization Model and Qualitative Case Study](#)

- [Employing Socially Assistive Robots in Elderly Care](#)

- [A social robot assisting in cognitive stimulation therapy](#)

2. Assistive technology for older adults

Assistive Technology for Older Adults is increasingly important in our aging society, especially with the rise of information and communication technologies post-COVID-19. A comprehensive guide categorizes these technologies, summarizing evidence across various domains. Research highlights a significant gap between the needs of older adults and their adoption of assistive technologies, identifying critical areas such as health, leisure, safety, communication, and social involvement. The most pressing needs include support for daily activities, mobility, smart kitchen technology, and maintaining social contacts. Assistive technologies range from simple devices to complex robotic systems, enhancing independence and quality of life for older adults. Despite their benefits, these technologies face challenges and limitations, which are crucial for ongoing research and development to address.

References

- [Older People's Needs and Opportunities for Assistive Technologies](#)

- [A Complete Guide to Assistive Technology for the Elderly – At Least, by Now](#)

- [Discernment on assistive technology for the care and support requirements of older adults and differently-abled individuals](#)

3. Iot-based elderly health monitoring systems

IoT-Based Elderly Health Monitoring Systems leverage advancements in physiologic sensory systems, stable wireless networks, and low-energy mechanics to enable remote health monitoring. These systems, often integrated into smart homes with wearable sensors and medical actuators, allow elderly individuals to stay in their homes while receiving real-time health monitoring and feedback from medical staff, reducing the need for hospital visits. In developing regions like Sub-Saharan Africa, IoT technologies are being designed to monitor elderly health and activities, providing vital signs information, emergency alerts, and location tracking to improve their quality of life. These systems use various sensors and microcontrollers to collect and transmit data to the cloud, where it is processed

and analyzed for caregivers and doctors. Additionally, IoT-based health monitoring systems employ biomedical sensors and intelligent task mapping to monitor critical health parameters and detect anomalies using machine learning, ensuring timely interventions and reliable performance in home, ambulance, and hospital environments.

References

- [IoT system to monitor health conditions of elderly](#)

- [Health monitoring system for elderly patients using intelligent task mapping mechanism in closed loop healthcare environment](#)

- [IoT Healthcare Monitoring Systems Overview for Elderly Population](#)

4. Wearable technology for physical activity in older adults

Wearable technology for physical activity in older adults shows significant potential in promoting healthier lifestyles and increasing physical activity levels. Studies indicate that older adults who use wearable devices are more likely to meet recommended physical activity guidelines, particularly those with higher incomes, better self-rated health, and greater enjoyment of exercise. Despite the low overall uptake, these devices serve as important facilitators of physical activity, especially for those with cardiovascular disease or risk. Interventional studies combining wearable activity monitors with telecare have demonstrated that these technologies can motivate physical activity and provide safety features, although technical issues and previous experience with smart technologies can affect their usefulness. Additionally, wearable-enhanced training programs, designed with user-centered approaches, have shown that older adults can regularly engage in physical activity when motivated by evidence-based programs, fitness tracking, and visualization of results. However, to ensure long-term use, it is crucial to address technical design, robustness, and provide individualized support tailored to the needs of older adults.

References

- [Benefits of a Wearable Activity Tracker with Safety Features for Older Adults: An Intervention Study](#)

- [Requirements for Wearable Technologies to Promote Adherence to Physical Activity Programs for Older Adults](#)

- [Wearable device use in older adults associated with physical activity guideline recommendations: Empirical research quantitative](#)

5. Social technology use by older adults

Social Technology Use by Older Adults is a multifaceted topic that addresses the social needs and wellbeing of older individuals through the use of digital media and social technologies. Research indicates that fulfilling social needs such as connectedness, autonomy, affection, and status is crucial for the mental and physical health of older adults. However, the adoption and effective use of social technology among this demographic are hindered by factors such as health problems, reduced mobility, lack of access, and insufficient digital literacy. The COVID-19 pandemic has exacerbated these challenges by necessitating social distancing, which has increased loneliness among older adults. Despite these barriers, social technology holds promise as a resource for enhancing social interaction and reducing isolation. Studies have shown that older adults with disabilities are more likely to engage in technology-mediated socializing, although seasonal variations affect in-person socializing habits. To support older adults in leveraging social technology, targeted interventions and support from key stakeholders are essential. Further research is needed to explore the benefits and optimal use of social technologies for older adults, particularly in mitigating the effects of social isolation and enhancing their quality of life.

References

- [Who uses technology to socialize? Evidence from older Canadian adults](#)

- [Older Adults, Social Technologies, and the Coronavirus Pandemic: Challenges, Strengths, and Strategies for Support](#)

- [When your world gets smaller: How older people try to meet their social needs, including the role of social technology](#)

6. Lithium-ion battery state of health estimation

Lithium-Ion Battery State of Health Estimation is crucial for extending the service life and ensuring the reliability and safety of energy storage systems. The state of health (SOH) of lithium-ion batteries (LIBs) is influenced by various internal and external conditions such as aging, temperature, and chemistry. Estimation methods for SOH include experimental, model-based, and machine learning approaches. Experimental methods, while informative, are not practical for commercial applications. Model-based methods, particularly electrochemical models, use multidifferential equations to explain battery processes. Machine learning methods, which utilize past aging data, have gained popularity due to their predictive capabilities. For large-format batteries used in energy storage power stations, a combination of multi-feature extraction and artificial intelligence, such as artificial neural networks, has shown high accuracy and robustness in SOH estimation. Advanced machine learning techniques, including

recurrent and convolutional neural networks, have further improved SOH estimation by leveraging data from multiple cycles and studying features of voltage, current, and temperature during charging. These methods have demonstrated significant reductions in validation set loss, highlighting their effectiveness in capturing aging trends and improving estimation accuracy.

References

- [Lithium-ion Battery State of Health Estimation with Recurrent Convolution Neural Networks](#)

- [State of Health Estimation Methods for Lithium-Ion Batteries](#)

- [Multi-feature Extraction and Fusion-based State of Health Estimation of Large-format Lithium-ion Batteries under Uncertain Aging Mode](#)

7. Machine learning-based fall detection for elderly

Machine Learning-Based Fall Detection for Elderly is a critical area of research aimed at improving the safety and health of older adults. Falls are a significant cause of health deterioration and mortality among the elderly, making the development of effective fall detection systems essential. These systems utilize machine learning algorithms to classify activities into fall and non-fall actions, alerting caregivers in emergencies. Various machine learning techniques, such as SVM, decision trees, and convolutional neural networks (CNN), have been employed to enhance detection accuracy. Studies have shown that decision tree algorithms can achieve up to 96% accuracy, while CNNs, when combined with infrared sensors and accelerometers, offer high precision and recall rates. Despite the advancements, challenges such as high false-positive rates, data preprocessing, and dimensionality reduction remain. Future research is suggested to focus on self-adaptive systems and complexity reduction of machine learning models to further improve the efficiency and reliability of fall detection systems.

References

- [Fall Detection for Elderly People using Machine Learning](#)

- [Detecting Falls Through Convolutional Neural Networks Using Infrared Sensor and Accelerometer](#)

- [A systematic review on machine learning for fall detection system](#)

8. Human activity recognition using sensors

Human Activity Recognition Using Sensors leverages advanced sensor network technology and wearable devices to collect extensive data on human movements

and behaviors. This technology is increasingly applied in various domains such as smart homes, healthcare, and industrial applications. The data, gathered from sensors like IMUs, magnetometers, accelerometers, and gyroscopes, is used to recognize activities through machine learning and deep learning models. These models, including Random Forest, K-Nearest Neighbors, Decision Trees, and deep learning architectures like convolutional neural networks and long short-term memory networks, enable the automatic extraction and classification of features from raw signals. HAR is particularly significant in smart healthcare for elderly care, fall detection, and physical rehabilitation. Despite the progress, challenges remain in accurately recognizing complex activities, which drives ongoing research to improve model efficiency and accuracy. The field continues to evolve with a focus on enhancing computational performance and exploring new applications.

References

- [Human Activity Recognition using Deep Learning: Past, Present and Future](#)

- [Unique Action Identifier by Using Magnetometer, Accelerometer and Gyroscope: KNN Approach](#)

- [A Review of Wearable Sensor-based Human Activity Recognition using Deep Learning](#)

9. Alzheimer's disease diagnosis using machine learning

Alzheimer's Disease Diagnosis Using Machine Learning involves leveraging advanced computational techniques to improve early detection and classification of Alzheimer's Disease (AD). AD is a progressive neurodegenerative disorder that significantly impacts cognitive functions and is expected to affect a growing portion of the global population. Early diagnosis is crucial for managing the disease and informing treatment strategies. Machine learning algorithms such as Naive Bayes, Support Vector Machine (SVM), k-Nearest Neighbors (k-NN), Adaptive Boosting (AdaBoost), and eXtreme Gradient Boosting (XGBoost) have been employed to predict the progression from Mild Cognitive Impairment (MCI) to AD, utilizing data from MRI and PET scans, as well as clinical and demographic information. Despite challenges such as data limitations and the complexity of distinguishing AD from normal aging, recent studies have shown promising results. For instance, a convolutional neural network (CNN) model using MRI images has demonstrated enhanced accuracy in diagnosing AD with minimal computational resources. Additionally, empirical results from a study in Saudi Arabia highlighted the robustness of SVM in preemptively diagnosing AD with high accuracy and precision. Combining neuropsychological tests with cognitive tasks further improves classification accuracy, underscoring the potential of

machine learning to assist in the early detection and management of Alzheimer's Disease.

References

- [Preemptive Diagnosis of Alzheimer's Disease in the Eastern Province of Saudi Arabia Using Computational Intelligence Techniques](#)

- [Early Detection of Alzheimer's Disease Using Patient Neuropsychological and Cognitive Data and Machine Learning Techniques](#)

- [AD Classification and Detection Using Neuroimaging Data](#)

10. Telemedicine for older adults during covid-19 pandemic

Telemedicine for older adults during the COVID-19 pandemic has seen a significant increase in usage as a means to limit virus exposure and manage healthcare demands. At West China Hospital, telemedicine facilitated tele-education, tele-diagnosis, online treatment, and drug prescription and delivery, though older adults faced challenges in using internet-based platforms. In New York City, telemedicine helped shift care from overburdened emergency departments, but older adults encountered unique challenges such as visual, hearing, cognitive, and language limitations. A study revealed that telemedicine use by older adults increased 20-fold during the pandemic, with a notable portion requiring emergency department referrals and a 30-day mortality rate of 7%. Additionally, the readiness of older adults to use telemedicine varied significantly based on their medical conditions, with chronic conditions and mood symptoms often leading to unreadiness, while conditions like cancer, hypertension, and arthritis were associated with higher readiness. These findings highlight the need for tailored telemedicine solutions and support for older adults, considering their diverse medical and technical needs.

References

- [Telemedicine Use by Older Adults in a COVID-19 Epicenter](#)

- [Telemedicine Readiness Across Medical Conditions in a US National Representative Sample of Older Adults](#)

- [Equity in telemedicine for older adults during the COVID-19 pandemic](#)

11. Structural health monitoring for damage detection

Structural Health Monitoring for Damage Detection involves the use of modern electronic techniques to monitor the structural integrity and life expectancy of civil and mechanical structures, such as buildings, bridges, and pipelines.

Traditional methods, which relied on periodic inspections, have proven inadequate due to their lack of real-time capabilities and dependence on human involvement. Recent advancements have focused on micro and nano electronic trends, leading to the development of small, robust, and low-cost sensors like MEMS accelerometers and bolometers. Techniques such as Visual Inspection, Acoustic or Vibration Signature Detection, Fiber Optic Sensors, and Ground Penetrating Radar are employed to detect anomalies and prevent structural failures. Additionally, the integration of signal processing, soft computing, and IoT technologies has enhanced the ability to identify, locate, and assess damage at an early stage, thereby preventing catastrophic failures and improving the safety and sustainability of infrastructure. The use of advanced methods like the Electro-Mechanical Impedance Technique and vibration-based condition assessment further aids in the precise evaluation of structural weaknesses, making SHM a critical tool for disaster control and the maintenance of large-scale structures.

References

- [Application of machine learning with impedance based techniques for structural health monitoring of civil infrastructure](#)

- [Sensors for structural health monitoring: A review](#)

- [Modern Smart Sensing Technology in Structural Health Monitoring](#)

12. Autism and health-related technologies

Autism and Health-Related Technologies encompass a range of innovative tools designed to support individuals with Autism Spectrum Disorders (ASD) throughout their lives. These technologies include assistive devices that complement psychoeducational interventions, aid in diagnosis, and provide medical care tailored to individual needs. Challenges remain in areas such as early diagnosis, aging support, and access to employment and housing. Specific technologies like Augmentative and Alternative Communication (AAC) systems, exemplified by the AutistiCare android application, offer interactive and educational features for children aged 4 to 12, enhancing their learning and coordination through fun games. Additionally, Socially Assistive Robots (SARs) like EVA are being developed to assist in non-pharmacological interventions by recognizing and responding to user emotions, thereby making therapy sessions more engaging and effective. These advancements highlight the potential of technology to bridge gaps in learning and therapeutic interventions for individuals with autism, as validated by expert evaluations.

References

- [Bridging Learning Gap for Autism Spectrum Disorder](#)

- [What Can Technology Do for Autistic Spectrum Disorder People?](#)

- [Towards Enhancing the Multimodal Interaction of a Social Robot to Assist Children with Autism in Emotion Regulation](#)

13. Fall risk assessment in older adults

Fall Risk Assessment in Older Adults is a critical area of study due to the significant physical and psychological consequences of falls in this population. Recent advancements in sensing technology, such as inertial sensors, video/depth cameras, pressure sensing platforms, and laser sensing, offer promising methods for objective, low-cost, and easy-to-implement fall risk assessments. These technologies have shown varying degrees of diagnostic accuracy, influenced by differences in measured parameters and modeling techniques. Additionally, self-guided systems like the Kinect camera-based Fall Risk Assessment Avatar (FRAAn) have demonstrated high usability and strong correlation with clinical fall risk measures, indicating their potential for widespread use. Furthermore, automated methods using machine learning algorithms to analyze postural stability scores have proven reliable in predicting falls up to a year in advance, highlighting their utility in clinical settings for individualized fall prevention care. Despite these advancements, further research is needed to standardize assessment tools and bridge the gap between functional evaluation and user experience.

References

- [A Postural Assessment Utilizing Machine Learning Prospectively Identifies Older Adults at a High Risk of Falling](#)

- [Novel sensing technology in fall risk assessment in older adults: A systematic review](#)

- [Preliminary evaluation of a self-guided fall risk assessment tool for older adults](#)

14. Aging and health in society

Aging and Health in Society encompass a multifaceted and evolving landscape influenced by biological, societal, and technological factors. As the global population ages rapidly, challenges such as increased healthcare needs and structural agism arise, but these also present opportunities to redefine older life and promote healthy aging through preventive measures like diet, exercise, and positive psychology. Technological advancements, including artificial intelligence, play a crucial role in understanding and addressing aging processes. The well-being of older adults is further explored through geropsychiatry, highlighting the importance of research, storytelling, and policies to support successful aging and

well-trained caregivers. Public opinion on life-extension technologies reveals a cautious optimism, with a general agreement on the benefits of aging prevention but skepticism towards radical life extension and gene therapies. Overall, a collaborative effort from individuals, society, and various sectors is essential to enhance resilience, extend healthy longevity, and ensure that everyone can live better, longer lives.

References

- [Attitudes towards Aging Prevention: Results of a Focus-Group Study](#)

- [Living longer better](#)

- [Aging matters through the years a retrospective](#)

15. Home care and technology for ageing welfare

Home Care and Technology for Ageing Welfare focuses on the integration and utilization of advanced technologies to support the ageing population in maintaining independence and receiving care at home. The Finnish 'Smart Ageing and Care at Home' (KATI) programme exemplifies this effort by implementing various technology solutions across multiple regions, including monitoring devices, AI services, and digital health assessments, to enhance the well-being and care of older adults. This programme also addresses the training and adaptation of home care personnel to new technologies, aiming to create a sustainable, collaborative model for technology-supported ageing. In Norway, the use of robots as welfare technologies, particularly for fall prevention and detection, highlights both the potential benefits and challenges, such as privacy concerns and the need for personalized care. Overall, these initiatives demonstrate the critical role of technology in transforming home care services to meet the needs of an ageing population, ensuring safety, efficiency, and improved quality of life.

References

- [A governmental programme to support well-being, ageing and care at home with new technologies](#)

- [Robots as Welfare Technologies to Reduce Falls Amongst Older Adults: An Explorative Study from Norway](#)

- [Well-being and care at home with new technologies: Perspectives of home care personnel](#)

16. Artificial intelligence in healthcare

Artificial Intelligence in Healthcare encompasses a wide range of applications and technologies aimed at improving medical care and patient outcomes. AI, which includes machine learning and computer vision, has been integrated into various medical fields since its formal introduction in 1956. Notable applications include surgical robots inspired by Leonardo Da Vinci's designs, which assist in complex surgeries, and machine learning techniques for image recognition, particularly in cancer management and geriatric care. The synergy between AI and the Internet of Things (IoT) has also been highlighted, where AI processes vast amounts of data collected by IoT devices to enhance remote and at-home healthcare. This integration, known as the Artificial Intelligence of Things (AIoT), involves a unified architecture of sensors, devices, and communication technologies, offering promising solutions for proactive medical therapy, data augmentation, and patient care management. The field continues to evolve, presenting new challenges and opportunities for future research and real-world applications.

References

- [Artificial Intelligence in Medicine for Advance Treatment: A Survey](#)

- [Artificial intelligence in healthcare: major potential for innovations in our health system; [L'intelligence artificielle en santé, un potentiel majeur d'innovations pour notre système de santé]](#)

- [Artificial Intelligence of Things for Smarter Healthcare: A Survey of Advancements, Challenges, and Opportunities](#)

17. Ehealth literacy in older adults

eHealth literacy in older adults involves the ability to access, assess, and use digital health information effectively. Studies have identified several factors influencing eHealth literacy, including credibility in Internet health information, knowledge, and experience. Interventions aimed at improving eHealth literacy often focus on enhancing these factors and typically measure outcomes such as eHealth literacy efficacy. Research comparing multimedia tutorials to paper-based controls has shown significant improvements in older adults' knowledge and skills related to computer/Internet use and the quality of health information websites, with participants generally having positive attitudes toward training. Despite these advancements, older adults with lower eHealth literacy face challenges in engaging with telehealth services and often require additional support. These findings highlight the importance of using appropriate theoretical frameworks and considering multiple influencing factors when designing eHealth literacy interventions for older adults.

References

- [Building on Evidence to Improve eHealth Literacy in Older Adults: A Systematic Review](#)

- [Assessing the Effects of eHealth Tutorials on Older Adults' eHealth Literacy](#)

- [An Integrative Literature Review on Older Adults, Their eHealth Literacy and Use of Telehealth](#)

18. Machine learning in biological aging

Machine Learning in Biological Aging leverages modern techniques, particularly deep learning, to advance the understanding and estimation of biological age. Traditional machine learning approaches in aging research often require extensive feature engineering, which is a significant challenge due to the need for deep domain knowledge. However, deep learning offers a paradigm shift by extracting meaningful insights from complex data without explicit feature engineering. Recent literature reviews highlight the use of deep learning in biological age estimation, utilizing various data modalities and architectures, and identifying performance measures for these algorithms. These advancements have significant implications for healthcare, from palliative care to public health, by improving the understanding of individual health statuses based on physical activities, blood samples, and body shapes. Additionally, machine learning algorithms have been developed to estimate Biological Age (BA) using circulating and non-circulating biomarkers, which are crucial for monitoring healthy aging and assessing health risks. Studies like the Moli-sani cohort have explored the potential of BA estimation through blood biomarkers and neuroimaging features, linking these estimates to epidemiological variables, genetic and environmental factors, and age-related diseases. Deep learning systems, particularly deep aging clocks, have shown promise in identifying therapeutic targets, evaluating intervention efficacy, and predicting health trajectories, thus playing a pivotal role in pharmaceutical research and clinical applications.

References

- [Machine learning approaches for the estimation of biological aging: The road ahead for population studies](#)

- [Deep learning for biological age estimation](#)

- [Deep biomarkers of aging and longevity: From research to applications](#)

19. Immersive virtual reality for older adults

Immersive Virtual Reality (IVR) for older adults presents new opportunities to support healthy aging, particularly in addressing frailty, immobility, social isolation, and loneliness. Studies have shown that older adults' initial attitudes towards IVR, which may be neutral or negative, often shift to positive after first exposure, with minimal reported cybersickness. Systematic reviews and thematic syntheses of qualitative studies reveal that older adults generally have positive experiences with IVR, despite some initial discomforts. Key themes from these studies highlight the practical aspects of IVR use, the unique features experienced, and the overall perceptions of the technology. Improvements in IVR hardware and software, as well as better initial presentations, could further enhance its accessibility and usability for older adults, enabling them to engage in meaningful activities and environments that might otherwise be inaccessible due to age-related limitations.

References

- [Acceptance of immersive head-mounted virtual reality in older adults](#)

- [Older Adults' Experiences and Perceptions of Immersive Virtual Reality: Systematic Review and Thematic Synthesis](#)

- [Older Adults' Experiences and Perceptions of Immersive Virtual Reality: A Protocol for a Systematic Review and Thematic Synthesis](#)

20. Telemedicine and covid-19 impact on elderly neurological patients

Telemedicine and COVID-19 Impact on Elderly Neurological Patients have been significant, as the pandemic has drastically altered the management and care of neurological disorders. The pandemic has increased the health burden on elderly patients with neurological conditions, affecting their daily routines and access to care. Telemedicine has emerged as a crucial tool in this context, providing a platform for rehabilitation, neurological examinations, and other specialty services. Studies have shown that a substantial portion of patients, particularly those with headaches and epilepsy, are inclined to use telemedicine, although age influences this preference. The rapid shift to telemedicine during the pandemic has been reported by neurologists, with a preference for telephone consultations over video, especially for follow-ups rather than new referrals. Telemedicine has been found to be more effective for managing conditions like headaches and epilepsy compared to multiple sclerosis and movement disorders. The implementation of telemedicine has been essential in maintaining care for elderly neurological patients during the COVID-19 pandemic, highlighting its potential to contribute to the medical economy and patient management.

References

- [Actual Telemedicine Needs of Japanese Patients with Neurological Disorders in the COVID-19 Pandemic](#)

- [Experiences of telemedicine in neurological out-patient clinics during the COVID-19 pandemic](#)

- [The management of neurological disease during the COVID-19 pandemia; [COVID-19 Pandemi Sürecinde Nörolojik Hastaliklara Yaklasim]](#)

21. Healthcare expenditure and resource allocation

Healthcare Expenditure and Resource Allocation are significantly influenced by population aging, which leads to increased healthcare costs, particularly for older age groups. Studies indicate that healthcare expenditure per capita is substantially higher for individuals aged 65 and over compared to younger age groups. This trend is evident in China, where the healthcare expenditure for those aged 65 or over is 7.25 times higher than for those under 25. The aging population globally poses a risk to the sustainability of healthcare funding, as increased longevity without corresponding health improvements results in higher demand for healthcare services and overall spending. In the EU, the public healthcare system's reliance on employees' social security contributions further complicates funding sustainability. Additionally, the shift from cost-based to global budget payment schemes, as observed in Taiwan, highlights the impact of population aging and high technology on healthcare expenditures. The growth in outpatient, inpatient, and prescription drug expenditures is driven by these factors, with high-cost patients contributing significantly to the rising costs. Effective management of these patients is crucial for controlling healthcare expenditures and improving resource allocation.

References

- [Population aging and the influence on healthcare spending](#)

- [Counterfactual Decomposition of Health Care Expenditures: From Cost-Based Payment to a Global Budget System](#)

- [The effect of population aging on healthcare expenditure from a healthcare demand perspective among different age groups: Evidence from beijing city in the people's republic of china](#)

22. Covid-19 impact on older adults' mental health

COVID-19 Impact on Older Adults' Mental Health has been profound, with social isolation, loss of activities, and routines leading to increased feelings of worry and uncertainty among older adults. Despite these challenges, many have shown resilience by finding new activities and using technology to maintain social connections. Research indicates that food insecurity, community closeness, and COVID-19 experiences significantly affect mental health, resilience, and quality of life in older adults. Additionally, older adults face unique challenges such as limited access to services and technology, which exacerbate mental health issues like depression, anxiety, loneliness, and trauma symptoms. Systematic screening and cross-disciplinary collaborations are essential for identifying and addressing these mental health needs, highlighting the importance of community support and technological solutions in mitigating the adverse effects of the pandemic on older adults' mental well-being.

References

- [Mental health and well-being for aging adults during the COVID-19 pandemic](#)

- [Research-Practice Partnership to Develop and Implement Routine Mental Health Symptom Tracking Tool Among Older Adults During COVID-19](#)

- [Experiences of Older Adults During COVID-19: Loss, Boredom, Uncertainty, Worry, and Resilience](#)

23. Mild cognitive impairment in older adults

Mild Cognitive Impairment in Older Adults is a growing concern as the population ages, with the prevalence of cognitive impairments increasing due to age being a primary risk factor for neurodegenerative conditions. Innovative approaches such as the TECH-'Tablet Enhancement of Cognition and Health' program, which utilizes touchscreen tablet applications for cognitive self-training, have shown high feasibility and satisfaction among older adults with MCI, though further data is needed to confirm its effectiveness. Non-invasive monitoring techniques, including digitized psychological tests and gaze tracking technologies, are also being explored to detect MCI in older adults, providing valuable insights for future research and avoiding potential pitfalls. Addressing this issue requires early identification and intervention through public health campaigns, a trained workforce, and leveraging technology to mitigate the medical, behavioral, and economic burdens associated with cognitive impairments.

References

- [Cognition is a Critical Vital Sign for Older Adults: The Need for Early Detection of Cognitive Impairment is Now](#)

- [A trial study of using DSST to evaluate cognitive impairment in older adults](#)

- [The feasibility of TECH: Tablet Enhancement of Cognition and Health, a novel cognitive intervention for people with Mild Cognitive Impairment](#)

24. Skin and aortic valve health

Skin and Aortic Valve Health involves understanding the interplay between cardiovascular conditions and their impact on overall health, including the skin. Chronic mitral regurgitation (MR) is a prevalent cardiovascular issue that necessitates surgical intervention, with emerging transcatheter techniques offering less invasive options to reduce perioperative risks. Acute myocardial infarction (AMI) can lead to severe complications such as left ventricular free wall rupture, requiring immediate surgical repair to prevent fatal outcomes. Additionally, primary cardiac tumors, though rare, are increasingly detected due to advancements in medical imaging, with cardiac hemangiomas being a notable example. These conditions highlight the importance of timely and effective cardiovascular interventions to maintain both heart and skin health, as systemic cardiovascular issues can manifest in various ways, including through skin-related symptoms.

References

- [Atrial Hemangioma: A Case Report and Review of the Literature](#)

- [Alternative Method of Surgical Treatment of Post-Infarction Left Ventricular Free Wall Rupture. Case Report](#)

- [Transcatheter Mitral Valve Intervention for Chronic Mitral Regurgitation: A Plethora of Different Technologies](#)

25. Depressive symptoms and assistive products for health

Depressive Symptoms and Assistive Products for Health are explored through various studies focusing on older adults. One study using data from the China Health and Retirement Longitudinal Studies found that assistive devices increased depression levels among older adults, particularly in developed areas, women, those under 75, and socially active individuals. The type and number of devices also influenced depression levels, with decreased health satisfaction being a mediating factor. Another study examined the impact of a socially assistive

humanoid robot (SAHR) named Hyodol on low-income, socially isolated older adults, showing reduced depressive symptoms and improved health-related quality of life (HRQOL) at 3 months, but not at 6 months, indicating limited long-term effects. A review of social robots for older adults with depressive symptoms in smart cities highlighted that while there is potential for these robots in mental health interventions, the evidence of their effectiveness is limited, with only a third of studies showing significant improvement in depression symptoms. The review emphasized the need for well-planned interventions tailored to the specific needs and contexts of older adults.

References

- [Impact of assistive devices use on levels of depression in older adults: Evidence from China](#)

- [Effects of social robots on depressive symptoms in older adults: a scoping review](#)

- [Socially Assistive Humanoid Robots: Effects on Depression and Health-Related Quality of Life among Low-Income, Socially Isolated Older Adults in South Korea](#)

26. Brain age and epigenetic methylation

Brain Age and Epigenetic Methylation involve the use of DNA methylation data to develop biomarkers of aging, known as 'epigenetic clocks', which help identify differences between chronological and biological age in various health conditions, including neurodegeneration and dementia. Traditional DNA methylation clocks, while accurate in blood, are less precise in older samples or tissues not included in their training, such as the brain. A novel epigenetic clock optimized for human cortex tissue has been developed, using a dataset spanning ages 1 to 108 years, and validated in independent datasets, showing superior performance in predicting age in the brain. This suggests that previous associations between DNA methylation age and neurodegenerative phenotypes may have been false positives due to inadequate calibration of the clocks. DNA methylation levels change with age, and the epigenetic clock captures biological features of aging, although the underlying mechanisms remain unclear. Research indicates that epigenetic aging begins early in life and continues uninterrupted, influenced by necessary developmental and homeostatic processes. Additionally, studies on elderly twins have identified specific genomic sites, such as the promoter region of PCDHGA3, where DNA methylation correlates with biological age, suggesting that DNA methylation at these sites is a key mediator of healthy aging.

References

- [DNA methylation associated with healthy aging of elderly twins](#)

- [Recalibrating the epigenetic clock: Implications for assessing biological age in the human cortex](#)

- [Current perspectives on the cellular and molecular features of epigenetic ageing](#)

27. Wearable health monitoring sensors

Wearable Health Monitoring Sensors represent a significant advancement over traditional Medicare techniques, which often rely on cumbersome, invasive, and time-consuming methods. These sensors can be attached to various body parts to capture biochemical and physiological data through the skin, allowing for real-time monitoring of health conditions with high accuracy and minimal discomfort. Most commercially available devices are wrist-worn and limited by battery size and weight, but emerging "skin-like" sensors offer enhanced flexibility, lightness, and portability. Recent advancements include battery-powered sensors based on optical phenomena and battery-free skin-like sensors, marking a breakthrough in wearable sensing technology. The field is rapidly evolving, with interdisciplinary efforts focused on expanding applications and translating research into widespread diagnostic and therapeutic use. Wearable sensors are also being integrated into flexible materials, such as vests, to provide elderly individuals with accurate vital sign monitoring and support therapeutic needs, demonstrating promising results in various health monitoring scenarios.

References

- [Development of Health Monitoring Vest using Velostat](#)

- [Recent Advances in Wearable Optical Sensor Automation Powered by Battery versus Skin-like Battery-Free Devices for Personal Healthcare—A Review](#)

- [Emerging technologies in wearable sensors](#)

28. Smart monitoring for dementia and alzheimer's patients

Smart Monitoring for Dementia and Alzheimer's Patients involves the development and implementation of advanced medical systems designed to enhance the quality of life for individuals with Alzheimer's disease and alleviate the burden on their caregivers. These systems typically include a Smart Biomedical Assistance device, which provides continuous monitoring of the

patient's stability, location tracking via GPS, automatic medication reminders, and an emergency call button. The device consists of a wearable unit equipped with sensors for motion processing, heart rate monitoring, and microcontrollers, along with an LCD display. This wearable unit is integrated with an Internet of Things (IoT) platform, enabling caregivers to communicate with and monitor the patient remotely. Additionally, the integration of AI in these systems aids in more accurate diagnosis, health predictions, and treatment recommendations, further enhancing patient care.

References

- [Dementia prediction using novel IOTM (Internet of Things in Medical) architecture framework](#)

- [A Smart Biomedical Assisted System for Alzheimer Patients](#)

- [Smart Biomedical Assisted System for Alzheimer Patient](#)

29. Diabetes and obesity prediction using machine learning

Diabetes and Obesity Prediction Using Machine Learning involves leveraging vast healthcare datasets to identify patterns and predict outcomes effectively. Diabetes, a condition exacerbated by factors such as aging, obesity, and poor diet, can lead to severe health issues if not detected early. Machine learning (ML) techniques, including Support Vector Machine (SVM), Logistic Regression (LR), Boosted Tree (BOT), Bagged Tree (BAT), K-Nearest Neighbor (KNN), and Gradient Boosting (GB), have been employed to enhance the accuracy of early diabetes prediction. Studies have shown that models like BAT and Random Forest achieve high accuracy rates, with BAT reaching 98% accuracy in one study. Additionally, integrating ML models with web applications facilitates easy and efficient diabetes prediction. Research also highlights the relationship between food consumption data and health outcomes, using ML models to predict obesity and diabetes prevalence among children and adults. These findings suggest that ML can significantly aid in early intervention and management of diabetes and obesity, providing valuable insights for healthcare providers, policymakers, and food companies to improve public health.

References

- [Early diabetes risk classification using supervised learning algorithms](#)

- [Analyzing and Predicting Diabetes Chronic Disease Using Machine Learning Techniques](#)

- [You Are What You Eat: Predictive Model of Eating Habits and Health Outcomes](#)

30. Emergency virtual reality and digital rehabilitation technology

Emergency Virtual Reality and Digital Rehabilitation Technology have emerged as pivotal tools in modern healthcare, particularly in response to the increased need for remote care during the COVID-19 pandemic. Integrating VR with electroencephalography, these technologies facilitate multi-user rehabilitation, allowing therapists to provide remote care and personalized rehabilitation plans based on real-time data analysis using cloud services like Azure ML Studio. This approach enhances the immediacy and accuracy of clinical evaluations and supports home-based and community healthcare services, especially for seniors. Despite the benefits, challenges remain, particularly for older adults and individuals with cognitive or physical impairments, who may find VR technology difficult to use. Efforts are being made to develop user-centered VR tools that address accessibility issues and ensure equal access for all users. Additionally, immersive VR platforms have been developed for in-home neurocognitive rehabilitation, offering structured programs that seniors with neurological conditions can complete independently. These advancements highlight the potential of VR and digital rehabilitation technologies to revolutionize remote healthcare delivery and training, providing innovative solutions for patient care and medical education.

References

- [Development of Virtual Reality Training System Based on EEG Biofeedback](#)

- [Virtual Reality for Health and Wellbeing](#)

- [Immersive VR for Training Cognition in Seniors with Neurological Disorders](#)

31. Chronic disease self-management and multimorbidity

Chronic Disease Self-Management and Multimorbidity involve complex routines for older adults, including symptom monitoring, medication management, healthcare coordination, and communication with multiple providers. Research highlights the need for technology to support these individuals, particularly through digital health platforms like ProACT, which aim to facilitate home-based self-management and integrated care. Studies conducted in Europe, specifically in Ireland and Belgium, have shown that such platforms can improve self-management, health, and well-being by providing tools for monitoring conditions and receiving support from care networks. Despite challenges like poor health and technological issues, user-centered design and engagement strategies have

proven effective in maintaining user participation and satisfaction. The integration of clinical guidelines, human-computer interaction, behavioral science, and data analytics into these platforms is crucial for advancing self-management and creating a patient-centric care ecosystem.

References

- [A Digital Platform to Support Self-management of Multiple Chronic Conditions (ProACT): Findings in Relation to Engagement during a One-Year Proof-of-Concept Trial](#)

- [A Digital Health Platform for Integrated and Proactive Patient-Centered Multimorbidity Self-management and Care (ProACT): Protocol for an Action Research Proof-of-Concept Trial](#)

- [Managing multimorbidity: Identifying design requirements for a digital self-management tool to support older adults with multiple chronic conditions](#)

32. Smart elderly care services

Smart Elderly Care Services address the challenges posed by an aging population through the development of smart, physical, social, and age-friendly environments. These services leverage machine learning, robot assistive technologies, and integrated care systems to support independent living, delay institutionalization, and enhance the quality of life for older adults. Examples include systems for polypharmacy management and social and cognitive activity support, which utilize advanced technology and data models to ensure healthier, safer, and more socially connected lives. Additionally, sustainable healthcare systems for nursing homes incorporate cost-effective fingerprint indoor-positioning technology and parallel path-finding algorithms to provide rapid assistance and improve safety and management efficiency. The concept of "smart pension" further integrates digital information platforms to offer emergency assistance, life services, and home services, meeting the diverse needs of the elderly through innovative pension management and enhanced security mechanisms.

References

- [Research on the Design of Internet Plus Home Care Service Platform for Intelligent Elderly](#)

- [Smart environments and social robots for age-friendly integrated care services](#)

- [A Sustainable, Interactive Elderly Healthcare System for Nursing Homes: An Interdisciplinary Design](#)

33. Voice assistants for older adults

Voice Assistants for Older Adults offer significant potential by enabling voice-based interaction without requiring expertise in traditional computing devices. Studies have shown that older adults use these assistants for various purposes, including finding online information, particularly health-related, although concerns about the credibility of such information persist. Despite initial interest in features like timers and reminders, actual usage is low due to reliability issues. Research also indicates that older adults use voice assistants to address social and relational needs, such as asking personal questions, seeking advice, and alleviating stress, highlighting the importance of ethical considerations in long-term care settings. Additionally, the design of voice assistants, often characterized by young and female voices, may activate stereotypes that affect trust and usage. Understanding how perceived age, gender, and reliability influence user trust is crucial for improving the design and effectiveness of these technologies for older adults.

References

- [Use of intelligent voice assistants by older adults with low technology use](#)

- [Investigating user perceptions and stereotypic responses to gender and age of voice assistants](#)

- [Voice Assistant Use in Long-Term Care](#)

34. Digital health adoption in older adults

Digital Health Adoption in Older Adults is influenced by various factors including the COVID-19 pandemic, which has increased internet use among older age groups, though they still lag behind younger populations in adopting digital health technologies. Systematic reviews indicate that digital health interventions can enhance access, monitoring, and self-care for older adults, but barriers such as technology challenges and distrust need to be addressed. Studies show that older adults have positive attitudes towards digital health but emphasize the need for patient-centric and ethical designs. Research in Hungary reveals that a significant portion of older adults use the internet for health-related purposes and are familiar with digital health devices and services like e-prescriptions and online appointments. However, usage rates vary with age and education level, and there is a high interest in digital solutions among this demographic. Additionally, factors such as perceived usefulness, self-efficacy, and privacy concerns significantly impact the intention to adopt digital health services. Support from

family and formal institutions also plays a crucial role in encouraging adoption. Overall, while digital health technologies hold promise for promoting healthy aging, tailored implementation strategies and further efficacy research are essential to maximize their benefits for older adults.

References

- [Acceptance of digital health services among older adults: Findings on perceived usefulness, self-efficacy, privacy concerns, ICT knowledge, and support seeking](#)

- [Older adults in the digital health era: insights on the digital health related knowledge, habits and attitudes of the 65 year and older population](#)

- [Digital Health Interventions for Promoting Healthy Aging: A Systematic Review of Adoption Patterns, Efficacy, and User Experience](#)

35. Hearing aid use and hearing loss in older adults

Hearing Aid Use and Hearing Loss in Older Adults is a significant public health issue, with up to two-thirds of older adults in the United States experiencing hearing loss, yet less than 20% using hearing aids. Factors influencing hearing aid use include sociodemographics, health status, access to care, patient engagement, and technology use. Older age, being male, higher education, higher income, and having a usual source of care are associated with greater odds of hearing aid use. Globally, the uptake of hearing aids remains low, even in middle- and high-income countries, due to factors such as high costs and lack of insurance coverage. Efforts to improve access to hearing aids should focus on regulatory changes, technological advancements, and better reimbursement schemes. Additionally, individuals who do not use hearing aids often perceive their hearing loss as less severe, have lower technology commitment, and lower socioeconomic status compared to those who use hearing aids. Addressing these barriers and improving access to information and healthcare can potentially increase the use of hearing aids among older adults.

References

- [What Keeps Older Adults With Hearing Impairment From Adopting Hearing Aids?](#)

- [Factors Associated With Hearing Aid Use Among Medicare Beneficiaries](#)

- [Access to adults' hearing aids: Policies and technologies used in eight countries; [Accès aux prothèses auditives pour adultes: Les politiques et](#)

technologies utilisées dans huit pays]; [Acceso a los audífonos para adultos: Políticas y tecnologías utilizadas en ocho países]

36. Power electronics health monitoring and reliability

Power Electronics Health Monitoring and Reliability involves the use of advanced techniques to ensure the safe and efficient operation of power electronic systems. Partial discharge (PD) detection is crucial for monitoring the reliability of insulation systems in critical components such as ships, aircraft, and vehicles, where electrification increases voltage and power density. Innovations in PD detection, leveraging artificial intelligence for automatic and unsupervised analysis, aim to enhance the design and health monitoring of these systems. Insulated-Gate Bipolar Transistors (IGBTs) and Silicon Carbide (SiC) power switches are key components in medium to high-power applications, and their reliability is essential. Data-driven approaches and predictive models are employed to estimate the state of health (SOH) of these devices by monitoring parameters like on-state voltage drop and junction temperature. Accelerated aging tests and real-time data processing help predict the remaining useful life and issue maintenance alerts, thereby preventing unexpected failures. These methodologies contribute significantly to the health monitoring and reliability of power semiconductor devices, ensuring their compliance and operational safety.

References

- [Innovative Insulation System Design and Partial Discharge Detection to Optimize Resilience of Electrical Transportation Assets](#)

- [Health Monitoring of IGBTs Using Machine Learning Techniques](#)

- [A Data-driven Condition Monitoring method to predict the Remaining Useful Life of SiC Power Modules for Traction Inverters](#)

37. Embodied conversational agents for dementia care

Embodied Conversational Agents (ECAs) for Dementia Care are emerging as promising tools to support the complex needs of people with dementia through natural and familiar verbal and nonverbal communication. These virtual entities aim to improve the accessibility and acceptance of assistive technologies, addressing high-level needs that current technologies fail to meet. Research in this field is still novel and underexplored, with studies focusing on the usability, acceptability, and independent use of ECAs by dementia patients and their caregivers. Trials have shown that while users engage well with ECAs, technical issues such as speech recognition remain a barrier. Despite these challenges, ECAs have demonstrated potential in supporting memory, providing enjoyment, and promoting social interaction, suggesting their future role as nonpharmacological

support systems in dementia care. The integration of interdisciplinary research networks and collaboration among medical scientists, technology developers, and caregivers is crucial to advance this field and enhance the efficacy of ECAs in dementia care.

References

- [Embodied conversational agents for patients with dementia: Thematic literature analysis](#)

- [Usability and acceptance of the embodied conversational agent anne by people with dementia and their caregivers: Exploratory study in home environment settings](#)

- [The Design and Implementation of a Chatbot's Character for Elderly Care](#)

38. Transformer health index and insulation assessment

Transformer Health Index and Insulation Assessment are critical for ensuring the reliability and longevity of power transformers, which are essential components in power transmission and distribution systems. The Health Index (HI) provides a general assessment of a transformer's condition, often determined through various conventional and non-conventional methods, including transformer oil testing and condition monitoring (CM) techniques. Key parameters such as Breakdown Voltage (BDV), water content, 2-furfuraldehyde (2FAL), and Dissolved Gas Analysis (DGA) are significant in evaluating the health and predicting the life of transformers. Advanced computational methods, including Artificial Neural Networks (ANN) and Support Vector Regression (SVR), have been developed to predict the HI with high accuracy, even with a reduced number of input features, making the process more cost-effective. These methods help in identifying potential faults early, allowing for timely maintenance and better asset management. The integration of machine learning algorithms further enhances the prediction of insulation conditions, such as furan levels, thereby supporting effective maintenance strategies and resource allocation to maximize operational efficiency and minimize the risk of transformer failure.

References

- [Prediction Health Index Using Machine Learning and Its Correlation with Transformer Age on Historical Data](#)

- [Data-Driven Strategies for Optimal Performance and Maintenance: Using Machine Learning for Improved Power Transformer Management](#)

- [Assessing the power transformer insulation health condition using a feature-reduced predictor mode](#)

39. Glaucoma and nutrition in older adults

Glaucoma and Nutrition in Older Adults is a critical area of study given the rising prevalence of glaucoma, which is the leading cause of irreversible blindness worldwide, particularly affecting an aging population. The detection and management of glaucoma are complicated by various factors, including the challenges in using macular optical coherence tomography (OCT) imaging to monitor retinal ganglion cells, which are crucial for assessing glaucoma progression. Aging and concurrent macular conditions further complicate the detection of structural changes in the eye. Addressing these challenges through improved imaging techniques, artificial intelligence, and statistical methods can enhance early detection and treatment. Additionally, disparities in glaucoma care based on socioeconomic status, race, age, and geographic region highlight the need for targeted strategies such as teleophthalmology to ensure equitable access to care. While the abstracts do not directly address the role of nutrition, the overall health and management of older adults with glaucoma could potentially benefit from a holistic approach that includes nutritional considerations to support eye health and mitigate oxidative stress, a known factor in age-related eye diseases.

References

- [Cataracts](#)

- [Identifying, Understanding, and Addressing Disparities in Glaucoma Care in the United States](#)

- [Detection of Glaucoma Deterioration in the Macular Region with Optical Coherence Tomography: Challenges and Solutions](#)

40. Heart disease prediction using machine learning

Heart Disease Prediction Using Machine Learning leverages advanced algorithms to identify individuals at risk of heart disease by analyzing patterns within large datasets. The World Health Organization highlights the global prevalence of cardiovascular diseases, with machine learning (ML) and deep learning (DL) algorithms showing promising results in predicting and diagnosing these conditions. Various algorithms, including XGBoost, Decision Trees, and Multi-Layer Perceptron, have achieved high prediction accuracies, with some models reaching up to 98.54%. The implementation of these algorithms involves data crawling, collection, and analysis, utilizing tools like ETL, OLAP, and data mining to enhance prediction effectiveness. Studies have shown that Support Vector

Classifier (SVC) and Random Forest algorithms are particularly effective, with SVC achieving 92% accuracy. These methods not only provide high performance and accuracy but also offer flexibility and reliability, making them valuable for early detection and prevention of heart disease, ultimately aiding medical practitioners in delivering faster and more accurate diagnoses.

References

- [Machine Learning Based Heart Disease Prediction System](#)

- [Statistic Solution for Machine Learning to Analyze Heart Disease Data](#)

- [Improving Cardiovascular Prediction with Advanced Machine Learning and Deep Learning Approaches](#)

41. Electronic medication adherence systems

Electronic Medication Adherence Systems are designed to address the challenges of medication management among older adults, particularly those with chronic conditions. These systems include various electronic products that are evaluated for their usability, features, and user preferences. Key factors influencing their effectiveness include simplicity, portability, secure medication compartments, and adequate storage capacity. Studies have shown that these systems can significantly improve medication adherence and health perception in older adults. For instance, a pilot Randomized Controlled Trial demonstrated that an in-home electronic medication dispensing system led to higher adherence rates compared to traditional methods. Additionally, the integration of technology in healthcare, such as telehealth and digital health platforms, has been beneficial, especially during the Covid-19 pandemic, by providing reliable and flexible medication reminders and enhancing overall health management. These systems not only support independent medication management but also positively impact the physical and mental health of older adults by increasing their awareness and motivation for better health practices.

References

- [Medication adherence support of an in-home electronic medication dispensing system for individuals living with chronic conditions: a pilot randomized controlled trial](#)

- [A Framework for a Mobile Informative Push Notification and Web Application for the Office of Senior Citizens Affairs City of Manila](#)

- [Stakeholder feedback of electronic medication adherence products: Qualitative analysis](#)

42. Robotic exercise assistance for older adults

Robotic Exercise Assistance for Older Adults leverages Socially Assistive Robots (SARs) to engage, coach, assess, and motivate older adults in performing physical exercises recommended by health authorities like the NHS. These robots aim to improve the quality of life for the growing elderly population by enhancing physical fitness, immune function, and mental well-being while reducing health issues such as diabetes, cardiovascular disease, and dementia. The NAO robot, for instance, can guide elderly individuals through gymnastic exercises using voice commands and movement demonstrations, even incorporating real-time video interactions with loved ones to reduce isolation. Another robotic system, utilizing humanoid robots like Nao and Poppy, provides real-time corrective and positive feedback during exercises, which has been shown to motivate older adults to engage more in physical activities. User studies indicate that these systems are generally well-received, with preferences leaning towards more mechanical-looking robots like Poppy, and highlight the importance of feedback timing and mode in enhancing user interaction and motivation.

References

- [Socially Assistive Robotics: Robot Exercise Trainer for Older Adults †](#)

- [Autonomous and remote controlled humanoid robot for fitness training](#)

- [Robotic System for Physical Training of Older Adults](#)

43. Privacy concerns in video-based aal technologies

Privacy concerns in video-based AAL technologies are significant due to the potential for privacy intrusion and data security issues, despite the benefits these technologies offer in supporting older adults' independence and safety. Studies indicate that acceptance of these technologies varies depending on the activity being monitored, with higher acceptance for household and social activities and lower acceptance for intimate activities like changing clothes or showering, where privacy concerns are most pronounced. Older adults find the concept of privacy complex and difficult to define, but clear concerns emerge in the context of video monitoring, particularly regarding nudity. While some older adults are initially resistant to camera-based assistive technologies, their concerns can be somewhat alleviated by explaining privacy-preserving techniques. The most critical factor for users is who has access to the data, while the prominence of the system, sensor location, and sensor types are less important. These findings highlight the need for careful design and communication strategies to address privacy concerns and enhance the acceptance of video-based AAL technologies.

References

- [Eyes on privacy: acceptance of video-based AAL impacted by activities being filmed](#)

- [Privacy perceptions in ambient assisted living](#)

- [What Is Privacy? Perceptions of Older Adults in the South of Spain About the Concept of Privacy and in Terms of Video-Based AAL Technologies](#)

44. Wireless body area network security and authentication

Wireless Body Area Network (WBAN) Security and Authentication are critical for ensuring the safe and reliable transmission of health-related data collected by biomedical sensors placed on the human body. WBANs are primarily used in healthcare for remote patient monitoring, entertainment, gaming, and sports fitness, where they track vital health indicators and transmit data to distant monitoring equipment via the internet or cloud services. The main challenges in WBANs include energy usage, secure network connections, and potential attacks by hostile nodes. To address these issues, various security and authentication protocols have been proposed. The Network Reliability based Secure Routing Algorithm (NRSRA) and an authentication algorithm have been shown to enhance network reliability and security by determining secure paths and authenticating nodes. Another approach, the Two-Party Lightweight Authentication Protocol (TLAP), uses self-certified public keys based on Elliptic Curve Cryptography (ECC) and lightweight operations to reduce computational costs and energy consumption while providing mutual authentication and resistance to attacks. Additionally, a novel mutual authentication scheme using asymmetric bilinear pairing has been developed to overcome the limitations of previous schemes, offering improved security, performance, and efficiency. These advancements in WBAN security and authentication protocols are essential for protecting patient data and ensuring the reliability of health monitoring systems.

References

- [Lightweight Authentication Protocol Using Self-Certified Public Keys for Wireless Body Area Networks in Health-Care Applications](#)

- [Analysis and Improvement of a Mutual Authentication Scheme for Wireless Body Area Networks](#)

- [A Network Reliability based Secure Routing Protocol (NRSRP) for Secure Transmission in Wireless Body Area Network](#)

45. Architectural design and pandemic impact

Architectural Design and Pandemic Impact have been significantly influenced by the COVID-19 pandemic, prompting architects and urban designers to rethink and adapt living spaces to new health and safety standards. The pandemic has led to a focus on creating independent, self-sufficient homes with enhanced interior design, natural daylighting, ventilation, and the use of natural materials. The integration of touchless and smart technologies, as well as the separation of heating and ventilation systems, has become crucial to prevent the spread of infectious diseases. Additionally, the need for multifunctional spaces and well-equipped home offices has emerged, moving away from open-plan designs. The introduction of robots and sensors in living spaces to predict and control non-steady motions, such as turning, highlights the importance of safe and comfortable environments, especially for the elderly. Urban space design, particularly in high-density cities like Macau, must consider the physical and mental health of the elderly, emphasizing street openness, greenery, and interface coverage. These changes reflect a broader trend towards designing spaces that promote public health, adaptability, and quality of life in response to the challenges posed by the pandemic.

References

- [The impact of street space perception factors on elderly health in high-density cities in Macau—analysis based on street view images and deep learning technology](#)

- [How the COVID 19 pandemic would change the future of architectural design](#)

- [Effects of architectural space design on predicting turning in daily life](#)

46. Air pollution and health impacts

Air Pollution and Health Impacts are significant public health concerns globally, with fine particulate matter (PM2.5) being a major contributor. In China, despite improvements in air quality, PM2.5 exposure remains high, leading to substantial disease burdens, particularly as the population ages. Future emission scenarios indicate that while PM2.5 exposure will decline, the disease burden may still increase unless stringent air pollution and climate mitigation technologies are implemented. In the United States, studies have shown that PM2.5 exposure is associated with increased age-specific mortality risk (ASMR), particularly in areas with lower socioeconomic status (SES), highlighting the need for equitable public policies to improve air quality. In South America, specifically Lima, Peru, advanced machine learning models have been developed to estimate PM2.5 concentrations, revealing severe air pollution due to topography and aging vehicular fleets. These models are crucial for supporting future epidemiological

studies and understanding the spatial distribution of air pollution. Overall, addressing air pollution through targeted emission reductions and equitable policies is essential for mitigating its adverse health impacts.

References

- [Air Pollution, Socioeconomic Status, and Age-Specific Mortality Risk in the United States](#)

- [The contribution of emission sources to the future air pollution disease burden in China](#)

- [Developing an advanced PM2.5 exposure model in Lima, Peru](#)

47. Emergency department critical care

Emergency Department Critical Care has evolved significantly to address the increasing complexity of critically ill patients, driven by factors such as an aging population, advancements in medical technology, and hospital congestion. Emergency physicians now play a crucial role in initiating timely diagnostic and therapeutic interventions, including advanced airway management, mechanical ventilation, and treatment of shock and metabolic disturbances. The case of a 9-year-old girl during the COVID-19 pandemic highlights the importance of emergency departments in managing severe, rapidly progressing conditions through coordinated care with specialists. Additionally, the frequent occurrence of trauma-related falls in older adults underscores the need for comprehensive risk assessments and interventions, both prehospital and post-ED care, to reduce injurious falls. Despite challenges, ongoing innovations aim to enhance fall detection and implement evidence-based strategies in emergency settings.

References

- [From Telemedicine to the ICU-Fever and Rash in a 9-Year-Old Girl](#)

- [Older Adult Falls in Emergency Medicine: 2019 Update](#)

- [A paradigm shift in the provision of improved critical care in the emergency department](#)

48. Digital health interventions for cancer patients

Digital health interventions for cancer patients have become an essential component of healthcare, particularly in the context of remote care delivery. These interventions, primarily web-based, are frequently used at home and often include multiple functional components such as self-management and cognitive function support. They have shown positive outcomes in managing symptoms,

improving decision-making, and enhancing knowledge. However, there is a notable gap in targeting older adults and patients with advanced or metastatic cancer. Usability and perceived usefulness are critical factors influencing the uptake and adherence of digital health interventions among older cancer patients, with minimalist design and customizability being key enablers. The COVID-19 pandemic has accelerated the adoption of digital health and telehealth interventions, with recent reviews highlighting their positive effects on quality of life and psychological outcomes. Despite these advancements, there are gaps in addressing older adults, bereavement, and the sustainability of these interventions, indicating a need for further systematic reviews to guide innovation and integration into clinical practice.

References

- [Barriers and enablers of uptake and adherence to digital health interventions in older patients with cancer: A systematic review](#)

- [Digital health and telehealth in cancer care: a scoping review of reviews](#)

- [Digital Health Interventions for Adult Patients with Cancer Evaluated in Randomized Controlled Trials: Scoping Review](#)

49. Passive remote monitoring for home care

Passive Remote Monitoring for Home Care addresses the growing need for effective home care solutions in response to the global aging population. Telemonitoring technologies, such as autonomous bathroom devices, are being developed to detect emergency situations and facilitate independent living for the elderly. These technologies are still evolving but show great promise. Additionally, the use of 2D LiDAR sensors has been explored to monitor daily activities while ensuring privacy through anonymous data collection. This method has demonstrated high accuracy in identifying activities, although challenges remain with occlusions from furniture. Furthermore, Internet of Things (IoT) technologies, including RFID indoor positioning and various sensors, are being utilized to provide real-time monitoring of elderly individuals' status, detect dangerous situations, and offer reminders for medication and medical appointments. These advancements collectively aim to enhance the safety, independence, and quality of home care for the elderly.

References

- [Design of a Home Care System for the Elderly under the Background of the Internet of Things](#)

- [Bathroom telemonitoring system with alerting function for independent life of elderly](#)

- [Development and Preliminary Evaluation of a Method for Passive, Privacy-Aware Home Care Monitoring Based on 2D LiDAR Data](#)

50. Dementia care and assistive technologies

Dementia Care and Assistive Technologies have become increasingly significant as the global population ages and the prevalence of dementia rises. Information and communication technologies (ICTs) have been integrated into assistive technologies (ATs) for dementia care, particularly since the 1990s, focusing on supporting aging-in-place, assisting with daily activities, home modifications, and promoting recreational activities. Despite these advancements, there remains a research gap in using technology to enhance social interactions for people with dementia. The systematic literature review highlights the potential of ATs to address the challenges faced by people with dementia (PwD) and their caregivers, offering insights into existing supportive technologies and their applications. These technologies aim to facilitate aging-in-place, reduce medical costs, and alleviate caregiver burden by maintaining patient functioning. However, legal issues such as workplace safety, data privacy, and healthcare ethics pose significant barriers to the widespread implementation of these technologies. The hope is that advancements in artificial intelligence (AI) will further enhance the capabilities of ATs, uncovering new knowledge and management options for dementia and mild cognitive impairment (MCI).

References

- [New assistive technologies in dementia and mild cognitive impairment care: A PubMed review](#)

- [Understanding the research landscape of information and communication technology integration in dementia-focused assistive technologies: Mining literature from 1970 to 2020](#)

- [Survey on assistive technologies for people with Dementia](#)

51. Ecg monitoring and wearable heart devices

ECG Monitoring and Wearable Heart Devices have gained significant attention due to the aging global population and the increasing focus on health. Technological advancements in front-end circuitry, chip selection, and algorithm application are crucial for enhancing the performance of these devices, ensuring lower noise and higher gain in signal detection. Wearable ECG devices are designed to reliably record health parameters and assist in disease diagnosis, with

future directions for improvement identified through substantial research. The development of a prototype ECG Smart Jersey using IoT, Machine Learning, and Android applications aims to provide automated heart defect detection for athletes, addressing the issue of sudden deaths during strenuous activities. Additionally, a wearable ECG monitor integrated with a wireless sensor and a machine learning-based smartphone application has shown high accuracy in classifying ECG signals among older adults, demonstrating potential for early diagnosis and effective treatment of cardiovascular diseases in low and middle-income countries. These innovations highlight the potential of wearable ECG devices to improve health monitoring and accessibility to healthcare services.

References

- [Mobile Personal Health Monitoring for Automated Classification of Electrocardiogram Signals in Elderly](#)

- [Development of an ECG Smart Jersey Based on Next Generation Computing for Automated Detection of Heart Defects Among Athletes](#)

- [Wearable ECG Devices: A State of the Art about Circuit, Software and Application](#)

52. Mhealth solutions for diabetes self-management

mHealth Solutions for Diabetes Self-Management have shown promise in improving self-management behaviors, glycemic control, and medication adherence, particularly in older adults. Research indicates that psychological techniques such as cognitive-behavioral therapy (CBT), self-monitoring, tailored motivational feedback, and psychoeducation are effective components of these interventions. However, there are challenges in maintaining long-term adherence to healthy behaviors. In the Kingdom of Saudi Arabia, barriers such as human resource shortages, funding, legal and regulatory issues, and organizational impediments hinder the successful implementation of mHealth technologies. Despite these obstacles, appropriate leadership and clinical environments could mitigate these barriers. Additionally, mHealth interventions like SMS coupled with telemedicine for coaching have demonstrated positive effects on various health outcomes, including weight loss, BMI, diet, exercise, HbA1c, and medication adherence. However, the cost of equipment and user training remains a significant drawback. Further research and adaptation of mHealth solutions to address sensory deficits in older adults are necessary to enhance their effectiveness and user-friendliness.

References

- [Analysis of effectiveness and psychological techniques implemented in mhealth solutions for middle-aged and elderly adults with type 2 diabetes: A narrative review of the literature](#)

- [mHealth for diabetes self-management in the kingdom of Saudi Arabia: Barriers and solutions](#)

- [Analyzing the Effectiveness of mHealth to Manage Diabetes Mellitus Among Adults Over 50: A Systematic Literature Review](#)

53. Social isolation and loneliness in older adults

Social isolation and loneliness in older adults have been significantly impacted by the COVID-19 pandemic, exacerbating existing health challenges. These conditions are major risk factors linked to poor physical, mental, and cognitive health outcomes, including increased mortality. Various approaches to address these issues include promoting social connections through public health messaging, leveraging family and community resources, and developing technology-based interventions. The distinction between social isolation and loneliness is crucial, with both being influenced by biopsychosocial factors such as psychiatric and medical comorbidities, transitions in care, technology access, and ageism. Protective factors like wisdom and resilience play a role in mitigating these effects. Research highlights the importance of identifying at-risk individuals through standardized assessments and tailored interventions. Studies show that loneliness is strongly associated with depression and poor self-rated health, while social isolation correlates with less social support and greater loneliness. Older adults with smaller social networks and more functional limitations are particularly vulnerable. Information and Communication Technologies (ICTs) offer potential solutions to enhance social connectivity and engagement, emphasizing the need for accessible and user-friendly applications for aging populations.

References

- [Social isolation and loneliness among older adults in the context of COVID-19: a global challenge](#)

- [Social Support, Isolation, Loneliness, and Health Among Older Adults in the PRISM Randomized Controlled Trial](#)

- [Impact of Social Isolation and Loneliness in Older Adults: Current Understanding and Future Directions](#)

54. Chronic disease home-based care practices

Chronic Disease Home-Based Care Practices involve providing medical care to frail older adults and other patients with chronic conditions in their homes, addressing disparities in access and utilization based on sex, race, ethnicity, and geographic location. Between 2011 and 2014, there was a slight increase in the use of home-based medical care (HBMC) among Medicare beneficiaries, with significant variations observed across different demographics and regions. Women and black individuals were more likely to use HBMC, while rural residents and Asians were less likely. The integration of telemedicine and intelligent medical care systems is seen as essential to expanding HBMC, particularly in underserved rural areas. The development of reliable home care assessment scales and the design of supportive physical environments are crucial for enhancing the safety, comfort, and effectiveness of home-based care. These practices aim to meet the complex needs of patients with chronic diseases, ensuring better management and treatment outcomes while addressing the challenges posed by an aging population and limited medical resources.

References

- [Construction and Reliability and Validity Test of Home Care Assessment Scale for Elderly Patients with Chronic Diseases Based on Intelligent Medical Care](#)

- [Use of Home-Based Medical Care and Disparities](#)

- [Impact of Aging: The New Frontier of Healthcare at Home](#)

55. Design guidance for video chat systems

Design Guidance for Video Chat Systems emphasizes the importance of addressing the specific needs and preferences of older adults, including those with Mild Cognitive Impairment (MCI), to enhance the acceptability and usability of these technologies. Utilizing the Technology Acceptance Model, research identified that older adults are open to using video chat systems for social engagement, particularly for conversations about books, health, family, and exercise, with an ideal group size of 3 to 6 people. Key usability issues such as technical terminology, small font size, and confusing icons were identified and addressed to improve the system's design. Additionally, the implementation of a Home Tele-assistance system highlights the necessity of integrating emergency response features for elderly users, ensuring that personal and geographical information can be efficiently communicated to relatives and emergency services. These insights provide valuable guidance for designing video chat systems that are user-friendly and beneficial for social engagement among older adults.

References

- [Design guidance for video chat system to support social engagement for older adults with and without mild cognitive impairment](#)

- [Design guidance for video chat system to support social engagement for older adults with and without mild cognitive impairment](#)

- [Home Tele-assistance System for Elderly or Disabled People in Rural Areas](#)