Springer Proceedings in Business and Economics

Pedro Miguel Gaspar
Juan Manuel Cueva Lovelle
Carlos Mentenegro-Marín
Teresa Guarda *Editors*

Health Technologies and Demographic Challenges

International Conference on Demographic Transition, Health, and Technologies 2025 (ICDTHT25), February 13-14, Salinas, Ecuador, Vol 2

Springer

Springer Proceedings in Business and Economics

Springer Proceedings in Business and Economics brings the most current research presented at conferences and workshops to a global readership. The series features volumes (in electronic and print formats) of selected contributions from conferences in all areas of economics, business, management, and finance. In addition to an overall evaluation by the publisher of the topical interest, scientific quality, and timeliness of each volume, each contribution is refereed to standards comparable to those of leading journals, resulting in authoritative contributions to the respective fields. Springer's production and distribution infrastructure ensures rapid publication and wide circulation of the latest developments in the most compelling and promising areas of research today.

The editorial development of volumes may be managed using Springer Nature's innovative EquinOCS, a proven online conference proceedings submission, management and review system. This system is designed to ensure an efficient timeline for your publication, making Springer Proceedings in Business and Economics the premier series to publish your workshop or conference volume.

This book series is indexed in SCOPUS.

Pedro Miguel Gaspar
Juan Manuel Cueva Lovelle
Carlos Mentenegro-Marín • Teresa Guarda
Editors

Health Technologies and Demographic Challenges

International Conference on Demographic Transition, Health, and Technologies 2025 (ICDTHT25), February 13-14, Salinas, Ecuador, Vol 2

Springer

Editors
Pedro Miguel Gaspar
University of Trás-os-Montes and
Alto Douro
Vila Real, Portugal

Juan Manuel Cueva Lovelle
Departamento de Informática
University of Oviedo
Oviedo, Spain

Carlos Mentenegro-Marín
District University of Bogotá
Bogota, BOGOTA, Colombia

Teresa Guarda
Universidad Estatal Península de Santa
Santa Elena, Ecuador

ISSN 2198-7246 ISSN 2198-7254 (electronic)
Springer Proceedings in Business and Economics
ISBN 978-3-031-94900-5 ISBN 978-3-031-94901-2 (eBook)
https://doi.org/10.1007/978-3-031-94901-2

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2025

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

If disposing of this product, please recycle the paper.

Technology and the Well-Being of the Elderly

Teresa Guarda, Washington Torres, Datzania Villao, José A. M. Victor, and Isabel Lopes

1 Introduction

Technology is constantly evolving at a rapid pace, and it is becoming increasingly integral in the day-to-day activities of many individuals across various age groups. However, its impact is particularly significant for older adults, as it holds remarkable potential to greatly enhance the overall well-being of our aging population. The realm of technology and aging is an intricate and multifaceted one, presenting a multitude of challenges and complexities that must be carefully considered.

As the average life expectancy continues to rise, it is disconcerting to witness a simultaneous decline in the physical and mental health of elderly individuals. Age related ailments, such as dementia and sensory loss, are becoming alarmingly prevalent, posing immense difficulties for seniors. Furthermore, managing one's own

T. Guarda (✉) · W. Torres · D. Villao
Universidad Estatal Península de Santa Elena, La Libertad, Ecuador

J. A. M. Victor
N2i Research Centre, Maia Polytechnic Institute, Maia, Portugal

University of Maia, Maia, Portugal

LIACC - Artificial Intelligence and Computer Science Laboratory, University of Porto, Porto, Portugal
e-mail: javemor@umaia.pt

I. Lopes
Polytechnic Institute of Bragança, Bragança, Portugal
e-mail: isalopes@ipb.pt

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2025

P. M. Gaspar et al. (eds.), *Health Technologies and Demographic Challenges*, Springer Proceedings in Business and Economics,
https://doi.org/10.1007/978-3-031-94901-2_17

health becomes increasingly arduous with age, often creating obstacles that impede safe and effective healthcare management. These challenges further exacerbate the feelings of loneliness and social isolation that seniors often experience due to declining health.

Given the rapidly aging population, it is crucial that we urgently innovate and develop solutions in this domain. By the year 2050, it is predicted that the global population aged 60 or older will exceed a staggering two billion individuals [1]. Therefore, it is imperative that we address the hurdles faced by seniors in adopting and utilizing technology. It is worth noting that this population often finds some of the available technology either challenging or uninteresting, resulting in decreased engagement and benefits.

In conclusion, technology's evolution is an undeniable force that permeates our society, profoundly impacting various aspects of our lives. However, its potential for empowering and improving the lives of older adults is particularly noteworthy. Nevertheless, we must navigate the intricate landscape of technology and aging, taking into consideration the unique challenges faced by this population. By doing so, we can truly leverage technology to address their needs and foster their overall well-being in an increasingly digital world [2–5].

Thus, the aim of this paper is to investigate various methods in which technology could be created, developed, or integrated to assist the elderly. This includes looking at the concept of an 'aging in place' model, remote health monitoring, sensors for the maintenance of home care, and robotics in assisting with the needs of the older adults. It is also important to understand the overall impact of aging and technology, both in terms of its positive and negative aspects.

2 Technological Innovations for Elderly Well-Being

A technological society is integral for facilitating and maintaining smooth social relations and the quality of life for older adults [6]. The elderly have certain needs and limitations, and advanced healthcare and lifestyle technologies can help in serving them [7]. The market for the development and manufacturing of tools for the well-being of the elderly can be categorized based on the following: health monitoring devices, assistive technologies, and social connection platform's.

Health monitoring devices help in keeping a watch on the biological vital signs, which can help in indicating a deteriorating health condition. The sensors and internet-based devices can help the responsible physician or a family member to immediately ring the alarm under such circumstances. Since many elderly people live alone or stay alone for the better part of the day, health monitoring devices are very important. They control the heart rate, respiration rate, temperature, cholesterol level, blood sugar level, and other indicators of wellness [8, 9].

In the case of the assistive technologies, mobility aids are the assisting devices available for helping the elderly to move about. Smart homes are the living environments furnished with sensors and voice activation devices [10].

The desirable characteristics of this technology are that they are personalized, adaptable, easy to use, and acceptable to the end users. Regular users of technology are not well-versed with the technological advancements and do not look for added features as long as they can continue to use their equipment. It is only in some cases that people feel the need to upgrade the technology. The well-being factor keeps changing with the passage of time, and users wish to keep pace with it. Seniors want to stay relevant and engaged in life, and personal smartphones, tablets, and computers are the vehicles to provide this mobility and interaction.

The interaction is possible due to the inbuilt design features that allow the users to interact easily without any technical need to know about the intricacies of the technology. The user-friendly design is scalable and affordable with added security features. Technology-centric devices are important for social interactivity by ICT savvy users. These devices should be custom-designed for the outfit, fashion, or taste of the elderly users, and they should be value-added and user-friendly. The independent and social interactions that enhance well-being are centered around the technology that the elderly are most likely to use. They may unanimously use cellular mobiles, smartphones, tablets, computers, telephonic consultation, and many more. The use of these technologies results in better health management, easier social interaction, and freedom from isolation. Technology reinvigorates the elderly by providing additional facilities and better opportunities to manage health and diseases through the use of technology. Social integration brings about improved confidence in communications as well as reduced anxiety and isolation. With all the facts, we can infer that society is ready for the onset of technological advances for the elderly.

2.1 Health Monitoring Devices

Health monitoring devices are considered yet another vital instrument that can contribute to improving the overall well-being of the aging community. Real-time monitoring of health parameters such as blood oxygen levels, pulse, blood pressure, hydration levels, sugar levels, and body fat can enhance the prevention and control of chronic illnesses, which have become a common health ailment in the aged population. A variety of monitoring devices are found in the market that elderly individuals use for tracking their health in real time [10–12]. These include those in the form of wristbands, smart watches, blood glucose meters, and blood pressure monitoring devices, among others. Blood pressure and glucose meters sharing their readings can also be linked with home automation systems, contributing to several elderly applications [8]. These monitoring devices also function as a considerable stipulation in tracking the vital health conditions of the elderly while traveling solo, particularly in cities where the average age of retirement is sixty. This can contribute to the early identification of medical anomalies that, in turn, allow the individual to consult a medical practitioner in advance [11, 13].

Remote monitoring of patients by healthcare providers is another important practice in developed countries. This enables the provision of services to large numbers of the aging community at their respective residences and reduces the number of visits to the hospital. Regarding personal health management, reports and trends of various wearables are available at different time intervals. Another means of remote monitoring is the sharing of health statistics through available apps or services [13]. The sharing of health parameters such as glucose statistics in real time with healthcare professionals can enable the adoption of preventive measures by consulting various specialists, even if no abnormalities are detected [11]. The introduction of health apps has the potential to offer the same functionality through mobile technology. However, such practices require substantial security considerations, and hence the introduction of technological healthcare solutions should focus on a secure platform. This aspect aids in boosting the confidence levels of the aging community in sharing their personal health records and metrics. Hence, the issue of privacy and data security should be addressed before introducing any such technological healthcare solution. In conclusion, the usage of such assistive apps can significantly contribute to improving the well-being of aged individuals in either a city or in rural areas. Remote patient monitoring in developing nations currently lacks a standardized solution due to the non-availability of relevant wearable devices that provide an enrollment facility.

2.2 Assistive Technologies

Assistive technologies or tools play a significant role in maintaining the quality of life of an aging individual. An assistive technology can be a low-priced item or a sophisticated device depending on the users' conditions in utilizing them. In this section, we discuss various assistive technologies developed to provide assistance to older people or people with disabilities in their daily self-care and household activities [14, 15].

For older people, mobility is a significant component that enables them to do things independently. Some mobility aids include canes, crutches, and walkers. Walkers are available in different types, such as front-wheeled walkers, posterior-wheeled walkers, two-wheeled walkers, and with or without add-ons such as a basket to place items.

Some technological options were also considered to make homes safer for vulnerable persons. Smart home technology can detect activities in the home. This technology provides the installation of remote aid devices, such as lighting, cooking appliances, entertainment systems, home weather, and more. In the market, voice-activated assistance could also be considered. Basic reminder systems to enhance an older individual's memory or cognitive support include a simple medication prescription list and daily events. In terms of technology ease of use, pill boxes help according to individual preferences. This might be counted under mobility aids,

where shower chairs offer support when a user takes a shower. One interesting technology is the use of a wearable panic alarm.

The use of assistive technology is not necessarily always viewed with a medical predisposition, but many older adult users prefer to have a positive view of technologies to allow enhanced safety at home. Some older people who have disabilities do not necessarily need an assistive device to regain control and facilities in their daily lives [16, 17]. However, individuals' needs and requirements to live efficiently and safely are essential points to be considered. The use of an assistive device can help prevent accidents (e.g., stopping falls, opening the door bolt in the event it falls and might be stuck on the opposite side of the house). The use of assistive technology can also promote independence, alleviate the demand for older people with various daily living assistance, and may significantly improve dignity [18, 19].

2.3 Social Connection Platforms

There are a number of online tools and applications available that can help older adults communicate with family, friends, and the community. This includes, but is not limited to, social media platforms; video conferencing tools; and specific social connection products [20, 21]. The importance of maintaining strong social connections across the lifespan is understood to have significant psychological benefits. It is an important factor in improving mental health, life satisfaction, and emotional well-being. There is some evidence that increased social contacts are linked to well-being through the social interaction and support networks that emerge. There is also a positive association between socializing and well-being—getting 'out and about' can be a protective factor concerning the risk of entering or continuing in isolation in older age.

With many social connection tools in the social networking space, some can feel daunting for older individuals who may not have used technology previously. The design of social connection products and services should, in many cases, be straightforward and intuitive, with particular attention to involving older individuals in co-design. The needs of individuals in terms of usability should be considered to ensure contribution to user well-being. The creation of social connection products that offer value upfront is also a critical factor. If older adults can see the use of the product before purchase and understand its value, they are more likely to engage with the product and experience the social benefit. Despite the variation in costs associated with these tools and applications, they offer the prospect of connecting people who may be unable to due to geographic constraints, which can help mitigate loneliness in older age [22, 23].

3 Challenges and Barriers to Technology Adoption

The challenges and barriers vary between user groups, and some barriers revolve around preferences and attitudes. Many of these challenges stem from the digital divide. The digital divide refers to the social and economic disparities in access to, use of, and impact of ICT [24, 25]. Many elderly people in various countries cannot afford either the technology to benefit from public online services or the support services needed to do this. Economic constraints mean that elderly people from low-income families often cannot afford technology or the broadband services that the technology requires. Using more advanced technologies, such as robots, tends to be even more expensive [26, 27]. Thus, poor elderly people are likely to experience the least advantages from technology to sustain autonomy.

Moreover, even among elderly people who can afford technology and the services, there may be practical and cognitive limitations or reluctance. Some elderly feel uncomfortable using modern technology as they consider the internet to be complicated, too large, or time-consuming [16, 26, 28]. The combination of several service channels to reach public services might also be confusing for some elderly, and one reason might be that the elderly are less experienced and feel more insecure in multitasking. Ever-changing technology and design make it difficult for the elderly to keep up with constantly evolving new technology [28, 29]. They fear that they are less able to make use of this technology, and this is experienced as a barrier. Thus, the underlying usability limitations may be prevalent among many elderly users. Furthermore, the elderly believe they are entitled to scrim information, and that their personal data is not to be risked at all. Only targeted education can empower the user. Many elderly consider the internet a hostile and distrustful surrogate community that facilitates large-scale identity theft and invasions of privacy. Finally, many elderly have multimedia advantages, which can hinder the usage of the internet. The disadvantage of multimedia affects much more than just the technical aspects. In fact, web surfing or many advanced facilities have nearly nothing to do with info-seeking or performing practical everyday tasks.

4 Benefits of Technology for Elderly Well-Being

Technology offers numerous benefits for elderly individuals, positively impacting their overall well-being. Remote monitoring solutions and assistive technologies can help the elderly better manage their health and can prompt medical interventions when necessary [14, 30, 31]. Patient self-management, self-monitoring, compliance, and behavioral modifications are improved through the innovative use of technological tools and software. It is also easier for the elderly to schedule medical appointments, request prescription renewals, and access a wide range of medical documentation. Social technologies help keep older individuals connected with family and friends. Moreover, there are endless resources, programs, and courses

for personal development and leisure-time enjoyment available. As a result, the increase in positive emotional and mental health in response to digital technologies is evident. Telecare gadgets also enable the elderly to live independently [32, 33]. The automatic shutoff network helps reduce gas leaks at home. In addition, services like wireless doorbells or a webcam and motion sensors contribute to the safety of the household. Remote monitoring solutions could also help caregivers keep in contact with the elderly as well.

The key to keeping the elderly connected is embracing advances in technology. One way small businesses can assist is by providing the skills and resources that allow the elderly to stay linked by hiring older employees to advise them on the best equipment and services. The Internet Age may be reducing the social isolation of older individuals. Television alone offers a degree of companionship, but communicating via email or through chat rooms really fosters a link [23, 34]. Moreover, when using the devices to connect with a group of individuals, loneliness diminishes. More retirees are studying many new abilities, such as computer skills and online banking. The informal nature of message boards, based on shared interests, often leads to deepening exchanges with strangers online. Moreover, the benefit of email is that it has helped people of the same age remain in touch. Technology can be an elderly buddy, and a set of technologies can be adapted to contribute to the quality of their lives. A laptop for checking and sending emails and storing and processing photos can be useful [23, 31].

5 Conclusions

The last years saw an increased interest in technology acceptance among older adults and the aging in place paradigm. Although there are many obstacles to overcome, there are also promising technologies that help elderly people maintain their well-being and ideal lifestyles for as long as possible. In this review, we investigated the influence of technology on the well-being of elderly people. Improvements in technology are useful to increase social interactions and reduce feelings of loneliness and isolation. Benefits related to simply having support were also noted. Tools that help older people monitor their health and obtain remote medical advice can also serve as effective electronic caregivers. There is also increasing evidence that technology can contribute to the increased resilience of older adults. This is because technology can play a supporting role in assisting the elderly in their everyday activities and continuing to maintain physical and social activities. Finally, several studies have shown that technology has a positive impact on subjective well-being by creating a sense of positivity, peace of mind, and comfort. The benefits of technology cannot be denied, but there are still many challenges to overcome, especially regarding the use of technology by elderly people who are less interested and passionate about technological devices. Our literature review on the impact of technology on the well-being of elderly people has shown that technological advancements can positively impact human life in many ways. Future research should focus on

reducing the digital divide, not only in using technology but also in developing technology that is accessible and usable for all older adults. Policy initiatives need to be aimed at promoting the use of innovative technological initiatives. In addition, further control studies should be performed to provide more solid evidence in this matter. Finally, family members and caregivers have an important role to play not only in promoting technology but also in the approach. The research into our health and well-being is just beginning. To make it realistic and applicable, it is critical that we focus on the specific requirements and wishes of elderly individuals and that several different players work together, that is, engineers, designers, and the elderly themselves, with the help of caregivers. The results of this research did highlight how we are indeed moving toward a technological ecosystem that takes the specific needs of users into account, including elderly adults, and that targets specific aims that enable holding on to good-quality and comfortable living, the relationship with their loved ones, and effective age management. In addition, people are increasingly aware of the impact that technology can have in shaping a society in which we can all grow older. This was evident in our review, which showed that a number of researchers turned their attention and research efforts toward investigating the psychological and social benefits of technological use in old age specifically, what aspects of the "older self" and their elements are amenable to promotion or well-being and are suitable for intervention in late life.

References

1. Yin, K., Zhao, X., Liu, Y., Zhu, J., & Fei, X. (2024). Aging increases global annual food greenhouse gas emissions up to 300 million tonnes by 2100. *Environmental Science & Technology, 58*(13), 5784–5795. https://doi.org/10.1021/acs.est.3c06268
2. Bailey, L., Ward, M., DiCosimo, A., Baunta, S., Cunningham, C., Romero-Ortuno, R., Kenny, R. A., Purcell, R., Lannon, R., McCarroll, K., Nee, R., Robinson, D., Lavan, A., & Briggs, R. (2021). Physical and mental health of older people while cocooning during the COVID-19 pandemic. *QJM: An International Journal of Medicine, 114*(9), 648–653. https://doi.org/10.1093/qjmed/hcab015
3. Creese, B., Khan, Z., Henley, W., O'Dwyer, S., Corbett, A., Da Silva, M. V., & Ballard, C. (2021). Loneliness, physical activity, and mental health during COVID-19: a longitudinal analysis of depression and anxiety in adults over the age of 50 between 2015 and 2020. *International Psychogeriatrics, 33*(5), 505–514. https://doi.org/10.1017/S1041610220004135
4. Belkacem, A. N., Jamil, N., Palmer, J. A., Ouhbi, S., & Chen, C. (2020). Brain computer interfaces for improving the quality of life of older adults and elderly patients. *Frontiers in Neuroscience, 14*(692), 1–11. https://doi.org/10.3389/fnins.2020.00692
5. Grinin, L., Grinin, A., & Korotayev, A. (2023). Global aging: An integral problem of the future. How to turn a problem into a development driver? In V. Sadovnichy, A. Akaev, I. Ilyin, S. Malkov, L. Grinin, & A. Korotayev (Eds.), *Reconsidering the limits to growth: A report to the Russian association of the club of Rome* (pp. 117–135). Springer. https://doi.org/10.1007/978-3-031-34999-7_7
6. Grossi, G., Lanzarotti, R., Napoletano, P., Noceti, N., & Odone, F. (2020). Positive technology for elderly well-being: A review. *Pattern Recognition Letters, 137*, 61–70. https://doi.org/10.1016/j.patrec.2019.03.016

7. Morato, J., Sanchez-Cuadrado, S., Iglesias, A., Campillo, A., & Fernández-Panadero, C. (2021). Sustainable technologies for older adults. *Sustainability, 13*(15), 1–35. https://doi.org/10.3390/su13158465. MDPI, Ed.
8. Olmedo-Aguirre, J. O., Reyes-Campos, J., Alor-Hernandez, G., Machorro-Cano, I., Rodriguez-Mazahua, L., & Sanchez-Cervantes, J. L. (2022). Remote healthcare for elderly people using wearables: A review. *Biosensors, 12*(2), 1–31, 73. https://doi.org/10.3390/bios12020073
9. Javaid, M., Haleem, A., Rab, S., Singh, R. P., & Suman, R. (2021). Sensors for daily life: A review. *Sensors International, 2*, 1–10. https://doi.org/10.1016/j.sintl.2021.100121
10. Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2022). Medical 4.0 technologies for healthcare: Features, capabilities, and applications. *Internet of Things and Cyber-Physical Systems, 2*, 12–30. https://doi.org/10.1016/j.iotcps.2022.04.001
11. Papa, A., Mital, M., Pisano, P., & Giudice, D. (2020). E-health and wellbeing monitoring using smart healthcare devices: An empirical investigation. *Technological Forecasting and Social Change, 153*, 1–23. http://hdl.handle.net/2318/1663412
12. Kashani, M. H., Madanipour, M., Nikravan, M., Asghari, P., & Mahdipour, E. (2021). A systematic review of IoT in healthcare: Applications, techniques. *Journal of Network and Computer Application, 192*, 1–41. https://doi.org/10.1016/j.jnca.2021.103164
13. Lu, L., Zhang, J., Xie, Y., Gao, F., Xu, S., Wu, X., & Ye, Z. (2020). Wearable health devices in health care: narrative systematic review. *JMIR mHealth and uHealth, 8*(11), e18907. https://doi.org/10.2196/18907
14. Cicirelli, G., Marani, R., Petitti, A., Milella, A., & D'Orazio, T. (2021). Ambient assisted living: a review of technologies, methodologies and future perspectives for healthy aging of population. *Sensors, 21*(10), 1–22. https://doi.org/10.3390/s21103549
15. Ashfaq, Z., Rafay, A., Mumtaz, R., Zaidi, S. M., Saleem, H., Zaidi, S. A., & Haque. (2022). A review of enabling technologies for Internet of Medical Things (IoMT) ecosystem. *Ain Shams Engineering Journal, 13*(4), 1–19. https://doi.org/10.1016/j.asej.2021.101660
16. Ghorayeb, A., Comber, R., & Gooberman-Hill, R. (2021). Older adults' perspectives of smart home technology: Are we developing the technology that older people want? *International Journal of Human-Computer Studies, 147*, 1–13. https://doi.org/10.1016/j.ijhcs.2020.102571
17. Pirzada, P., Wilde, A., Doherty, G. H., & Harris-Birtill, D. (2022). Ethics and acceptance of smart homes for older adults. *Informatics for Health and Social Care, 47*(1), 10–37. https://doi.org/10.1080/17538157.2021.1923500
18. Albarqi, M. N. (2024). Exploring the effectiveness of technology-assisted interventions for promoting independence in elderly patients: A systematic review. *Healthcare, 12*(21), 1–20. https://doi.org/10.3390/healthcare12212105
19. André, M., Enez, J., Charras, K., Besançon, M., & Delouvée, S. (2024). Autonomy, independence, and participation of nursing home habitants addressed by assistive technology: a scoping review. *Disability and Rehabilitation: Assistive Technology*, 1–13. https://doi.org/10.1080/17483107.2024.2359472
20. Haase, K. R., Cosco, T., Kervin, L., Riadi, I., & O'Connell, M. E. (2021). Older adults' experiences with using technology for socialization during the COVID-19 pandemic: Cross-sectional survey study. *JMIR Aging, 4*(2), e28010. https://doi.org/10.2196/28010
21. Brown, G., & Greenfield, P. M. (2021). Staying connected during stay-at-home: Communication with family and friends and its association with well-being. *Human Behavior and Emerging Technologies, 3*(1), 147–156. https://doi.org/10.1002/hbe2.246
22. Hoang, P., King, J. A., Moore, S., Moore, K., Reich, K., Sidhu, H., & McMillan, J. (2022). Interventions associated with reduced loneliness and social isolation in older adults: a systematic review and meta-analysis. *JAMA Network Open, 5*(10), 1–20. https://doi.org/10.1001/jamanetworkopen.2022.36676
23. Sen, K., Prybutok, G., & Prybutok, V. (2022). The use of digital technology for social wellbeing reduces social isolation in older adults: A systematic review. *SSM-Population Health, 17*(2022), 1–9. https://doi.org/10.1016/j.ssmph.2021.101020

24. Tewathia, N., Kamath, A., & Ilavarasan, P. V. (2020). Social inequalities, fundamental inequities, and recurring of the digital divide: Insights from India. *Technology in Society, 61*, 1–11. https://doi.org/10.1016/j.techsoc.2020.101251
25. Murthy, K. V., Kalsie, A., & Shankar, R. (2021). Digital economy in a global perspective: Is there a digital divide? *Transnational Corporations Review, 13*(1), 1–15. https://doi.org/10.1080/19186444.2020.1871257
26. Verloo, H., Kampel, T., Vidal, N., & Pereira, F. (2020). Perceptions about technologies that help community-dwelling older adults remain at home: qualitative study. *Journal of Medical Internet Research, 22*(6), 1–17. https://doi.org/10.2196/17930
27. Kalicki, A. V., Moody, K. A., Franzosa, E., Gliatto, P. M., & Ornstein, K. A. (2021). Barriers to telehealth access among homebound older adults. *Journal of the American Geriatrics Society, 69*(9), 2404–2411. https://doi.org/10.1111/jgs.17163
28. Karaoglu, G., Hargittai, E., Hunsaker, A., & Nguyen, M. H. (2021). Changing technologies, changing lives: older adults' perspectives on the benefits of using new technologies. *International Journal of Communication, 15*, 3887–3907. https://doi.org/10.5167/uzh-207350
29. Mubarak, F., & Suomi, R. (2022). Elderly forgotten? Digital exclusion in the information age and the rising grey digital divide. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 59*, 1–7. https://doi.org/10.1177/00469580221096272
30. Yousaf, K., Mehmood, Z., Awan, I. A., Saba, T., Alharbey, R., Qadah, T., & Alrige, M. A. (2020). A comprehensive study of mobile-health based assistive technology for the healthcare of dementia and Alzheimer's disease (AD). *Health Care Management Science, 23*, 287–309. https://doi.org/10.1007/s10729-019-09486-0
31. Ollevier, A., Aguiar, G., Palomino, M., & Simpelaere, I. S. (2020). How can technology support ageing in place in healthy older adults? A systematic review. *Public Health Reviews, 41*(26), 1–12. https://doi.org/10.1186/s40985-020-00143-4
32. Moore, R. C., & Hancock, J. T. (2020). Older adults, social technologies, and the coronavirus pandemic: Challenges, strengths, and strategies for support. *Social Media+ Society, 6*(3), 1–5. https://doi.org/10.1177/2056305120948162
33. Ibarra, F., Baez, M., Cernuzzi, L., & Casati, F. (2020). A systematic review on technology-supported interventions to improve old-age social wellbeing: Loneliness, social isolation, and connectedness. *Journal of Healthcare Engineering, 2020*, 1–14. https://doi.org/10.1155/2020/2036842
34. Balki, E., Hayes, N., & Holland, C. (2022). Effectiveness of technology interventions in addressing social isolation, connectedness, and loneliness in older adults: systematic umbrella review. *JMIR Aging, 5*(4), 1–20. https://doi.org/10.2196/40125