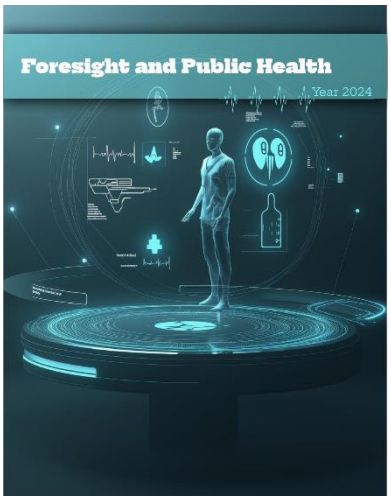
Volume 2, Issue 1, pp 11-20
Article history:
Received 21 November 2024
Revised 14 December 2024
Accepted 24 December 2024
Published online 01 January 2025

Article type:
Original Research



Smart Cities for Aging Populations: Future Trends in Age-Friendly Public Health Policies

Yoko. Wong[1], Xian Seng. Neo[1*]

1 Faculty of Humanities, Department of Psychology, Nanyang Technological University, Nanyang, Singapore

Corresponding author email address: xianseng.neo@ntu.edu.sg

How to cite this article:
Wong, Y., & Neo, X. S. (2025). Smart Cities for Aging Populations: Future Trends in Age-Friendly Public Health Policies. Foresight and Public Health, 2(1), 11-20. https://doi.org/10.61838/jfph.2.1.2

© 2025 the authors. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

ABSTRACT

This study explores the role of smart cities in promoting age-friendly public health policies. A qualitative research design was employed, utilizing semi-structured interviews and a comprehensive review of scientific literature to examine emerging trends in age-friendly urban policies. The study sample consisted of 29 participants recruited from online communities, with data collection reaching theoretical saturation. Thematic analysis was conducted using NVivo software, identifying key patterns across healthcare accessibility, social engagement, mobility, urban planning, and policy development. The results highlight six major themes essential to age-friendly smart cities. Digital health technologies, such as telemedicine and AI-driven diagnostics, were found to improve healthcare accessibility but raised concerns over data privacy and digital literacy gaps. Social inclusion and community engagement initiatives were recognized as crucial in reducing isolation and promoting civic participation. Mobility solutions, including pedestrian-friendly infrastructure and AI-powered transportation, were valued but often hindered by technological accessibility barriers. Urban planning and smart infrastructure were seen as necessary for ensuring accessible housing and public spaces, while preventive healthcare programs were identified as vital but underdeveloped. Policy and governance emerged as key factors in ensuring ethical and inclusive smart city strategies, particularly in data security and public-private collaborations. The study underscores the importance of integrating digital innovations with human-centered policies to ensure smart cities are truly inclusive of aging populations. Addressing technological barriers, enhancing digital literacy, and prioritizing community engagement will be critical in fostering sustainable and health-conscious urban environments for older adults.

Keywords: Smart cities, aging population, public health policies, digital health technologies, mobility solutions, social inclusion, urban planning, governance frameworks, AI in healthcare, age-friendly infrastructure.

Introduction

The rapid urbanization of global populations has necessitated a shift in public health strategies, particularly concerning the aging demographic. With cities becoming increasingly dense and technologically driven, ensuring that they remain inclusive and supportive of older adults is a growing challenge. The concept of smart cities has emerged as a promising framework that integrates digital innovations, data-driven governance, and intelligent infrastructure to enhance the quality of life for residents. However, the successful implementation of age-friendly public health policies

within these smart urban environments remains a critical concern. As populations age, public health systems must not only focus on disease prevention and medical interventions but also prioritize social inclusion, mobility, and digital accessibility for older citizens (Grum, 2024).

Demographic shifts indicate that by 2050, the proportion of people over 60 years old will nearly double, reaching 22% of the global population (Kandel, 2024). This transformation poses significant public health challenges, requiring governments and urban planners to rethink conventional health services and adopt more inclusive strategies. The World Health Organization (WHO) has emphasized the necessity of integrating age-friendly policies into smart city frameworks to address key concerns such as accessibility, healthcare, and social participation (Cardoso et al., 2024). However, despite these initiatives, many cities struggle with implementation due to financial constraints, resistance to policy change, and digital literacy gaps among older adults (Kent, 2023).

One of the core aspects of smart cities is the use of artificial intelligence (AI) and the Internet of Things (IoT) in healthcare services, which enable telemedicine, remote monitoring, and predictive analytics for disease management (Kim et al., 2024). These innovations have the potential to reduce hospital visits, enhance patient autonomy, and improve chronic disease management. However, digital health initiatives are often met with skepticism from aging populations due to data privacy concerns and technological unfamiliarity (Daniore, 2024). Studies have shown that while digital health interventions improve accessibility, they can also deepen health disparities if older adults lack the skills to navigate these technologies effectively (Alasadi, 2023).

Beyond healthcare, mobility and urban planning play an equally significant role in fostering age-friendly cities. Accessible public transport systems, pedestrian-friendly infrastructure, and AI-driven navigation tools have been identified as critical components in ensuring that aging individuals maintain independence and social engagement (Grum, 2024). However, research highlights that many urban spaces remain physically inaccessible to seniors, creating barriers to daily activities (Landqvist, 2024). Additionally, while smart cities advocate for the integration of autonomous vehicles and ride-sharing services, studies indicate that older populations often face digital exclusion, making it difficult for them to adopt these new modes of transportation (Goldsobel et al., 2021).

The social dimensions of aging in smart cities also demand attention. With increasing urbanization, many older adults experience social isolation, exacerbated by digital divides and declining community interactions (Graffigna et al., 2021). Smart cities must implement policies that prioritize intergenerational programs, community-driven initiatives, and mental health support services to counteract these issues (Rosas et al., 2022). Research suggests that online social networks for seniors and community engagement platforms can be highly effective in reducing loneliness and increasing civic participation (Sousa et al., 2022). However, the success of such initiatives depends on the willingness of local governments to invest in digital literacy programs that cater specifically to older citizens (Standerfer et al., 2022).

Governance and policy frameworks also play a fundamental role in shaping age-friendly smart cities. Effective data management policies, public-private partnerships, and regulatory frameworks are essential in ensuring that smart city innovations are implemented ethically and inclusively (Siddiqi et al., 2023). One of the major criticisms of smart city policies is their reliance on data collection and surveillance, which can lead to concerns regarding privacy and data security (Daniore, 2024). Research indicates that many older adults are hesitant to engage with smart city technologies due to fears of data misuse and lack of transparency in AI-driven decision-making (Kim et al., 2024). Therefore, creating trustworthy health data spaces is a crucial step in improving citizen engagement and ensuring the successful adoption of smart technologies in aging populations (Naughton et al., 2024).

The impact of public health crises, such as the COVID-19 pandemic, has further underscored the necessity of integrating digital health solutions into urban planning. Studies demonstrate that cities with well-established telehealth services, digital health records, and remote monitoring systems were better equipped to manage the pandemic's challenges and ensure continuity of care for older adults (Kembo & Bothma, 2023). The pandemic also highlighted the importance of public health engagement and citizen participation in emergency preparedness, as evidenced by the increased role of citizen science initiatives in tracking and responding to health threats (Feng, 2024; Siddiqi et al., 2023). These findings suggest that age-friendly public health policies must not only focus on daily healthcare accessibility but

also incorporate disaster preparedness strategies that account for the unique vulnerabilities of older populations (Saran, 2024).

Despite the promising advancements in smart city infrastructure, there remain significant barriers to widespread adoption of age-friendly policies. Financial constraints, bureaucratic inefficiencies, and inter-agency coordination challenges have hindered the successful implementation of smart health initiatives (Smith et al., 2022). Moreover, disparities in digital literacy continue to be a major obstacle, with many seniors lacking the necessary skills to navigate telemedicine services, mobile health applications, and AI-driven healthcare systems (Uzuegbunam, 2025). Policymakers must recognize that the digital transformation of public health should not exacerbate inequalities but rather aim to bridge the gap between technological advancements and user accessibility (Kolyvanova & Strygin, 2021).

In conclusion, the future of smart cities for aging populations relies on the successful integration of age-friendly public health policies that prioritize accessibility, digital inclusivity, and ethical governance. While AI, IoT, and telemedicine hold significant potential to enhance healthcare services, these innovations must be implemented alongside comprehensive social, mobility, and policy interventions that address the unique challenges faced by older adults (Kim et al., 2024). Cities that fail to adapt their infrastructures and public health frameworks to accommodate aging populations risk deepening health inequalities and marginalizing a significant segment of their residents (Graffigna et al., 2021). As urban environments continue to evolve, governments and policymakers must ensure that smart city initiatives are designed for all generations, fostering inclusive, sustainable, and health-focused urban futures (Grum, 2024). Through thematic analysis, the study aims to provide actionable recommendations that can inform policymakers, urban planners, and healthcare professionals in designing more inclusive and health-conscious smart cities for the future. Hence, this study explores the role of smart cities in promoting age-friendly public health policies

Methods and Materials

Study Design and Participants

This study follows a qualitative research design to explore future trends in age-friendly public health policies within the context of smart cities. The research focuses on identifying key themes and strategies that contribute to the development of inclusive urban environments that accommodate aging populations. Given the complexity of this topic, a thematic analysis approach was chosen to extract meaningful insights from participant experiences and existing literature.

The study sample consists of twenty-nine participants recruited from various online communities. These participants were selected based on their familiarity with aging-related urban policies, public health initiatives, and digital health infrastructure. Their diverse backgrounds provided a comprehensive understanding of the challenges and opportunities in designing smart cities that are inclusive of older adults. Theoretical saturation was reached when no new themes emerged from the collected data, ensuring that the analysis captured a well-rounded perspective on the topic.

Data Collection

Data collection was carried out through semi-structured interviews and a thorough review of relevant scientific articles. The semi-structured interviews allowed participants to express their thoughts on various aspects of age-friendly public health policies, including digital health technologies, social inclusion efforts, mobility solutions, and urban planning strategies. The interview guide was designed to encourage open-ended discussions, providing deeper insights into both the limitations and benefits of current smart city initiatives. In addition to the interviews, scientific articles were analyzed to contextualize the qualitative findings within broader theoretical and empirical frameworks. The literature review focused on studies that examined the integration of smart technologies into public health policies and urban development plans aimed at supporting aging populations.

Data analysis

Data analysis was conducted using NVivo software to systematically code and categorize the collected information. A thematic analysis approach was applied, beginning with open coding to identify recurring patterns in the data. Axial coding was then used to establish connections between emerging themes, allowing for a more structured understanding of the factors influencing age-friendly smart city policies. Finally, selective coding refined the findings into core themes that highlight the most significant trends and challenges in this area. The combination of participant perspectives and scientific literature provided a comprehensive foundation for understanding how smart cities can evolve to better support aging populations through innovative public health strategies.

Findings and Results

The demographic characteristics of the participants in this study reflect a diverse group of older adults engaged in discussions about smart cities and age-friendly public health policies. The sample consisted of 29 participants, with an age range between 60 and 85 years. The majority of participants (n=17) were between the ages of 65 and 75, while 8 participants were aged 76 and above, and 4 were between 60 and 64 years old. In terms of gender distribution, 16 participants identified as female and 13 as male. The educational background of the participants varied, with 12 individuals holding a university degree, 9 participants having completed secondary education, and 8 having primary-level education or below. Regarding living arrangements, 19 participants lived independently, while 10 lived with family members or in assisted living facilities. Additionally, 21 participants reported using digital technologies such as smartphones, smart home devices, or wearable health monitors, while 8 individuals stated they had limited or no experience with digital tools. The diversity in age, education, and technological familiarity provided a comprehensive range of perspectives on the accessibility and effectiveness of smart city initiatives for aging populations.

Table 1

The Results of Thematic Analysis

Category	Subcategory	Concepts
Digital Health Technologies	Telemedicine and Remote Care	Virtual doctor visits, teleconsultation platforms, digital prescriptions
	Wearable Health Monitoring	Heart rate monitoring, fall detection, sleep tracking, glucose monitoring
	AI-driven Diagnostics	AI-assisted diagnostics, predictive analytics, automated screening tools
	Health Data Security	Data encryption, privacy laws, cybersecurity measures
	Digital Literacy for Seniors	Senior-focused tech education, user-friendly app design, accessibility training
Social Inclusion and Community Engagement	Intergenerational Programs	Senior-youth mentorship, community storytelling, shared activity programs
	Online Social Networks for Seniors	Social media for elderly, online support groups, virtual events
	Accessible Public Spaces	Wheelchair-friendly pathways, accessibility in parks, senior-friendly benches
	Mental Health Support Initiatives	Counseling services, stress management workshops, peer support groups
	Volunteer and Engagement Programs	Community volunteering, senior employment programs, social clubs
	Cultural and Recreational Activities	Music therapy sessions, arts and crafts workshops, senior dance classes
Mobility and Transportation	Smart Public Transport	Real-time scheduling, smart bus stops, voice-assisted ticketing
	Pedestrian-friendly Infrastructure	Wider sidewalks, barrier-free crossings, tactile paving
	Autonomous Vehicles for Seniors	Senior-exclusive ride services, AI-driven mobility solutions, safety features
	Affordable Transport Solutions	Subsidized transport, free shuttle services, senior discounts
	Real-time Navigation Assistance	GPS-enabled mobility aids, real-time navigation apps, voice-guided routes
	Accessible Ride-sharing Services	On-demand transportation services, affordable ride-sharing platforms
Urban Planning and Smart Infrastructure	Age-friendly Housing	Accessible elevators, wide doorways, adjustable countertops
	Smart Home Adaptations	Motion-sensing lighting, smart home alarms, voice-controlled devices
	Public Park Accessibility	Wheelchair-accessible paths, shaded seating, senior-friendly exercise zones
	Multi-functional Community Spaces	Community gardens, multipurpose halls, intergenerational centers
	Green and Sustainable Urban Design	Eco-friendly materials, solar-powered facilities, urban green spaces
Public Health and Preventive Care	Preventive Health Programs	Regular health checkups, fitness screenings, wellness workshops
	Chronic Disease Management	Telemonitoring for chronic conditions, integrated healthcare networks

	Mental Well-being Initiatives	Mindfulness training, senior peer counseling, resilience-building activities
	Nutrition and Lifestyle Guidance	Balanced diet planning, healthy aging programs, dietary workshops
	Vaccination and Immunization Campaigns	Mass vaccination drives, flu shot campaigns, COVID-19 booster outreach
	Home-based Healthcare Services	Mobile health units, home nurse services, remote patient monitoring
Policy and Governance	Regulatory Frameworks for Smart Cities	Legal guidelines for urban aging, regulatory compliance, ethical AI policies
	Data Privacy Regulations	Secure data access, consent management, AI transparency rules
	Public-Private Partnerships	Government-industry collaborations, funding models, innovation grants
	Global Best Practices Implementation	Global aging policies, smart city benchmarking, international partnerships
	Stakeholder Engagement in Policy Development	Citizen participation in policymaking, public feedback mechanisms, advocacy groups

The findings of this study are categorized into six main themes that encapsulate the essential elements of age-friendly smart city policies. Each theme is broken down into various subcategories, reflecting key areas of development and concern for aging populations in urban environments. The integration of participant quotations further enriches the insights, providing first-hand perspectives on the lived experiences and expectations of older adults regarding smart cities.

Digital Health Technologies

Telemedicine and remote care have emerged as vital solutions in ensuring accessible healthcare for older adults within smart cities. Participants highlighted the convenience of virtual doctor visits, teleconsultation platforms, and digital prescriptions as critical to maintaining their health. One participant noted, *"I no longer have to travel to the clinic for minor issues. My doctor can see me online and send my prescription directly to the pharmacy."*

Wearable health monitoring devices have significantly contributed to proactive healthcare by enabling real-time tracking of heart rate, sleep patterns, glucose levels, and fall detection. Many participants appreciated the ability of such devices to provide peace of mind for both seniors and their families. One participant shared, *"My smartwatch notifies my daughter if my heart rate drops too low. It makes me feel safer living alone."*

Artificial intelligence-driven diagnostics were seen as transformative in early disease detection and personalized treatment planning. Automated screening tools and predictive analytics have helped older adults receive timely medical interventions. One respondent remarked, *"AI can detect health risks I might not even notice myself. It feels like having a doctor on my wrist."*

Health data security emerged as a major concern, with participants emphasizing the need for robust encryption, privacy regulations, and cybersecurity measures. Several interviewees expressed fears about data breaches and unauthorized access to their medical records. As one individual stated, *"I'm worried that my health data might be misused. If smart cities collect my medical information, they must ensure it stays private."*

Digital literacy for seniors was repeatedly identified as a barrier to utilizing smart healthcare services. Many participants highlighted the importance of user-friendly app designs and accessibility training programs. One interviewee stated, *"I want to use technology for my health, but sometimes it feels too complicated. We need better training for older people."*

Social Inclusion and Community Engagement

Intergenerational programs have been recognized as essential for fostering meaningful social interactions between older and younger generations. Programs such as senior-youth mentorship and community storytelling were viewed as effective ways to bridge generational gaps. A participant noted, *"Spending time with young people gives me energy. We learn from each other and build a better community."*

Online social networks for seniors have played a crucial role in reducing isolation and fostering virtual connections. Many participants mentioned the value of online support groups, social media platforms, and virtual events. One respondent expressed, *"I never thought I would make friends online at my age, but these platforms help me stay connected."*

Accessible public spaces, including wheelchair-friendly pathways, senior-friendly benches, and well-maintained parks, were frequently mentioned as crucial for mobility and social engagement. One interviewee emphasized, *"I avoid places that don't have proper seating or accessible paths. It's frustrating when the city is not designed for us."*

Mental health support initiatives tailored to older adults were considered necessary, particularly in the wake of increased loneliness and stress. Participants valued peer support groups, counseling services, and stress management workshops. As one person shared, *"I joined a senior support group online, and it has made such a difference. Talking to people who understand my struggles is comforting."*

Volunteer and engagement programs were highlighted as effective in keeping older adults active and socially involved. Community volunteering and senior employment programs were seen as beneficial not just for individuals but for society as a whole. A participant stated, *"I feel useful when I volunteer. Just because we are older doesn't mean we should stop contributing."*

Cultural and recreational activities, including arts and crafts workshops, music therapy sessions, and dance classes, were found to improve well-being and socialization. One interviewee remarked, *"I love our dance classes. They keep me moving and give me something to look forward to every week."*

Mobility and Transportation

Smart public transport systems that include real-time scheduling, smart bus stops, and voice-assisted ticketing were viewed as essential for ensuring independent mobility. Participants appreciated features that helped them navigate public transport without relying on others. One individual shared, *"Knowing exactly when my bus arrives through an app makes me feel more confident to go out."*

Pedestrian-friendly infrastructure, such as barrier-free crossings, wider sidewalks, and tactile paving, was mentioned as a necessity for safe mobility. Many older adults expressed concerns about poorly designed urban spaces. One participant stated, *"Sometimes I avoid going out because the sidewalks are too narrow, and I'm afraid of falling."*

Autonomous vehicles for seniors were discussed as a promising future solution for mobility challenges. AI-driven transportation solutions, including self-driving cars with safety features for older adults, were considered highly beneficial. A respondent remarked, *"If self-driving cars can help us remain independent, I'd be happy to use them."*

Affordable transport solutions, including subsidized transport and senior discounts, were widely supported. Participants stressed the need for cost-effective mobility options tailored to older adults. As one interviewee put it, *"Public transport should be more affordable for us. Many seniors live on fixed incomes."*

Real-time navigation assistance tools, such as GPS-enabled mobility aids and voice-guided routes, were seen as beneficial for seniors with mobility impairments. One individual shared, *"I love my navigation app. It helps me find the easiest and safest way to get around."*

Urban Planning and Smart Infrastructure

Age-friendly housing, including accessible elevators, wide doorways, and adjustable countertops, was seen as crucial in enabling older adults to live independently. Many participants emphasized the need for urban housing to be designed with aging in mind. One respondent stated, *"My apartment was not built for someone my age. I wish more homes were designed with seniors in mind."*

Smart home adaptations, including motion-sensing lighting, voice-controlled devices, and smart alarms, were viewed as essential in enhancing safety. A participant noted, *"I feel safer knowing my home can alert me if something goes wrong."*

Public park accessibility, such as shaded seating areas and senior-friendly exercise zones, was frequently mentioned. Many participants expressed a desire for more outdoor spaces designed to accommodate older adults. One interviewee said, *"We need parks where we can safely walk and rest. Green spaces are important for our mental health."*

Multi-functional community spaces that support intergenerational interactions and community engagement were emphasized. A participant highlighted, *"We need spaces where different generations can come together. It makes the city feel more like home."*

Green and sustainable urban design, incorporating eco-friendly materials and solar-powered facilities, was seen as beneficial for both older adults and society at large. A respondent remarked, *"Smart cities should also be green cities. Sustainability matters for all generations."*

Public Health and Preventive Care

Preventive health programs that offer regular checkups and wellness workshops were highly valued by older adults. A participant shared, *"I prefer prevention over treatment. Regular screenings keep me healthy."*

Chronic disease management through telemonitoring and integrated healthcare networks was seen as essential. One interviewee stated, *"Having remote monitoring helps me manage my condition without frequent hospital visits."*

Mental well-being initiatives, including mindfulness training and senior peer counseling, were emphasized. A respondent noted, *"Mental health is just as important as physical health. We need more resources to support us."*

Policy and Governance

Strong regulatory frameworks for smart cities that address ethical AI policies and data privacy regulations were seen as necessary. A participant stated, *"I want technology to help, not invade my privacy."*

Stakeholder engagement in policy development was seen as crucial. Many participants emphasized the need for older adults to have a say in shaping smart city initiatives. One respondent shared, *"We should be included in decisions that affect our future. Our voices matter."*

Discussion and Conclusion

The findings of this study highlight the essential role of age-friendly public health policies in shaping smart cities that are inclusive of older populations. Through thematic analysis, six major categories emerged: digital health technologies, social inclusion and community engagement, mobility and transportation, urban planning and smart infrastructure, public health and preventive care, and policy and governance. The results indicate that while technological advancements offer significant potential to improve healthcare, mobility, and social engagement for aging populations, the successful implementation of these strategies remains contingent on accessibility, trust, and policy support.

One of the key findings relates to the growing reliance on digital health technologies, such as telemedicine, wearable health monitors, and AI-driven diagnostics, to improve healthcare access and disease management for older adults. Participants expressed appreciation for the convenience and autonomy that digital health solutions provide, particularly in reducing the need for physical hospital visits and improving real-time health monitoring. This aligns with existing research indicating that telemedicine and AI-assisted diagnostics enhance healthcare accessibility and promote preventive care (Kim et al., 2024). However, concerns regarding digital literacy and data security were frequently mentioned, with many older adults hesitant to adopt these technologies due to a lack of familiarity or fears of privacy breaches. Similar challenges have been reported in previous studies, where older individuals demonstrated lower adoption rates of digital health tools due to usability concerns and cybersecurity risks (Daniore, 2024). Addressing these barriers requires targeted digital literacy programs and stronger regulatory frameworks to ensure data protection and user confidence (Kent, 2023).

The role of social inclusion and community engagement in smart cities was another significant finding. Participants emphasized the importance of intergenerational programs, online social networks, and community-driven initiatives in reducing social isolation and promoting civic participation among older adults. Previous research confirms that loneliness and social disengagement are among the most pressing concerns for aging populations, with digital exclusion further exacerbating these issues (Graffigna et al., 2021). Several studies suggest that integrating community-based programs and digital communication platforms can significantly enhance the well-being of seniors by fostering social connections and increasing participation in local governance (Rosas et al., 2022). However, as this study found, the effectiveness of such programs depends on the willingness of older adults to engage with digital tools and their ability to navigate online platforms (Sousa et al., 2022). Ensuring that community engagement programs are accessible both digitally and physically is critical to overcoming this challenge.

Findings also indicate that mobility and transportation systems in smart cities must be designed with aging populations in mind. Participants expressed strong support for pedestrian-friendly infrastructure, accessible public transport, and AI-driven mobility solutions, particularly in enhancing their independence. This finding aligns with research demonstrating that urban mobility plays a significant role in determining the quality of life for older adults (Landqvist, 2024). However, the results also highlight that many smart city initiatives rely heavily on digital ride-sharing services and app-based mobility solutions, which can be inaccessible to older individuals with limited technological proficiency (Goldsobel et al., 2021). Similar findings have been reported in previous studies, where older adults faced

barriers in using ride-hailing services due to the complexity of mobile applications and a lack of user-friendly interfaces (Grum, 2024). Ensuring that public transportation systems remain both technologically advanced and easily accessible will be crucial in designing inclusive smart city frameworks.

The results also emphasize the importance of urban planning and smart infrastructure in creating age-friendly cities. Participants highlighted the need for accessible housing, public park adaptations, and sustainable urban spaces to enhance livability for older adults. These findings correspond with previous research indicating that well-designed housing and urban infrastructure contribute significantly to the well-being and independence of aging populations (Kandel, 2024). Smart home technologies, such as motion-sensing lighting and voice-controlled devices, were perceived as beneficial but underutilized due to affordability concerns and a lack of technical awareness. This is consistent with studies that have shown cost and digital illiteracy as primary barriers to smart home adoption among seniors (Kim et al., 2024). Addressing these challenges will require affordable technology integration, financial support mechanisms, and city-wide digital education programs.

The role of public health and preventive care was another critical area of concern. Findings suggest that preventive health programs, chronic disease management initiatives, and mental well-being strategies are highly valued by aging populations but are often underdeveloped in smart city frameworks. Participants expressed a need for regular health screenings, mental health support systems, and accessible vaccination campaigns. This aligns with research indicating that proactive health interventions reduce long-term healthcare costs and improve the quality of life for older adults (Alasadi, 2023). However, this study found that many preventive care initiatives in smart cities remain technology-dependent, which may exclude populations with limited digital access. Research suggests that blending digital and in-person healthcare models is necessary to bridge this gap and ensure widespread participation (Daniore, 2024).

Lastly, policy and governance emerged as an essential factor in the successful implementation of age-friendly smart cities. Participants emphasized the need for strong regulatory frameworks, data privacy laws, and public-private partnerships to ensure that smart city initiatives are both ethical and effective. This aligns with findings from other studies that highlight data privacy concerns as a key barrier to citizen trust in smart city programs (Daniore, 2024; Naughton et al., 2024). The results suggest that while digital health records and AI-driven decision-making can enhance urban governance(Naughton et al., 2024), they also introduce ethical challenges related to surveillance, consent, and data ownership (Kerich, 2018; Kim et al., 2024). Ensuring transparent governance and community involvement in smart city policymaking is critical for building trust and long-term engagement among older populations (Siddiqi et al., 2023).

Despite the valuable insights generated in this study, there are several limitations that should be acknowledged. The study was conducted using a qualitative approach with 29 participants, which, while providing rich thematic insights, may not be fully representative of broader aging populations in different smart city contexts. The sample was also drawn exclusively from online communities, which means that individuals who are not digitally connected were underrepresented. This may have introduced a selection bias, as participants were likely more technologically aware than the general older population. Additionally, cultural and regional variations in smart city development were not fully explored, limiting the generalizability of findings across different global urban settings. Future studies incorporating larger, more diverse samples and mixed-method approaches may provide more comprehensive insights into the evolving role of smart cities in supporting aging populations.

Future research should explore comparative studies across different smart cities to assess how age-friendly public health policies vary based on regional governance, economic factors, and technological infrastructure. Conducting quantitative analyses alongside qualitative findings could offer a deeper understanding of the actual impact of smart city innovations on older populations. Additionally, longitudinal studies could examine how aging populations adapt to new urban technologies over time and whether digital literacy programs effectively bridge accessibility gaps. Research focusing on the intersection of AI, ethics, and aging would also be valuable in shaping policies that prioritize both innovation and inclusivity in future smart city developments.

To create truly age-friendly smart cities, policymakers and urban planners must focus on both technological and social interventions. Digital health technologies, while transformative, should be paired with in-person healthcare services to ensure accessibility for all older adults. Public transport systems must integrate user-friendly designs that

accommodate seniors with varying levels of digital literacy. Urban spaces should be designed with inclusivity in mind, ensuring that public parks, community centers, and housing developments are accessible to aging populations. Local governments must prioritize citizen engagement in smart city policymaking, ensuring that older adults have a voice in shaping the digital and physical environments they navigate daily. By integrating technological innovation with human-centered policies, smart cities can become truly sustainable, inclusive, and supportive of aging populations in the years ahead.

Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

Alasadi, M. N. (2023). The Ministry of Health Efforts to Combat Epidemics and Promote Public Health for Citizens and Visitors. *SFS*. https://doi.org/10.53555/sfs.v10i6.2267

Cardoso, J., Simões, C., Quatorze, M., Coelho, N., & Amaral, S. V. (2024). Health in Knowledge. *European Journal of Health Communication*, *5*(3), 85-108. https://doi.org/10.47368/ejhc.2024.305

Daniore, P. (2024). Developing a Trustworthy National Health Data Space: Public Needs and Policy Implications. *European journal of public health*, *34*(Supplement_3). https://doi.org/10.1093/eurpub/ckae144.1149

Feng, Y. (2024). Bibliometric Analysis of Citizen Science in Global Healthcare: Current Trends, Challenges, and Future Directions. *JCTT*, *1*(1), 41-50. https://doi.org/10.54254/3049-5458/1/2024008

Goldsobel, G., Herrath, C. v., Schlickeiser, S., Brindle, N., Stähler, F., Reinke, P., Aberman, Z., Ofir, R., Dessole, G., Benvenuti, S., Neves, N. M., Reis, R. L., Moll, G., & Volk, H. D. (2021). RESTORE Survey on the Public Perception of Advanced Therapies and ATMPs in Europe—Why the European Union Should Invest More! *Frontiers in Medicine*, *8*. https://doi.org/10.3389/fmed.2021.739987

Graffigna, G., Palamenghi, L., Barello, S., Savarese, M., Castellini, G., Lozza, E., & Bonanomi, A. (2021). Measuring Citizens' Engagement During Emergencies: Psychometric Validation of the Public Health Engagement Scale for Emergency Settings (PHEs-E). *PLoS One*, *16*(12), e0261733. https://doi.org/10.1371/journal.pone.0261733

Grum, B. (2024). Smart Cities: Catalyst for Sustainability and Health. *Itm Web of Conferences*, *69*, 02009. https://doi.org/10.1051/itmconf/20246902009

Kandel, R. (2024). Nepal's Geriatric Health Strategy 2021–2030: A Narrative Review. *Journal of the Indian Academy of Geriatrics*, *20*(3), 141-143. https://doi.org/10.4103/jiag.jiag_41_24

Kembo, S., & Bothma, C. (2023). A Critical Review of Health Marketing in Zimbabwe During COVID-19. *Journal of African Media Studies*, *15*(1), 911-209. https://doi.org/10.1386/jams_00094_1

Kent, R. (2023). Transformations of Health in the Digital Society. 1-22. https://doi.org/10.1332/policypress/9781529210156.003.0001
Kerich, M. (2018). Sustainable Health Equity. *Journal of Management Research*, *10*(3), 63. https://doi.org/10.5296/jmr.v10i3.13323
Kim, D.-J., Lee, Y.-S., Jeon, E.-R., & Kim, K. J. (2024). Present and Future of AI-IoT-Based Healthcare Services for Senior Citizens in Local Communities: A Review of a South Korean Government Digital Healthcare Initiatives. *Healthcare*, *12*(2), 281. https://doi.org/10.3390/healthcare12020281
Kolyvanova, L. A., & Strygin, M. Y. (2021). Professional Readiness of a Teacher-Trainer to Organize Health-Saving Activities of Athletes. *Izvestiya of the Samara Science Centre of the Russian Academy of Sciences Social Humanitarian Medicobiological Sciences*, *23*(81), 16-21. https://doi.org/10.37313/2413-9645-2021-23-81-16-21
Landqvist, H. (2024). ”Gratis Broddar Till Dig Som Är 65 År Och Bor I Göteborg”: En Fallstudie Av Legitimeringsstrategier I Svenska Kommuners Webbtexter Riktade Till Seniorer. *Vakki*, *16*. https://doi.org/10.70484/vakki.145590
Naughton, B., O'Shea, D., Werff, L. v. d., & Buckley, F. (2024). Influencing a Nation: How a Leader's Interpersonal Emotion Regulation Influences Citizen Compliance via Trust and Emotions During a Global Pandemic. *Emotion*, *24*(1), 196-212. https://doi.org/10.1037/emo0001262
Rosas, L. G., Espinosa, P. R., Jimenez, F. M., & King, A. C. (2022). The Role of Citizen Science in Promoting Health Equity. *Annual Review of Public Health*, *43*(1), 215-234. https://doi.org/10.1146/annurev-publhealth-090419-102856
Saran, S. (2024). Systematic Review on Citizen Science and Artificial Intelligence for Vector-Borne Diseases. *The International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences*, *XLVIII-4-2024*, 397-402. https://doi.org/10.5194/isprs-archives-xlviii-4-2024-397-2024
Siddiqi, S. M., Kareddy, V., Uscher-Pines, L., & Chari, R. (2023). Building Public Health Emergency Preparedness, Response, and Recovery Capabilities Through Disaster Citizen Science: Perspectives From Local Health Department, Academic, and Community Representatives. *Journal of Public Health Management and Practice*, *29*(4), 473-486. https://doi.org/10.1097/phh.0000000000001686
Smith, K. E., Macintyre, A., & Weakley, S. (2022). Beyond the Public Health/Political Science Stalemate in Health Inequalities: Can Deliberative Forums Help? , 127-152. https://doi.org/10.1007/978-3-030-98985-9_7
Sousa, L. B., Craig, A., Chitkara, U., Fricker, S., Webb, C. E., Williams, C., & Baldock, K. L. (2022). Methodological Diversity in Citizen Science Mosquito Surveillance: A Scoping Review. *Citizen Science Theory and Practice*, *7*(1), 8. https://doi.org/10.5334/cstp.469
Standerfer, C., Loker, E., & Lochmann, J. (2022). Look Before You Leap: Assessing Community Readiness for Action on Science and Health Policy Issues. *Journal of Science Communication*, *21*(02), N03. https://doi.org/10.22323/2.21020803
Uzuegbunam, C. E. (2025). Perceptions and Practices of Young People Regarding COVID-19 Health Misinformation and the Underlying Interdependencies. *Cultures of Science*. https://doi.org/10.1177/20966083241308655