Salud, Ciencia y Tecnología. 2026; 6:2462
doi: 10.56294/saludcyt20262462

ORIGINAL

From Disease Burden to Age-Friendly Cities: Developing Indicators for Healthy Aging in Makassar, Indonesia

De la carga de morbilidad a las ciudades adaptadas a las personas mayores: desarrollo de indicadores para un envejecimiento saludable en Makassar, Indonesia

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Cite as: Palutturi S, Fajarwati II, Rosmanelly S, Rahmah MN, Nam EW. From Disease Burden to Age-Friendly Cities: Developing Indicators for Healthy Aging in Makassar, Indonesia. Salud, Ciencia y Tecnología. 2026; 6:2462. https://doi.org/10.56294/saludcyt20262462

Submitted: 01-07-2025 **Revised:** 10-09-2025 **Accepted:** 04-12-2025 **Published:** 01-01-2026

Editor: Prof. Dr. William Castillo-González

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ABSTRACT

Introduction: the elderly population in Indonesia, including Makassar, faces an increasing burden of non-communicable diseases (NCDs). Hypertension, diabetes mellitus, gout, and related comorbidities are common among older adults due to physiological changes. However, the distribution patterns of these diseases among older adults remain underexplored.
Objective: to describe the distribution patterns of non-communicable diseases and identify dimensions and indicators of age-friendly environments in Makassar.
Method: a mixed-methods design was used with spatial patterns of NCDs were analyzed using Geographic Information Systems (GIS) based on 2024 secondary data from the Makassar Health Department. A qualitative exploratory study was also conducted through in-depth interviews and Focus Group Discussions (FGDs) with older adults, health workers, and community leaders. Qualitative data were analyzed using NVivo Pro 12 software.
Results: spatial analysis showed uneven distribution, with higher concentrations of hypertension, diabetes, and gout in densely populated areas with limited access to health-supportive environments. The study identified 29 indicators across nine dimensions: community support, housing, communication and information, financial condition, transportation, government and stakeholder roles, respect and social inclusion, open spaces and buildings, and social participation.
Conclusions: developing age-friendly environments and implementing targeted health interventions are essential to strengthen collaboration and improve the quality of life and well-being of older adults.

Keywords: Elderly Population; Non-Infectious; Age-Friendly Environments; GIS; Makassar.

RESUMEN

Introducción: la población de edad avanzada de Indonesia, incluida Makassar, se enfrenta a una carga cada vez mayor de enfermedades no transmisibles (ENT). La hipertensión, la diabetes mellitus, la gota y las comorbilidades relacionadas son frecuentes entre los adultos mayores debido a los cambios fisiológicos. Sin embargo, los patrones de distribución de estas enfermedades entre los adultos mayores siguen sin estar suficientemente estudiados.
Objetivo: describir los patrones de distribución de las enfermedades no transmisibles e identificar las dimensiones y los indicadores de los entornos adaptados a las personas mayores en Makassar.

Método: se utilizó un diseño de métodos mixtos y se analizaron los patrones espaciales de las ENT mediante sistemas de información geográfica (SIG) basados en datos secundarios de 2024 del Departamento de Salud de Makassar. También se llevó a cabo un estudio exploratorio cualitativo mediante entrevistas en profundidad y grupos de discusión (FGD) con personas mayores, trabajadores sanitarios y líderes comunitarios. Los datos cualitativos se analizaron con el software NVivo Pro 12.
Resultados: el análisis espacial mostró una distribución desigual, con una mayor concentración de hipertensión, diabetes y gota en zonas densamente pobladas con acceso limitado a entornos que favorecen la salud. El estudio identificó 29 indicadores en nueve dimensiones: apoyo comunitario, vivienda, comunicación e información, situación financiera, transporte, funciones del gobierno y las partes interesadas, respeto e inclusión social, espacios abiertos y edificios, y participación social.
Conclusiones: el desarrollo de entornos adaptados a las personas mayores y la aplicación de intervenciones sanitarias específicas son esenciales para reforzar la colaboración y mejorar la calidad de vida y el bienestar de las personas mayores.

Palabras clave: Población de Edad Avanzada, no Infeccioso, Entornos Adaptados a las Personas Mayores; SIG; Makassar.

INTRODUCTION

Indonesia is the fourth country in the world to enter a demographic dividend period, during which the proportion of elderly people continues to increase and is projected to surpass that of young people.[1] In 2020, the global population aged 60 years and above was 1 billion and is expected to reach 1,6 billion by 2050.[2] Data from the Indonesian Central Statistics Agency show that life expectancy in Indonesia has also increased from 72,51 years in 2015 to 75,47 years in 2045.[3] The Old-Age Dependency Ratio (OADR) continues to rise, indicating a higher proportion of older adults compared to the working-age population.[4]

This demographic transition results in an increase in the elderly population, which poses significant health challenges. Diseases such as neurodegenerative disorders and multimorbidity—including heart disease, stroke, cancer, diabetes, arthritis, hypertension, dementia, and chronic lung disease—continue to rise among older adults, leading to greater utilization of health services.[5] Major public health issues affecting the well-being of the elderly population include falls, adverse drug events, infections, malnutrition, loneliness, mental health disorders, and cognitive impairment.[6] These challenges are influenced by physiological changes,[7] lifestyle factors[8] and access to healthcare services.[9] The welfare issues faced by the elderly population have significant implications for both society and the state, affecting public resources, healthcare systems, social support networks, and economic sustainability.[10]

The spatial distribution of diseases among older adults has not been studied in depth, even though health data are available. However, the use of such data to identify disease distribution patterns among older adults remains very limited.[11] Programs addressing the welfare of the elderly population have been implemented in several cities in Indonesia, but their main focus remains on medical and environmental interventions, with insufficient integration of physical and social factors, urban spatial planning, and cross-sectoral policies.[12] Therefore, an approach that combines medical and non-medical aspects is needed to enable older adults to live in environments that support healthy and inclusive lifestyles.

The World Health Organization (WHO), through its Age-Friendly Cities and Communities (AFCC) initiative, emphasizes the importance of developing age-friendly urban environments to address the health, social, and demographic challenges posed by population aging.[13] Previous studies on the same topic have shown that public open spaces, buildings, community support, and health services have been proven to contribute significantly to the quality of life of older adults. The implementation of the age-friendly city concept cannot rely on identical indicators across countries but requires context-specific indicators that align with local conditions, as cultural, social, and spatial differences exist in each region.[14] The concept of age-friendly cities in Makassar is still relatively new, and the need to develop indicators is very relevant to support the transformation towards an inclusive, healthy city that is adaptive to the needs of the growing elderly population. The purpose of this study is to describe the distribution patterns of non-communicable diseases and explore the dimensions and indicators of age-friendly environments in Makassar.

METHOD

Study Design

A mixed-methods design was adopted to combine spatial mapping (GIS) for identifying distributional patterns with qualitative inquiry to understand contextual determinants of urban health. The combination of qualitative methods and spatial (GIS) analysis was essential to comprehensively address the research questions.

GIS provided a spatial understanding of the distribution, clustering, and geographic patterns of the studied phenomena, allowing the identification of spatial inequities and location-specific vulnerabilities. However, spatial patterns alone cannot explain the underlying social, institutional, and contextual factors shaping these patterns. Therefore, qualitative methods through in-depth interviews and focus group discussions were used to capture stakeholder perspectives, decision-making processes, cultural influences, and lived experiences that are not visible through spatial data. Integrating both approaches enabled a deeper interpretation of "why" and "how" spatial patterns occur, ensuring a more robust, contextualized, and policy-relevant understanding of the issue. This mixed-methods design also supports triangulation, thereby strengthening the credibility and validity of the findings.

Participants and Recruitment

This study aims to explore the dimensions and indicators of age-friendly environments in Makassar. The methodology included data collection through interviews and Focus Group Discussions (FGDs) and thematic analysis, as illustrated in figure 1, which describes the entire research process. Participants were selected using purposive sampling. This method allowed for the inclusion of diverse perspectives from various informants, namely older adults aged 60–70 years who resided in Makassar, did not experience severe cognitive impairment, and were able to communicate verbally. Additional information was provided by families and health cadres who focused on the welfare of the elderly population in Makassar. Participants were asked to explain how and what was needed to create an age-friendly city in Makassar. The activities were facilitated by the researchers and their team, as well as the Manggala Sub-district Office and the Faculty of Public Health at Universitas Hasanuddin, to ensure representativeness using a targeted outreach approach, multilingual materials, flexible schedules, collaboration with local organizations, pilot interviews, and incentives for participants who required significant travel and time commitment. The characteristics of the participants, including diverse professional roles with demographic data (age and gender), were described in detail in table 1.

Table 1. Participant Characteristics

ID	Age	Gender	Education Level	Occupational
I1	38	Male	University	Neighborhood Head
I2	70	Female	High School	Elderly People
I3	52	Male	University	Local Leader
I4	43	Female	University	Caregiver
I5	65	Female	Primary School	Elderly People
I6	67	Female	High School	Elderly People
I7	48	Female	University	Psychology Lecturer
I8	42	Female	High School	Caregiver
I9	42	Female	University	Caregiver
I10	61	Female	High School	Caregiver
I11	37	Female	University	Chairman of the Elderly Organization
I12	40	Male	University	Elderly Organization
I13	38	Female	University	Psychology Lecturer
I14	42	Male	University	Caregiver
I15	35	Female	University	Caregiver
I16	65	Female	High School	Elderly People

In this study, three In-Depth Interviews (IDIs) were conducted with key informants selected through purposive sampling, namely I7, I11, and I13, who were directly involved in the issue under investigation. In addition, one Focus Group Discussion (FGD) was carried out with 13 participants.

Data collection

To ensure data confidentiality, data collection was conducted in one sub-district in Makassar, specifically in a hall at the Manggala Sub-district Office, which was chosen because the sub-district has active elderly activities. The location was selected for its comfort and privacy to ensure that no one outside the participants was present during the interview process. Data were collected through in-depth interviews and Focus Group Discussions (FGDs) conducted from July to September 2025. Before the interviews were conducted, the researchers

provided guidance on informed consent to the participants. The researchers prepared interview guidelines that included additional material and open-ended questions, which were reviewed by two experts to ensure clarity and cultural relevance. The interviews lasted 20-30 minutes and focused on the dimensions and indicators of an age-friendly environments in Makassar. Follow-up interviews with participants were not conducted; however, if clarification was required, participants were contacted by telephone. The research team ensured accurate communication and transcription, as well as additional field notes to capture non-verbal cues and contextual details to enhance the richness of the data.

Outline interviews and semi-structured interviews

The interview guide was designed to gather important insights related to the dimensions and indicators of the age-friendly environments model. Semi-structured interviews were conducted to provide flexibility while maintaining consistency in the discussion. Open-ended questions allowed participants to reflect and provide in-depth insights. All sessions were recorded and transcribed verbatim for accuracy. This approach enabled the collection of rich qualitative data, capturing both general trends and unique perspectives.

Data Analysis

In this study, two tools were used to analyze the data. First, a Geographic Information System (GIS) application was used to map the distribution patterns of diseases from secondary data obtained from the Makassar Health Office. The use of GIS facilitated the presentation of data in interactive map formats and supported effective communication of spatial information to various stakeholders. The second tool used was NVivo Pro 12, which enabled thematic analysis due to its ability to manage qualitative data, support complex coding, develop themes, and ensure reliable and transparent analysis.

Spatial (GIS) Data Analysis

Spatial analysis was conducted to complement the qualitative findings by identifying the geographical distribution and spatial patterns related to the research topic. Geographic Information System (GIS) data were processed using [ArcGIS/QGIS], including geocoding of key locations, generation of spatial layers, and performing overlay analysis. The spatial outputs were used to map hotspots, clusters, and spatial disparities that corresponded to themes emerging from the qualitative data. The GIS component addressed the question of "where" certain phenomena were concentrated, while the qualitative analysis explained "why" and "how" these patterns occurred. If the GIS and qualitative findings were not directly aligned, the spatial outputs were placed in the Supplementary Material to avoid overextending the main manuscript while still offering additional analytical depth.

Ethical Consideration

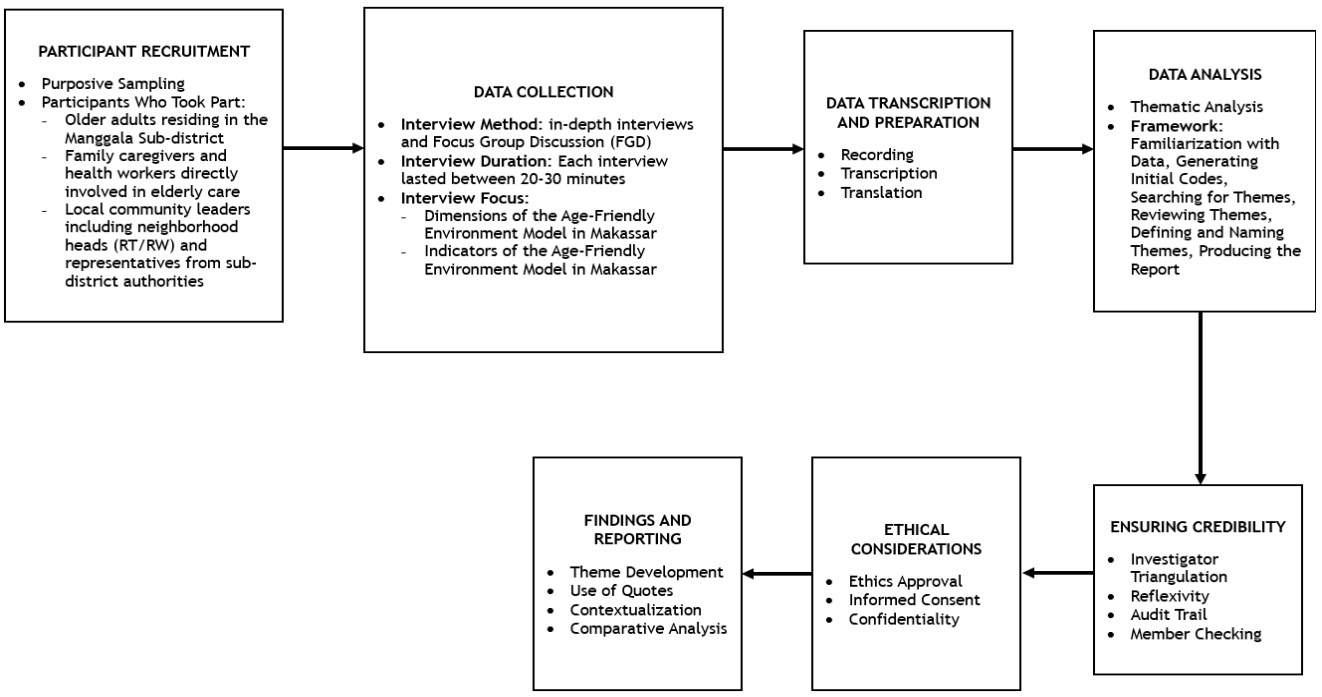

Figure 1. Research process of sampling procedure, interviews, and analysis

This study received ethical approval from the Faculty of Public Health, Universitas Hasanuddin, under protocol number 10325105002 and letter number 534/UN4.14.1/TP.01.02/2025. Before the study began, all participants were provided with a consent form. All participants were guaranteed data confidentiality and voluntary participation. Considering their interest in participating in social groups, especially those related to the elderly population, the researchers adopted a reflective approach to minimize bias during data collection. One member of the research team had extensive experience with qualitative methods, particularly phenomenological approaches. Before the research began, the researchers explained the objectives and purpose of the study to ensure transparency.

RESULTS

Spatial Distribution of Non-communicable Diseases (GIS Analysis)

In Makassar, three diseases were most commonly experienced by the elderly population: hypertension, diabetes mellitus, and gout (figure 2). The map illustrates the distribution of hypertension among older adults across the operational areas of primary health centers in Makassar in 2024. Of the 47 primary health center areas mapped, 24 are shown in white, indicating a low incidence of hypertension among older adults. In contrast, the remaining 23 areas are colored orange, indicating a high incidence. The map presents the distribution of diabetes mellitus (DM) among older adults across the operational areas of primary health centers in Makassar in 2024. Of the 47 primary health center areas mapped, 24 are shown in white, indicating a low incidence of DM among older adults. Meanwhile, the remaining 23 areas are colored orange, indicating a high incidence (figure 3). The map presents the distribution of gout among older adults across the operational areas of primary health centers in Makassar in 2024. Of the 47 primary health center areas mapped, 24 are shown in white, indicating a low incidence of gout among older adults. Whereas, the remaining 23 areas are colored orange, indicating a high incidence (figure 4).

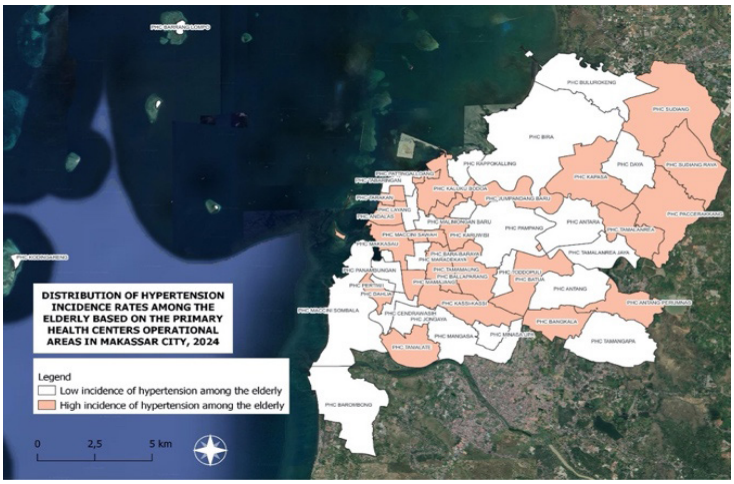

Figure 2. Distribution of Hypertension Incidence Rates Among Older Adults Based on Primary Health Centers' Operational Areas in Makassar, 2024

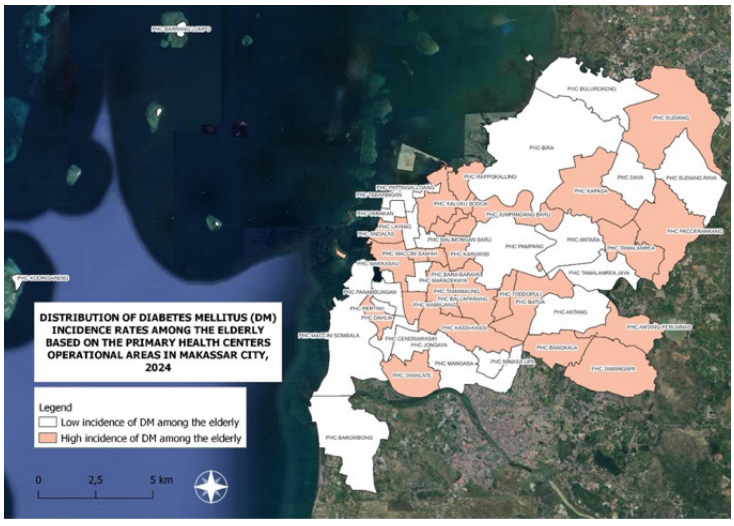

Figure 3. Distribution of Diabetes Mellitus (DM) Incidence Rates Among Older Adults Based on Primary Health Centers' Operational Areas in Makassar, 2024

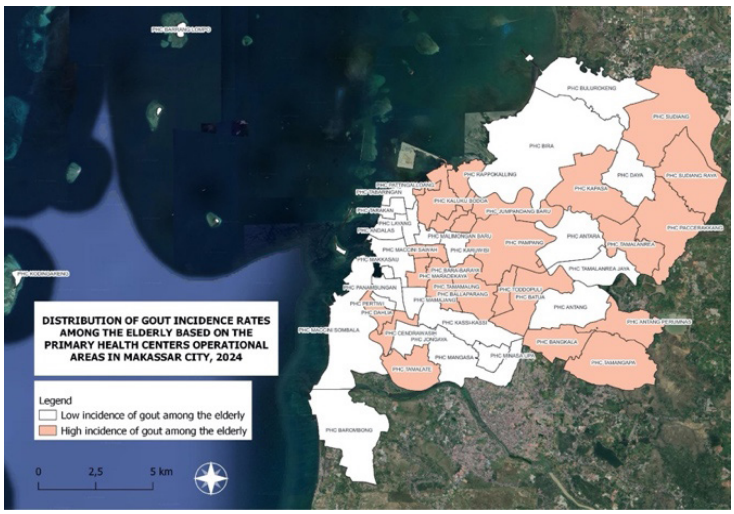

Figure 4. Distribution of Gout Incidence Rates Among Older Adults Based on Primary Health Centers' Operational Areas in Makassar, 2024

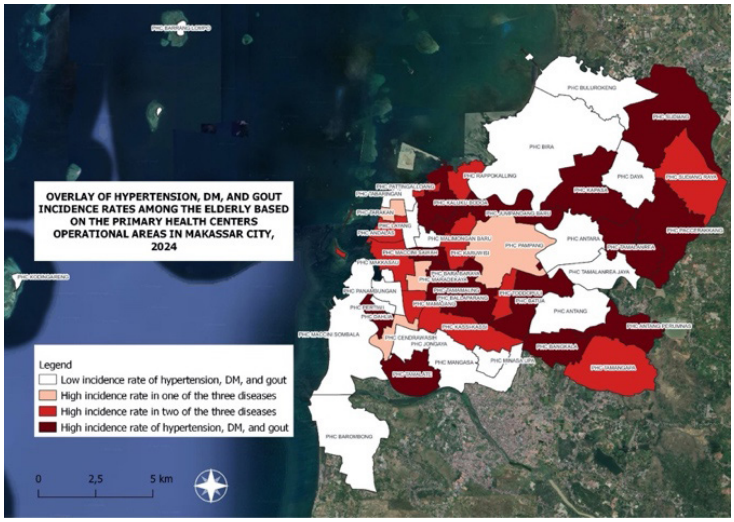

Figure 5. Distribution of Hypertension Incidence Rates Among Older Adults Based on Primary Health Centers' Operational Areas in Makassar, 2024

The map presents the overlay of hypertension, DM, and gout among older adults across the operational areas of primary health centers in Makassar in 2024. Of the 47 primary health center areas mapped, 18 areas are shown in white, indicating a low incidence rate for all three diseases. Four areas are shown in orange, indicating a high incidence rate in one of the three diseases. Ten areas are shown in red, indicating a high incidence rate in two of the three diseases, while 15 areas shown in in dark red, indicating a high incidence rate of hypertension, DM, and gout simultaneously (figure 5).

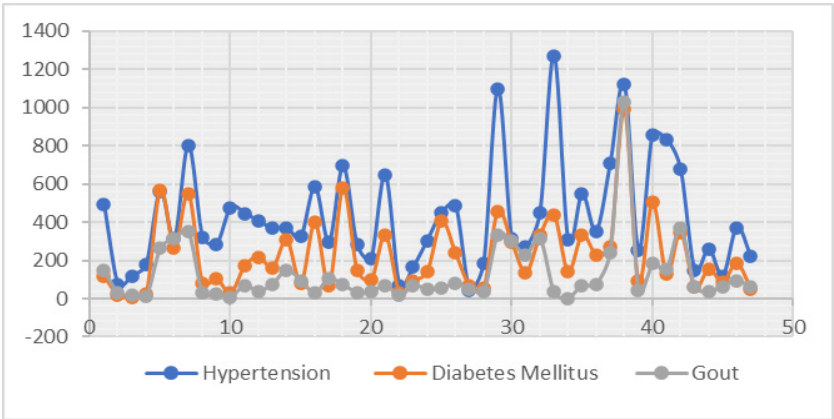

Figure 6. Distribution of Older adults with Hypertension, Diabetes Mellitus, and Gout in 47 Primary Health Centers in Makassar in 2024

Hypertension (blue line) appeared to dominate, with the highest number of cases in almost all primary health centers. Several primary health centers showed a significant spike in cases, even exceeding 1,000. Diabetes mellitus (orange line) showed a lower trend compared to hypertension but was still consistently found in most primary health centers, with hundreds of cases. Gout (gray line) had the lowest number of cases compared to the other two diseases, but its distribution was relatively even across all primary health centers. Overall, there was variation between primary health centers, which may reflect differences in risk factors, access to health services, and the characteristics of the elderly population in each working area (figure 6).

The results of the thematic analysis showed that the concept of age-friendly environments in the local context of Makassar could be mapped into nine main dimensions with several more specific indicators. These dimensions included: community support and health services, respect and social inclusion, open spaces and buildings, social participation, the role of government and stakeholders, housing, communication and information, financial situation, and transportation. Each dimension had indicators that reflected local needs, challenges, and potential (figure 7).

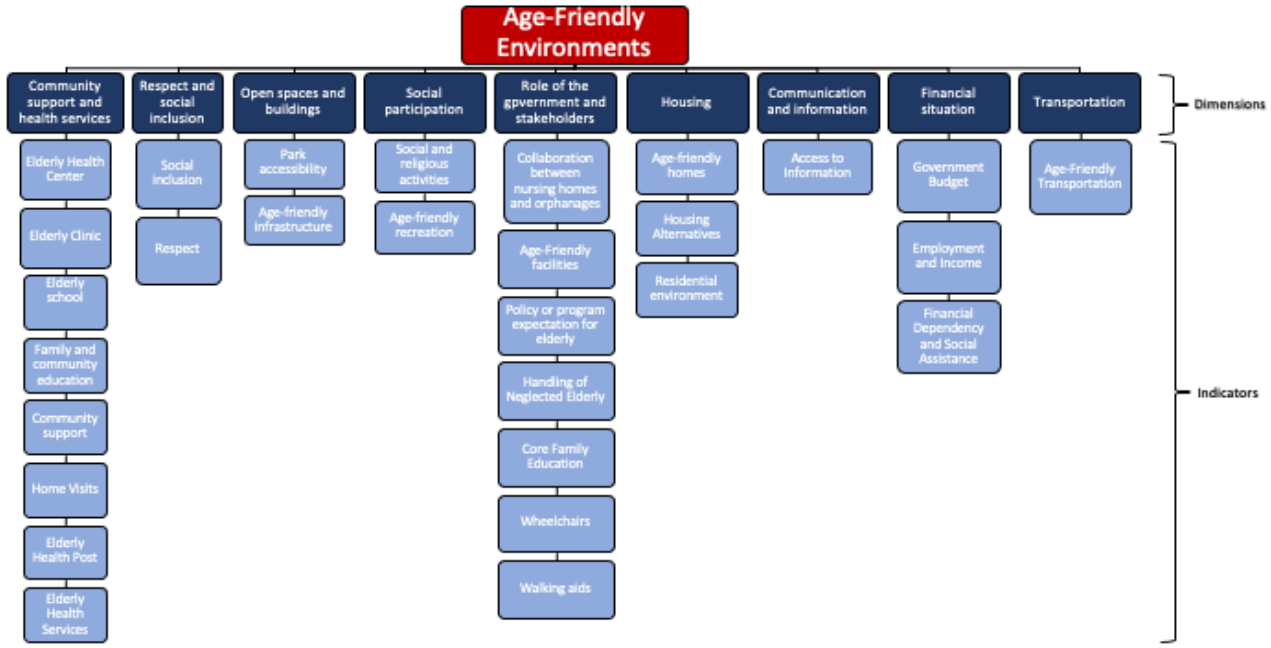

Figure 7. Dimensions and Indicators of Age-Friendly Environments: Results of Thematic Analysis of the Local Context of Makassar

The results of the word cloud analysis illustrated the findings of the qualitative transcript analysis related to the needs, roles, and environments that support the well-being of the elderly population. The word "Elderly" (figure 8) appeared most prominently, confirming that the main focus of the research was on the elderly population. Several other prominent keywords, such as health, community, family, support, caregiver, clinic, and education, indicated that health issues, social support, family roles, and access to public services are important aspects of the lives of the elderly population.

Figure 8. Word Cloud Results of Qualitative Transcript Analysis of Age-Friendly Environments in the Local Context of Makassar

Table 2. Dimensions and Indicators Age-Friendly Environments in the Local Context of Makassar

Dimension	Indicator	Interview transcript
Community Support and Health Services	Elderly Health Center Requirements	"Primary services are already available at each health center, ranging from pregnant women to older adults." (I11, 37 years old) "There is an eldercare facility where older adults can meet and engage in activities together, or engage in activities separately, as has already been done by older adults." (I7, 48 years old)
	Availability of Elderly Clinic	"Because they say there are no clinics for older adults in Makassar, There will be a psychologist at the elderly clinic." (I7, 48 years old)
	Availability of Elderly Schools	"Well, this is a great concept for a school for the elderly, because it brings friends together, and it is facilitated, and of course there is a curriculum." (I13, 38 years old)
	Availability of Support from Family and Community	"Lack of attention or support from family" (I13, 38 years old)
	Need for Community Support	"In my capacity, I also happen to have a BKL group, (Elderly Family Development), where we also have a school for older adults." (I12, 40 years old)
	Need for Home Visit Programs	"So these home visits are conducted for older adults who are no longer able to walk to the health center." (I13, 38 years old)
	Availability of Elderly Health Posts in Each Region	"The elderly, who are independent, come to the elderly health center themselves to maintain their health, starting from cholesterol, gout, or blood pressure." (I11, 37 years old)
	Availability of Elderly Health Services	"Because our elderly people need long-term care, there are those who can no longer move, who are bedridden due to paralysis, so we can pay attention to this in terms of access to health services" (I11, 37 years old)
Respect and Social Inclusion	Social Inclusion	"Productivity that makes older adults happy. Productivity makes older adults feel valued by others, but it turns out that it is what makes us happy." (I11, 37 years old)
	Respect	"Providing space for the elderly population to be heard and valued." (I13, 38 years old)
Open Spaces and Buildings	Park Accessibility	"There are park facilities for older adults, there are places to sit" (I8, 42 years old) "Has a place, a park for older adults, both those with disabilities and those who need peace and quiet, to socialize with each other and share stories" (I6, 67 years old)
	Age-Friendly Infrastructure	"Enough with those parks, many of them are messy, not maintained, not developed." (I16, 65 years old)
Social Participation	Social and Religious Activities	"Respect for older adults can be demonstrated by providing them with ample opportunities to actively participate in social and religious activities." (I7, 48 years old)
	Age-Friendly Recreation	"There are recreational activities." (I11, 37 years old)
Role of the Government and Stakeholders	Collaboration between Nursing Homes and Organizations	"There are many roles played by the private sector, the government, or existing non-governmental organizations, but perhaps this needs to be enhanced/improved. There needs to be a framework for this, of course." (I9, 42 years old)
	Age-Friendly Facilities	"And that must be followed by supporting facilities. And that goes back to the fact that there must be a genuine desire from the city level to build and then socialize it to the lower levels." (I4, 43 years old)
	Policy or Program Expectations for the Elderly Population	"I think it's age-friendly. We have already started. If it is age-friendly in Makassar, it does not mean that the policy does not exist or that the government does not want it." (I3, 52 years old), "Creating the need for this environment to be supported by regulations." (I9, 42 years old)
	Handling of Neglected Elderly	"The government could have a special program to take care of neglected elderly people who are no longer productive. That might be better." (I6, 67 years old)

	Core Family Education	"The first step in being older adult-friendly is to provide education within the family environment, the smallest family environment, the smallest unit in the household, the importance of education for the immediate family." (I3, 52 years old) "But activities targeting elderly families are very limited." (I7, 48 years old)
	Wheelchairs	"Of course, if there is assistance available, whether it is a cane or a wheelchair, for example." (I2, 70 Years Old)
	Walking Aids	"But there is no access for people in wheelchairs or who use walking aids." (I8, 42 years old)
Housing	Age-Friendly Houses	"Elderly parents live in a house with stairs and super slippery ceramic tiles." (I7, 48 years old)
	Housing Alternatives	"Safety is important for older adults." (I13, years old)
	Residential Environment	"A yard that is almost non-existent does not allow them to run or be active on the terrace, simply exercise or walk on the gravel that has been prepared" (I7, 48 years old)
Communication and Information	Access to Information	"Regarding the economic, social, environmental, and physical aspects, without detracting from what you have said earlier, if this is implemented and a system can be created so that it can be promoted, people will know that Makassar is like this, that it cares deeply about the elderly population" (I11, 37 years old)
Financial Situation	Government Budget	"Funding is budgeted, so indeed, everything depends on the budget" (I1, 38 years old
	Employment and Income	"Found elderly people who are part of families and categorized as poor" (I15, 35 Years old)
	Financial Dependency and Social Assistance	"To access social assistance or access health care" (I15, 35 Years old)
Transportation	Age-Friendly Transportation	"Furthermore, there is no public transportation facility specifically for older adults, such as seats reserved for older adults" (I8, 42 years old) "Maybe one day there will be special vehicles for the elderly, so that they don't have to struggle to get around" (I16, 65 years old)

DISCUSSION

This study employed a mixed-methods approach combining GIS-based spatial analysis with qualitative insights to understand the complexities of age-friendly environments. The spatial mapping of NCD prevalence was not conducted as a separate analysis but as an essential component to contextualize the lived experiences of older adults within the geographical distribution of health risks. By integrating spatial disparities with stakeholder narratives, the study provides a more holistic understanding of how place, health conditions, and age-friendly infrastructures interact. This bridge is critical, as environments with a higher NCD burden often coincide with barriers identified in the qualitative findings.

Distribution of Non-Communicable Diseases in the Elderly

The spatial patterns reveal clear geographic inequalities in the distribution of NCDs. Rather than simply stating that prevalence "varies," the maps show distinct clusters of higher NCD burden in areas such as Kapasa, Bulurokeng, Sudiang, and Paccerakang, which are characterized by higher population density, limited access to health services, and a lack of green and walkable spaces.[15] In contrast, areas such as Tamalate and Bontoala display more mixed patterns, with some sections exhibiting relatively better accessibility yet still facing environmental challenges that influence health risks.[16] These spatial differences suggest that the physical environment and infrastructural conditions play a significant role in shaping the NCD burden across these neighborhoods.[17] The qualitative findings reinforce this interpretation; participants consistently reported mobility constraints, unsafe pedestrian pathways, and limited access to primary healthcare particularly in areas like Kapasa, Bulurokeng, and Sudiang. Taken together, the spatial and qualitative evidence demonstrates that the physical environment not only coexists with but actively shapes the spatial distribution of NCD risk among older adults in these areas.

Local Context in Age-Friendly Environments (AFE)

The analysis of the nine AFE dimensions indicates that while the global framework provides a useful structure, local adaptations are necessary to capture cultural, infrastructural, and governance realities.

The central contribution of this study is the identification of three cross-cutting factors mobility constraints, social participation gaps, and service accessibility that consistently influence multiple AFE dimensions in this setting. Rather than functioning independently, these dimensions interact dynamically, shaping older adults' daily experiences. This finding extends existing literature that tends to treat the AFE dimensions as separate categories, demonstrating the need for a more integrated and context-sensitive interpretation.[18]

This study successfully identified nine dimensions and 29 indicators (figure 7) relevant to the needs of older adults in Makassar. Several indicators need to be adapted to the cultural and social conditions and infrastructure of Makassar, such as the development of elderly schools, home visit programs, and family-based support that reflect the strong family values of the Makassar community. Another study on Age-Friendly Environment indicators, which measured various contexts around the world and consulted international experts, identified four dimensions and 16 indicators consisting of the physical environment, social environment, impact, and equity. This study provides insights for cities to improve the quality of AFEs, actively respond to population aging, and support WHO initiatives in developing countries.[19] Research conducted in another Indonesian city, Surabaya, covered aspects of family, community, and public services and found that mental well-being and access to services still require greater attention in the Indonesian context.[20] Indicators for Age-Friendly Environments related to open spaces and buildings, transportation, and social participation and inclusion—such as providing green spaces, neighborhood watch programs, transportation options, and social opportunities—may be the most effective ways to support healthy and active aging.[21]

The main problem experienced by the elderly population are not only physical but also psychological. A lack of social interaction and emotional support has been shown to be associated with increased loneliness and decreased life satisfaction. Research by [22] has shown that older adults with good levels of social interaction are 5,6 times more likely to have a good quality of life compared to older adults with low levels of interaction. In this study, several activities (table 2) were identified as being highly needed by the elderly population, such as religious and social activities. This finding aligns with previous research showing that participation in religious activities for 12 weeks significantly reduced symptoms of depression and increased average quality-of-life scores compared to control groups. Our research findings provide the basis for a foundation for cross-sectoral integration in implementing Age-Friendly Environments based on the identified indicators—namely those from the health, housing, transportation, and social sectors. These indicators serve as guidelines for establishing policies and programs to promote Age-Friendly Environments.

When examined together, the spatial patterns of NCDs and the qualitative findings on AFE reveal a clear convergence: the environments with the highest NCD burden are the same environments where age-friendly infrastructure is weakest. This synthesis highlights how spatial health disadvantages and environmental barriers intersect to shape ageing experiences. By integrating these two strands of evidence, the study demonstrates that improving age-friendly environments is not merely a social or infrastructural challenge but a strategic public health intervention to address spatial inequities in NCDs. This mixed-methods perspective offers a more comprehensive and actionable understanding than either approach could provide alone.

CONCLUSIONS

This study shows that the burden of non-communicable diseases among older adults in Makassar—particularly hypertension, diabetes mellitus, and gout—is increasing, with an uneven distribution pattern across primary health centers. Through thematic analysis, this study successfully identified nine dimensions and 29 indicators of Age-Friendly Environments (AFE) that are relevant to the local context of Makassar. Therefore, age-friendly environments should not only focus on addressing the burden of disease but also ensure social inclusion, the provision of supportive infrastructure, and strong governance collaboration to improve the overall quality of life of the elderly population.

ACKNOWLEDGMENTS

We would like to thank all participants who took part in this study. We also extend our gratitude to the Head of the Manggala Sub-district for facilitating the venue, and to the Research and Community Service Institute of Universitas Hasanuddin for providing financial support for this study.

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FINANCING

This study received funding from Universitas Hasanuddin's internal Research and Community Service Institute under the Thematic Research Group program.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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