
THE IMPACT OF AGE-FRIENDLY ENVIRONMENTS ON THE WELLBEING OF OLDER ADULTS: EMPIRICAL EVIDENCE FROM SARAWAK

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ABSTRACT

Despite growing evidence linking age-friendly environments (AFEs) to psychosocial wellbeing in older adults, research remains heavily skewed towards Western and urban Asian contexts. No empirical study has examined this relationship in Sarawak, a rapidly ageing, multi-ethnic state in East Malaysia with unique rural and geographic characteristics. A community-based study with 1,077 individuals aged 60 years and above in Sarawak participated in the study. Both AFEs and psychosocial wellbeing were assessed using a validated questionnaire. The domain-specific relationships were determined using robust regression analysis. Psychosocial wellness was predicted by six out of the eight AFE domains, with civic participation and employment ($\beta=0.69$) and housing ($\beta=0.54$) showing the strongest associations. Communication and information showed a significant negative association ($\beta=-0.19$), likely reflecting digital literacy challenges among elderly Sarawakians. These findings provide actionable evidence for Sarawak state planners and the Ministry of Health Malaysia to prioritise age-friendly urban and rural interventions.

Keywords: ageing, age-friendly environments, older adults, psychosocial wellbeing

INTRODUCTION

Populations are ageing at an unprecedented rate, resulting in a transformation of the global demographic landscape. According to the United Nations (2013), the number of older adults will more than double by 2050, reaching 2 billion individuals, which is equivalent to one in every five individuals worldwide. This demographic shift presents both profound challenges and remarkable opportunities, necessitating proactive policy responses and thoughtful environmental adaptations across societies.

Malaysia is experiencing this demographic transition with notable velocity. According to the Department of Statistics Malaysia (2024), the percentage of people aged 65 and over has slowly grown since 2010. By 2040, 15% of Malaysia's population will be 65 or older, making the country an "aged nation". Sarawak, an East Malaysian state, is facing an even more rapid trajectory within this national setting; by 2028, it is projected to cross the threshold of an aged nation (Khushiri, 2024). Sarawak presents a distinctive ageing context shaped by dispersed rural settlements, limited infrastructure, and extraordinary ethnic diversity, including Iban, Bidayuh, Melanau, Orang Ulu, Chinese, and Malay communities. This convergence of rapid demographic ageing, rural geography, ethnic heterogeneity, and transitional socioeconomic conditions creates a distinctive context for examining age-friendly environments that cannot be extrapolated from Western or urban Asian research. The accelerated timeline observed in

Sarawak underscores an urgent imperative for context-specific research and targeted interventions capable of effectively supporting its growing elderly population.

Age-friendly environments (AFEs) provide dynamic support for the health, social engagement, and independence of older adults. AFEs are environments that "foster healthy and active ageing by building and maintaining intrinsic capacity across the life course and enabling greater functional ability," according to the World Health Organization (WHO) (World Health Organization, 2018). The WHO framework delineates essential domains, encompassing outdoor environments, transportation, housing, social engagement, and community assistance (Irwansyah & Febrina Ernungtyas, 2023). Research predominantly focuses on physical components, with more than 73% of studies highlighting outdoor environments, mobility, and housing, but social factors such as civic involvement are subjected to less quantitative analysis (Lai et al., 2016).

The psychosocial wellbeing of older adults encompasses the integrated dimensions of emotional, social, and psychological health, all of which exert a substantial influence on overall quality of life. Social isolation, physical decline, and mental health issues like depression and anxiety are prevalent obstacles that this demographic encounters (Saraswati, 2024). At the national level, a large-scale Malaysian study identified rural residence, marital status, financial independence, and family support as significant predictors of positive psychosocial wellbeing among older adults (Awang et al., 2022).

There is an increasing body of evidence that supports the positive correlation between psychosocial wellbeing and AFEs in older populations. Recent meta-analyses have documented a modest yet meaningful correlation, with particularly pronounced effects observed for emotional wellbeing relative to physical functioning (Zhou et al., 2022). However, there are still considerable gaps in the existing body of research, such as an excessive dependence on cross-sectional designs and a geographical bias towards European contexts (Irwansyah & Febrina Ernungtyas, 2023). This study is among the first in Malaysia to generate domain-specific, quantitative evidence on AFEs to inform the National Policy for Older Persons and the WHO-Malaysia Age-Friendly Cities initiative.

Understanding the relationship between AFEs and psychosocial wellbeing requires robust theoretical grounding. The Ecological Theory of Ageing, initially developed by Lawton and Nahemow (1973), serves as a fundamental framework in environmental gerontology. This theory posits that wellbeing emerges from the dynamic interplay between individual competencies and environmental press—that is, the demands and supports inherent within the surrounding context. The theory's immediate relevance to AFEs is apparent when examining how accessible design, proximity to critical services, and secure public spaces mitigate environmental pressures, thus enhancing social engagement and fostering psychological stability. Building upon this conceptual framework, the Person-Environment Fit Model highlights how attaining congruence between environmental conditions and personal needs and preferences is crucial for successful functioning. When a person's abilities and their surroundings are well-aligned, the latter delivers supports that are a good fit. Isolation, dissatisfaction, and a decline in mental health are some of the negative outcomes that can result from environmental-personal mismatches. Facilitating long-term participation and social integration, AFEs improve this alignment by providing accessible mobility, flexible housing, and welcoming public areas.

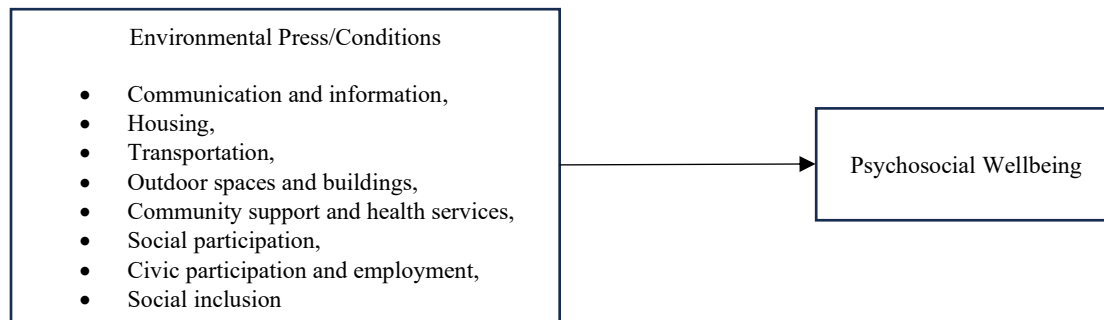


Figure 1: Conceptual framework of the study

Drawing from both frameworks, we hypothesise that: (H1) higher perceived age-friendliness of the environment is positively associated with psychosocial wellbeing and (H2) social and civic AFE domains will exhibit stronger associations with psychosocial wellbeing than physical domains.

Despite increasing international attention to the significance of AFEs, local research within Sarawak remains notably limited. Existing studies have predominantly concentrated on developed nations and urban settings, often overlooking the unique challenges characteristic of rural regions such as Sarawak (Irwansyah & Febrina Ernungtyas, 2023). The goals of this research are twofold: (1) to determine whether AFE domains are most strongly associated with older adults' psychosocial wellbeing in Sarawak; and (2) to assess the relationship between AFEs and this wellbeing.

METHODOLOGY

Setting and Design of the Study

This research utilised a cross-sectional, quantitative, community-based design implemented throughout three geographic areas of Sarawak, Malaysia: the Southern, Central, and Northern regions. Participants were community-dwelling Malaysian older adults aged 60 years and above. Individuals who were bedridden, housebound, or had a formal diagnosis of a mental disorder were excluded to ensure the sample comprised older adults capable of independent participation.

Procedure for Sampling and Sample Size

The required sample size was determined using a 39% prevalence estimate of perceived poor quality of life among Malaysian older adults (Institute for Public Health, 2018), with a 95% confidence interval, an absolute precision of ± 0.05 , and a design effect of 2. After incorporating a 20% non-response rate and an 80% eligibility rate, the final target sample was set at 1,136 participants. Proportionate quota sampling was applied to allocate participants across the three regions in a manner commensurate with the distribution of the elderly population. Participants in each region were recruited using convenience sampling, a practical necessity due to the geographic complexity, restricted accessibility, and logistical difficulties inherent to fieldwork in Sarawak.

The convenience sampling approach may introduce selection bias, potentially over-representing more accessible communities and healthier, mobile older adults while under-representing the most isolated or frail individuals. To mitigate these biases, we implemented systematic demographic balancing across age, sex, ethnicity, and socioeconomic strata. Regional quota allocation ensured proportionate representation across Southern, Central, and Northern Sarawak. However, findings may not fully generalise to institutionalised elderly individuals, those with severe cognitive impairment, or the most geographically remote populations.

Methods for Collecting Data

There were three parts to the closed-ended questionnaire:

(i) Sociodemographic features: these include age, sex, monthly household income, race, religion, level of education, occupation, marital status, size of family, and self-reported health conditions among the variables.

(ii) Age-Friendly Environments Questionnaire: Buildings and outdoor spaces, social participation, respect and inclusion, civic engagement and employment, communication and information, community support and health services, outdoor spaces, and transportation are the eight domains covered by the AFE Questionnaire, which was derived from the World Health Organization's age-friendly framework (World Health Organization, 2007). A 10-point Likert scale was used to score each item ('1' being strongly disagree to '10' being strongly agree). A composite total AFE score was computed by summing together all of the domain scores, which were obtained by adding the item answers within each corresponding domain. Throughout the study, domain-level and overall scores were considered as continuous variables, with higher scores denoting perceived surroundings that are more supportive.

The AFE Questionnaire's validity and reliability were thoroughly assessed before it was used in this investigation (Azman & Stephen, 2025). The eight-domain theoretical framework was validated by exploratory component analysis; all item factor loadings were greater than 0.50. Strong internal consistency was demonstrated by Cronbach's alpha values ranging from 0.78 to 0.86 across domains, exceeding the standard criterion of 0.70.

(iii) Psychosocial Wellbeing: The validated Malay version of the Mental Health Continuum-Short Form (MHC-SF) assessed psychosocial wellbeing using 11 items in three dimensions: emotional wellbeing (3 items assessing happiness, life satisfaction, and positive affect), social wellbeing (5 items assessing social contribution, integration, and acceptance), and psychological wellbeing (3 items assessing personal growth, purpose in life, and self-acceptance). Each item was scored on a 10-point Likert scale, with higher scores indicating better psychological wellness. Psychometric evaluation confirmed that all items loaded above 0.50, collectively accounting for 74% of total variance (Azman & Stephen, 2025). A Cronbach's alpha of 0.81 further substantiated the instrument's reliability for use with this population.

Procedure for Data Collection

Face-to-face questionnaires were administered by trained fieldworkers to gather data. In order to acknowledge the diverse linguistic heritage of Sarawak, all interviews were conducted in the respondent's preferred language, which was either Malay, Iban, or English. The period of data collection was from March 2023 to October 2024.

Data Analysis

The dependent variable was psychosocial wellbeing while the eight AFE domain scores served as the independent variables. The Durbin-Watson statistic of 1.584 (below the ideal range of 1.8–2.2) indicated positive autocorrelation, suggesting some dependence between observations. The Breusch-Pagan test ($p < .001$; $\chi^2(1) = 35.29$) confirmed significant heteroskedasticity, meaning error variance was non-constant across predictor levels. Univariate and multivariate normality assumptions were also violated. However, multicollinearity was not problematic (all VIF values < 5 , tolerance > 0.2). Visual inspection of robust Mahalanobis distance and Cook's distance plots identified outliers with high influence. These violations of classical ordinary least squares (OLS) assumptions

justified the use of robust regression, which provides consistent estimates even when normality and homoskedasticity assumptions are violated.

Robust regression was selected as the optimal analytical approach for three reasons: (1) it provides resistance to outliers and influential observations (Hair et al., 2019) identified in our dataset; (2) it produces consistent parameter estimates without requiring the normality and homoscedasticity assumptions that our data violated; and (3) it yields more reliable inference compared to ordinary least squares when dealing with heteroscedastic errors. The substantial improvement in adjusted R² from 0.45 (OLS) to 0.54 (robust model) demonstrates the enhanced model fit achieved through this approach. Statistical significance was determined by a p-value of less than .05, and unstandardised beta coefficients with 95% CI were reported.

Ethical Clearance

The ethics committee of Universiti Malaysia Sarawak (UNIMAS) approved this study (TNCPI/09–6.5.01 Jld.2). We obtained written informed consent from all participants.

RESULTS

Socio-demographic features

A total of 1,077 respondents, representing 94.8%, completed the questionnaire. The mean age of the total respondents was 67.11 years (SD = 6.62). The sociodemographic profile reveals a predominantly under 75 years of age, with a balanced gender distribution. The ethnic composition reflects Sarawak's diversity, with Dayak communities comprising nearly half the sample. Educational attainment was generally low (57.4% primary education or less), and most respondents were not working (82.4%), consistent with retirement patterns. The majority reported existing medical conditions (59.7%). Table 1 summarises the sociodemographic features.

Table 1: Distribution of the Respondents by Sociodemographic Features (N = 1077)

Variable	Frequency	Percentage
<i>Age</i>		
60 to 64	462	42.9
65 to 74	473	43.9
75 and above	142	13.2
<i>Sex</i>		
Male	560	52
Female	517	48
<i>Race</i>		
Malay	178	16.5
Dayak	515	47.8
Chinese	198	18.4
Others	186	17.3
<i>Religion</i>		
Muslim	368	34.2
Christian	640	59.4
Others	69	6.4
<i>Level of education</i>		
Up to primary	618	57.4
Secondary	395	36.7
Tertiary	64	5.9
<i>Working status</i>		
No	887	82.4
Yes	190	17.6
<i>Marital status</i>		
Married	791	73.4
Not married/single	48	4.6

Divorced/widowed	238	22
Household size		
Less than 5 members	622	57.7
5 to 7 members	343	31.9
8 or more members	112	10.4
Monthly household income (MYR)		
Less than 2000	603	56
Between 2001 to 3000	299	27.8
More than 3000	175	16.2
Medical problems		
No	434	40.3
Yes	643	59.7

Psychosocial wellbeing and age-friendly environments

Table 2 presents the means, standard deviations, and intercorrelations among AFE domains and psychosocial wellbeing. Correlation analysis revealed moderate to strong positive associations across AFE domains ($r = 0.13$ to $r = 0.72$). Social participation achieved the highest mean score ($M = 70.05$, $SD = 17.15$), while communication and information achieved the lowest ($M = 29.06$, $SD = 11.21$), suggesting a potential area of concern for elderly Sarawakians. All AFE domains were significantly correlated with psychosocial wellbeing, with civic participation and employment demonstrating the strongest relationship ($r = 0.58$). The overall AFE mean of 374.17 ($SD = 84.53$) reflects moderate perceived age-friendliness across the sample. The strong intercorrelations among AFE domains ($r = 0.13$ – 0.72) suggest that age-friendliness functions as an interconnected system rather than through isolated domain effects.

Table 2: Relationship of the Overall Scores of Each Afes Variables and Psychosocial Wellbeing (N=1077)

Variable	1	2	3	4	5	6	7	8	9	Mean	SD
1 Housing	-									38.08	7.75
2 Social Participation	0.49*	-								70.05	17.15
3 Respect and Social Inclusion	0.42*	0.61*	-							54.68	11.31
4 Civic Participation and Employment	0.29*	0.66*	0.56*	-						34.66	8.79
5 Communication and Information	0.14*	0.49*	0.47*	0.59*	-					29.06	11.21
6 Community Support and Health Services	0.21*	0.50*	0.57*	0.47*	0.66*	-				59.64	17.92
7 Outdoor Spaces and Buildings	0.21*	0.48*	0.55*	0.48*	0.60*	0.62*	-			46.25	17.56
8 Transportation	0.13*	0.41*	0.44*	0.47*	0.59*	0.47*	0.72*	-		41.74	20.41
9 Psychosocial Wellbeing	0.44*	0.53*	0.49*	0.58*	0.33*	0.33*	0.38*	0.41*	-	79.85	17.28

Note. * $p < .05$.

Regression Analysis

Substantial predictive power was demonstrated by the robust regression model, which accounted for 54% of the variance in psychosocial wellbeing ($R^2 = 0.54$). Six of the eight AFE domains emerged as significant predictors (Table 3). Civic participation and employment showed the strongest positive effect ($\beta = 0.69$, $SE = 0.08$, 95% CI [0.55, 0.85]), followed by housing ($\beta = 0.54$, $SE = 0.07$, 95% CI [0.40, 0.67]), then respect and social inclusion ($\beta = 0.22$, $SE = 0.06$, 95% CI), then transportation ($\beta = 0.17$, $SE = 0.03$), and finally social participation ($\beta = 0.14$, $SE = 0.05$). Notably, communication and information demonstrated a significant negative association ($\beta = -0.19$, $SE = 0.06$, 95% CI [-0.31, -0.07]), contrary to expectations. There were no statistically significant differences noted for the community support and health services ($\beta = -0.03$, $p > .05$) and outdoor spaces and buildings ($\beta = -0.01$, $p > .05$).

Table 3: Results of Robust Regression Analysis on AFE Domains and Psychosocial Wellbeing (N = 1077)

Variable	Estimate	Standard Error (S.E)	t value
(intercept)	13.88	2.57	5.41*
Housing	0.54	0.07	7.81*
Social Participation	0.14	0.05	2.96*
Respect and Social Inclusion	0.22	0.06	3.67*
Civic Participation and Employment	0.69	0.08	9.07*
Communication and Information	-0.19	0.06	-3.14*
Community Support and Health Services	-0.03	0.04	-0.71
Outdoor Spaces and Buildings	-0.01	0.04	-0.25
Transportation	0.17	0.03	5.08*

R-squared: 0.54

Adjusted R-squared: 0.54

*Note. *p < .05.*

A cautious interpretation is warranted by the negative correlation between psychosocial wellbeing and communication and information. This likely reflects digital divide challenges in Sarawak— an increased awareness of information technologies without corresponding access or digital literacy may create frustration rather than benefit. The non-significant results for community support and health services, as well as outdoor spaces and buildings, might be due to substitution effects, in which current government-funded programmes effectively address demands, or accessibility limitations that restrict the built environment's salience to this demographic.

DISCUSSION

These results validate that wellbeing outcomes are enhanced by matched environmental supports, which is consistent with the Ecological Theory of Ageing and the Person-Environment Fit Model. The negative communication and information association further reflects a mismatch between digital technology demands and the limited digital literacy of older adults. Consistent with a two-pronged approach to age-friendly design, both the objective accessibility of environments and older adults' subjective perceptions of those environments play meaningful roles in shaping wellbeing (Shen, 2014; Toma et al., 2015).

Rowles et al. (2003) observed that housing was a significant predictor of psychosocial wellbeing, which is indicative of the fact that the household becomes the primary location for social interaction and daily life as mobility decreases. Safe, well-maintained, and adaptable housing fosters autonomy and personal control — both fundamental to psychological health (Bahnini et al., 2022). These findings underscore the value of housing adaptation programmes that enable older adults to age in place.

The evidence that regular social engagement delays the advent of disability, promotes vitality, and reduces the risk of cognitive decline is consistent with the fact that social participation substantially predicts psychosocial wellbeing (Forsman et al., 2013; Levasseur et al., 2020; Novek et al., 2013). This finding is further corroborated at the national level, where family support and social connectedness were among the strongest predictors of psychosocial wellbeing in Malaysian older adults (Awang et al., 2022). Environments that facilitate meaningful social interaction are therefore both empirically warranted and culturally resonant in Sarawak's community-oriented context.

Civic participation and employment were the strongest predictors of psychosocial wellbeing in this study. Active involvement in community life sustains a sense of purpose, reinforces personal identity, and has been associated with reduced mortality and healthier behaviour (Batista & Cruz-Ledón, 2008; Filges et al., 2020). In Sarawak's multi-ethnic communities, programmes that leverage existing indigenous social networks and communal traditions may amplify these benefits beyond conventional volunteering models.

Accessible transportation was positively associated with psychosocial wellbeing, underscoring its role in enabling autonomy, social participation, and access to health services (Menec et al., 2011). In a geographically dispersed state like Sarawak, where rural communities are separated by considerable distances and infrastructure remains uneven, tailored mobility solutions require specific policy attention.

A significant negative association was observed between communication and information and psychosocial wellbeing, contrary to prior evidence (Black & Hyer, 2020). Limited digital literacy, financial barriers, and physical constraints such as visual impairment may transform digital resources into sources of frustration rather than benefit. This negative association likely reflects Sarawak's limited broadband penetration in rural areas and low digital literacy among elderly respondents, where higher exposure to communication technology may amplify awareness of service inadequacies rather than benefit wellbeing.

Expanding infrastructure alone is therefore insufficient without concurrent investment in culturally appropriate digital literacy support.

Substitution effect may account for the lack of a substantial correlation between psychosocial wellbeing and health services and community support (Hao, 2008). The Malaysian government's existing provision of primary care clinics, social welfare services, and long-term care facilities (Department of Social Welfare Malaysia, 2023) may generate a perception among older adults that their needs are already adequately met, thereby diminishing the incremental impact of further community support.

No significant association was found for outdoor spaces and buildings. According to Gothe et al. (2020) and Huang et al. (2019), the availability of outdoor surroundings may not have the same direct impact on wellbeing as individual levels of physical activity. It is possible that older adults with limited mobility may perceive outdoor spaces as inaccessible, and the extent to which environmental benefits are realised is further influenced by factors such as safety, aesthetics, and park maintenance (Teh et al., 2023; van Hoof et al., 2021).

This study has several limitations. The cross-sectional design precludes causal inference. Sarawak's multicultural context introduced challenges in conducting interviews across diverse languages and ethnicities, and differential item interpretation remains possible — particularly given age-related hearing limitations among some respondents. Self-reported data are additionally susceptible to recall bias. These limitations notwithstanding, the study's large sample, geographic breadth, and use of validated instruments strengthen the credibility of the findings within the Sarawakian context.

FINDINGS AND IMPLICATIONS

The findings from this study carry clear implications for policymakers, urban planners, and health practitioners in Sarawak and similar multi-ethnic contexts:

1. **Housing Modifications and Age-in-Place Support:** Housing modification subsidies enabling age-in-place adaptations—including grab bars, ramps, and non-slip flooring—should be prioritised to support independent living among older adults. Given the strong association between housing and psychosocial wellbeing ($\beta = 0.54$), investment in home adaptation programmes represents a cost-effective intervention compared to institutional care.
2. **Civic Engagement Infrastructure:** Community centres offering intergenerational programmes, skills-sharing initiatives, and volunteer opportunities would strengthen civic engagement across Sarawak's multi-ethnic population. With civic participation showing the strongest predictor effect ($\beta = 0.69$), creating accessible civic infrastructure should be a policy priority.
3. **Accessible Transportation Solutions:** Accessible transport options tailored to rural-urban contexts are critical to reducing social isolation and enabling older adults to maintain community connections. Transportation interventions should consider geographic dispersion and ethnic diversity in service design.
4. **Digital Inclusion Programmes:** Digital literacy training tailored to cultural and language needs is essential to bridge the technology gap identified in this study. The negative association between communication/information and wellbeing ($\beta = -0.19$) suggests that awareness without access creates frustration. Programmes should provide both training AND infrastructure access.
5. **Systematic Monitoring Framework:** A systematic monitoring framework aligned with the eight WHO age-friendly domains should be institutionalised to guide ongoing, evidence-based ageing policy in Sarawak. Regular assessment using validated instruments (such as the AFEs Questionnaire validated in this study) would enable data-driven policy adjustments.

CONCLUSION

The psychosocial wellbeing of older adults in Sarawak was significantly predicted by six of the eight AFE domains: housing, social participation, respect and social inclusion, civic participation and employment, communication and information, and transportation. Collectively, these domains accounted for 54% of the variance in wellbeing outcomes. Perceived age-friendliness was positively associated with psychosocial wellbeing across five domains, while social and civic domains outperformed physical domains in predictive strength, with civic participation and employment emerging as the strongest predictor.

These findings contribute domain-specific empirical evidence that reinforces Malaysia's engagement with the WHO Global Network for Age-Friendly Cities and Communities and supports Sarawak's efforts to meet age-friendly standards in line with its 2028 demographic milestone. Sarawak's geographic dispersion and rural settlements require interventions distinct from urban models. Strong housing effects favour in-situ improvements over institutional care, while transportation findings necessitate community-based mobility solutions. Ethnic diversity demands culturally sensitive designs respecting indigenous systems, warranting policies beyond WHO's urban-focused age-friendly framework and distinct policy attention as Malaysia's rural regions age rapidly.

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