Accepted on 20 March 2022

Associations between Social support Provided and Walkability among Older Adults: Health Self-Consciousness as a Moderator

Abstract

Background – The social support provided or given to others play a key role in healthy ageing. Empirical and anecdotal evidence suggests that walkable neighbourhoods can positively influence social support given. Higher health self-consciousness may strengthen the positive association between walkability and social support provided.

Aim – This study investigated whether the association between walkability and social support provided is moderated by health self-consciousness.

Methods – A cross-sectional design with sensitivity analysis and recommended procedures against common methods bias was employed. The study's population was community-dwelling older adults living in Accra, Ghana. Data from 923 participants were analysed using the hierarchical linear regression analysis.

Findings – The study found a positive association between walkability and social support provided after adjusting for the ultimate confounding variables. Health self-consciousness positively moderated the association between walkability and social support provided.

Conclusion – The study concludes that social support provided in older adults may be higher in more walkable neighbourhoods. Health self-consciousness can enhance the contribution of walkability to social support provided. Our results reinforce the importance of campaigns aimed at improving walkability of neighbourhoods.

Keywords: Walkability, social support, physical activity, older adults, Africa

1.0 Introduction

Social support can play a crucial role in the maintenance of health-seeking behaviours and health over the life course. Support from close and peripheral social ties facilitate and sustain active behaviours (e.g., physical activity) in the ageing process (Levasseur et al., 2015; Lee & Tan, 2019; Loh et al., 2019). More so, social support is necessary for a relatively healthy life among seniors facing physiological limitations (e.g., frailty) and a decline in cognition (Mohd et al., 2019; Lee & Tan, 2019). To explain, older adults who face mobility or cognitive limitations would need support from their family members to access services (healthcare) in the community. It is, therefore, understandable why interventions such as the creation of walkable and inclusive neighbourhoods that encourage social participation are an apex public health agenda (Roy et al., 2021; Liao et al., 2020; Asiamah et al., 2021a). Walkable neighbourhoods also enable access to social support and provide opportunities for maintaining this form of social capital into later life (Loh et al., 2019; Mohd et al., 2021; Asiamah et al., 2021a; Asiamah et al., 2021b).

Neighbourhood walkability is used to describe high residential density, mixed land use (i.e., industrial, and residential uses), and street connectivity (Sallis et al., 2010). Walkable neighbourhoods are characterised by essential services, road signs (e.g., traffic lights), parks, sidewalks, and psychosocial neighbourhood factors such as safety and peace. Person-environment (P-E) fit models, particularly Lewin's (1951) framework argue that people living in more walkable neighbourhoods are encouraged by the above built environment factors to maintain social support through lifelong social engagement. Corroborating this argument is research (Hand et al., 2012; Lee & Tan, 2019; Loh et al., 2019; Asiamah et al., 2021b) confirming that social support is higher in walkable neighbourhoods. More specifically, Lee and Tan (2019) in the United States (US) found a positive association between social support and key domains of neighbourhood walkability. In Australia, Loh et al. (2019) found that social support was positively associated with neighbourhood walkability. In Ghana, Asiamah and colleagues (2021b) found a positive association between social support and different built environment factors such as availability of services and safety. These pieces of evidence affirm that social support can be higher in more walkable neighbourhoods.

Given the above-mentioned role of social support in health-seeking behaviours and healthy ageing (Kim & Zakour, 2017; Lee & Tan, 2019), it is important to enable ageing people to maintain or replenish both received and provided social support over time. Commentaries in the extant literature (Geboers et al., 2014; Buja et al., 2020) suggest that health self-consciousness (HSC), defined as people's awareness of the value of health and their concerted efforts to maintain health (Gould, 1990), can influence healthy choices, including living in more walkable neighbourhoods and supporting others through volunteering. Similarly, people who are health self-conscious are more likely to understand and appreciate the role of walkable neighbourhoods in optimal health and utilize resources in these neighbourhoods (e.g., services, sidewalks, parks) to maintain physical activity (PA) and other healthy behaviours. Since walkable neighbourhoods can allow access to social support (Asiamah et al., 2021a; Asiamah, 2021; Asiamah et al., 2020b), residents who are more health self-conscious would better utilize walkable neighbourhoods to provide social support. In harmony with this thinking are person-environment fit models (Cantor, 1975; Wahl & Gerstorf, 2018), which assume that social capital including social support is received or provided more easily in more walkable neighbourhoods. These ideas imply that walkable neighbourhoods can have a stronger positive influence on social support among older adults with higher HSC.

Drawing on the foregoing assertions, HSC may moderate the association between neighbourhood walkability and social support. Though these moderating roles can provide implications for health promotion, no identifiable study has examined it. A systematic review conducted by Levasseur et al. (2015) reveals that social support has predominantly been measured as 'social support received' or available and that a dearth of studies has considered 'social support provided'. The few studies (Asiamah et al., 2021a; Asiamah et al., 2021b) that considered 'social support provided' measured it as a domain of social activity but not as a distinct potential outcome of neighbourhood walkability. More importantly, the moderating role mentioned earlier has not been assessed though they have implications for health promotion. These shortcomings are worth addressing for a couple of reasons. First, social support provided is as important as social support received since the latter cannot exist without the former. This idea aligns with the import that older adults cannot have social support if it is not provided by others (Asiamah et al., 2021a; Asiamah et al., 2021b; Kim & Zakour, 2017). If so, the desired effect of neighbourhood walkability on healthy ageing would include its opportunities for providing social support or repaying support received. This reasoning justifies a need for social support provided to be balanced in the empirical literature with social support received in terms of how it relates to walkability and HSC.

This study, therefore, aimed to address two research questions: *(1) is neighbourhood walkability associated with social support provided,* and *(2) is the association between* *neighbourhood walkability and social support provided moderated by HSC?* We attempted to address these questions to discuss implications for health promotion and to provide key findings relevant to the design of a potential cluster randomized controlled trial.

2.0 Methods

2.1 Design

This study adopted a cross-sectional design including sensitivity analyses adopted from Asiamah et al. (2021a) and procedures from some studies (Siemsen et al., 2010; Jacobsen & Jensen, 2015) against common methods bias (CMB). The sensitivity analyses were performed to adjust for potential confounding variables and to assess the potential influences of the confounding variables on the primary relationships of interest. Measures against CMB enabled us to avoid or minimise potential bias associated with data gathered at a fixed time.

2.2 Participants, sample, and selection

The participants of this study came from a sample recently used by Asiamah et al. (2021). This sample came from a research registry of 1,092 older residents in Accra aged 60 years or higher. This existing group was used because it was representative of older adults in Accra and met relevant inclusion criteria, namely: (1) being an older adult aged 60 years or higher; (2) having a minimum of basic education qualification (i.e., basic school leaving certificate), which was used as an indicator of the ability to read, speak, and write in English; (3) being a permanent resident of Accra; (4) not having any physiological or health problem that precluded walking, and (5) willingness to participate in the study voluntarily. Physicians in a health facility in Accra originally screened participants with the fourth criteria. A single question assessing the individual's ability to walk for at least 10 minutes was used to select participants who were currently active and met the fourth criterion. Over two weeks, older adults in the registry were contacted via a phone call to inform them about the study and identify those who met the inclusion criteria. We could not reach 88 individuals whereas 6 had lost their ability to walk unaided, so 998 met the inclusion criteria and consented to participate in the study. To maximise response rate and external validity, we decided to gather data on all 998 eligible participants.

2.3 Measurement

Previously validated scales were used to measure the three main variables of the study (i.e., walkability, social support provided, and HSC). Social support provided, subsequently referred to as 'social support', was measured with 3 items adopted from Asiamah et al. (2021b). These items constitute a domain (i.e., social support for others) within a previously validated measure of social activity and measured how often individuals provided social support to their social network members, particularly their peers. In the current study, the Cronbach's α coefficient of social support was 0.81. Appendix A shows items used to measure social support.

Neighbourhood walkability was measured with the Australian version of the Neighbourhood Environment Walkability Scale (NEWS-A) adopted in whole from Asiamah et al. (2021a). This scale accompanies five descriptive anchors (i.e., strongly disagree, disagree, somewhat agree, agree, and strongly agree) and produced a satisfactory Cronbach's α coefficient = 0.89 in the source study. In the current study, it produced a Cronbach's α coefficient = 0.91, which evidenced its internal consistency. This scale was transferrable to the current study for two main reasons. First, it produced satisfactory results on a similar

Ghanaian sample. Secondly, it is relatively short and was, therefore, easy to complete by older adults with potential vision and physiological limitations. HSC was measured with a 9-item standard scale wholly adopted from Gould (1990). It was associated with the same descriptive anchors as neighbourhood walkability and produced a Cronbach's α coefficient = 0.88. Appendices B and C respectively show items used to measure walkability and HSC.

Other variables measured in this study were personal characteristics likely to confound the primary association assessed. These variables are gender, physical function, employment status, education, income, chronic disease status (CDS), relationship status, context experience, and age. We drew on previous studies (Kim & Zakour, 2017; Asiamah et al., 2021; Asiamah et al., 2021a) to measure these variables. Gender was measured as a categorical variable (male versus female) likewise employment status (i.e., not employed versus employed), relationship status (i.e., no versus yes), and CDS (i.e., none versus one or more). Regarding relationship status, 'yes' meant that the individual was married or was in a romantic relationship. Context (neighbourhood) experience was measured as how long (in years) individuals had lived in their current neighbourhoods. Education was measured as years of formal schooling whereas physical function was measured with a single item that asked seniors to indicate the extent to which they could perform physical tasks unaided (Asiamah et al., 2021a). This item was associated with four anchors (i.e., not at all, low extent, moderate extent, high extent). CDS was measured by asking participants to report all chronic conditions that had been diagnosed on them. All categorical variables were dummy coded for their inclusion in regression analysis.

A self-reported questionnaire was used to gather data. The questionnaire had four main sections, with the first section measuring the demographic and confounding variables.

The second section presented items on social support. Sections 3 and 4 measured neighbourhood walkability and HSC respectively. Before the first section was a preamble that introduced the study's aim and significance. This introductory part also included the research ethics statement and instructions for completing the questionnaire accurately. Appendix D (Part 1) shows measures taken against CMB.

2.4 Data collection

This study received ethical clearance from an institutional ethics review board in Accra (No. 003-2021ACE) after the study's protocol was reviewed by the board. Participants provided written informed consent delivered by a courier driver after they read the study's informed consent and ethical statements. Over two weeks, questionnaires in sealed and stamped envelopes were delivered to older adults at home by the courier driver accompanied by a research assistant. The participants completed questionnaires over a period of two weeks. Thus, the data gathering process lasted about four weeks (12th August to 9th September 2021). A total of 932 questionnaires were returned, but 9 were not completed or were filled halfway. So, 923 questionnaires were analysed.

2.6 Statistical data analysis

Data were analysed with SPSS (Statistical Package for Social Sciences) version 28 in two phases. The first exploratory phase was focused on generating summary statistics on variables, conducting the sensitivity analysis, and evaluating assumptions (e.g., the existence of correlations between variables, linearity of the relationships, normality of the data, absence of multicollinearity, and independence of errors) governing the use of Hierarchical Linear Regression (HLR) analysis, which was used to analyse the relationships of interest.

The second phase employed the HLR analysis to analyse our primary relationships. Appendix D (Part 2) shows all exploratory analyses performed, including an assessment of assumptions governing the use of HLR analysis (Asiamah et al., 2021a; Osborne & Waters, 2003; Casson & Farmer, 2014).

We assessed the correlations between relevant variables with Pearson's correlation test. The key correlations of interest were significant at $p<0.05$, setting a basis for the HLR analysis. Following this, the association between walkability and social support was examined with the first model (i.e., Model 1) that does not incorporate the ultimate confounding variable, income. The second model (i.e., Model 2) differed from the first with its inclusion of the confounding variable. The third model (i.e., Model 3) tested the relationship between social support and the interaction term between HSC and walkability. The fourth model (i.e., Model 4) builds on model 3 by incorporating the ultimate confounder. As part of the sensitivity analysis, we compared models with and without the confounding variables to see how much the regression weights changed between them. The ultimate models serving as the source of our conclusions are the models including the ultimate confounders (Asiamah et al., 2021a).

To assess the moderation role of HSC, we generated a dummy variable representing the interaction between HSC and walkability (i.e., HSC*NW). We then tested a *pure moderation role* (Geboers et al., 2014; Asiamah et al., 2021a), which means that we were interested in only how the strength of the relationships between walkability and social support was changed by HSC. In harmony with Asiamah et al. (2021a), we generated a scatter plot that depicts the moderating role of interest. The statistical significance of all the results was detected at a minimum of $p<0.05$.

Table 1. Summary of findings from the sensitivity analysis (n = 923)

Predictor	Stage 1			Stage 2		
	β	t	p	Adjusted β	Change in β	% Change in β
Neighbourhood walkability[a]	0.17	5.18	<.001	---	---	---
Gender (reference – male)[c]	0.17	4.01	<.001	0.177	0.009	5%
PF[b]	-0.02	-0.53	0.598	---	---	---
ES (reference – not employed)[c]	-0.05	-1.33	0.183	0.162	-0.006	-4%
Education (yrs)[b]	0.05	0.83	0.406	---	---	---
Income (₵)[d]	0.08	1.52	0.130	0.216	0.048	29%
CDS (reference – none)[c]	-0.14	-3.29	0.001	0.166	-0.002	-1%
RS (reference – no)[b]	0.04	0.96	0.337	---	---	---
CE (yrs)[b]	0.02	0.57	0.570	---	---	---
Age (yrs)[c]	0.23	5.55	<.001	0.169	0.001	1%

Note: --- Not applicable; [a] Neighbourhood walkability serving as the predictor of social support at stage 1; [b] variables removed in the first stage of the sensitivity analysis; [c] variable removed at the second stage of the analysis; [d] ultimate confounding variables retained for the actual analysis.

Table 2. Demographic and personal characteristics of participants (n = 923)

Variable	Group	Frequency[a]/Mean[b]	Percent(%)[a]/SD[b]
Categorical variables			
Gender	Male	468	50.70
	Female	455	49.30
Physical function	No	286	30.99
	Yes	597	64.68
	Missing	40	4.33
Employment status	No	91	9.86
	Yes	787	85.27
	Missing	45	4.88
Chronic disease status	None	94	10.18
	One or more	804	87.11
	Missing	25	2.71
Relationship status	No	280	30.34
	Yes	529	57.31
	Missing	114	12.35
Continuous variables			
Education (yrs)	---	18.16	9.27
Income (₵)	---	765.61	388.79
Context experience (yrs)	---	11.16	5.47
Age (yrs)	---	67.76	5.23
Social Support	---	7.19	0.91
Neighbourhood Walkability	---	31.66	2.73
HSC	---	23.07	4.23

Note: SD – standard deviation; --- Not applicable; [a]for categorical variable; [b]for continuous variables

3.0 Findings

Table 1 shows results from our sensitivity analysis for the ultimate confounding variables. In the table, income is the only variable retained as the ultimate confounder as it is the only variable associated with a percentage ≥10%. Table 2 shows summary statistics on participant characteristics. In this table, 51% (n = 468) of the participants were men whereas 87% (n = 804) of the respondents had at least one chronic condition. The average age of participants was 68 years (Mean = 67.76; SD = 5.23). The mean neighbourhood walkability is 31 (Mean = 31.66; SD = 2.73).

Table 3. Bivariate correlations between primary and confounding variables (n = 923)

Variable	No.	1	2	3	4	5	6
Neighbourhood walkability	1	1	.169**	.358**	.651**	-.091**	0.056
Social support	2		1	.139**	.170**	-.263**	.185**
Health self-consciousness	3			1	.939**	-0.02	0.023
HSC*NW	4				1	-0.039	0.038
ES (reference – not employed)	5					1	-.118**
Income (₵)	6						1

**p<0.001; *p<0.05; HSC – health self-consciousness; NW – neighbourhood walkability; ES – employment status

Table 3 shows the correlation between relevant variables, including the ultimate confounding variables. This table shows a positive correlation between neighbourhood walkability and social support (r = 0.169; p < 0.001; two-tailed). These results connote that higher social support was associated with larger scores of walkability. There is also a positive correlation between neighbourhood walkability and HSC (r = 0.358; p < 0.001; two-tailed), which means that HSC was associated with larger scores of walkability. Other relevant correlations are shown in Table 3.

Table 4 shows 4 regression models assessing the primary relationships of interest. This table (model 2) shows a positive association between neighbourhood walkability and social support after controlling for income (β = 0.22; t = 6.13; p < 0.001), which confirms that higher social support was associated with larger scores of walkability. HSC (in model 4) positively moderates the association between walkability and social support (β = 0.23; t = 6.47; $p < 0.001$), which implies that neighbourhood walkability was associated with higher social support among those with higher HSC.

Table 4. The associations between walkability, social support provided, and health self-consciousness (n = 923)

Model	Predictor	Coefficients			95%CI	Tolerance	R^2	Adjusted R^2	Durbin-Watson	F-test
		B	SE	β(t)						
1	(Constant)	5.41	0.35	(15.69)**	±1.35	---	0.028	0.027		26.80**
	NW	0.06	0.01	0.17(5.18)**	±0.04	---	---	---	---	---
2	(Constant)	4.56	0.38	(12.14)**	±1.48	---	0.081	0.079	2.31	32.81**
	NW	0.07	0.01	0.22(6.13)**	±0.05	1.00	---	---	---	---
	Income (₵)	0.00	0.00	0.17(4.93)**	±0.00	1.00	---	---	---	---
3	(Constant)	6.52	0.13	(49.82)**	±0.51	---	0.029	0.028		27.64**
	HSC*NW	0.00	0.00	0.17(5.26)**	±0.00	---	---	---	---	---
4	(Constant)	5.92	0.16	(37.81)**	±0.62	---	0.086	0.084	2.24	35.05**
	HSC*NW	0.00	0.00	0.23(6.47)**	±0.00	1.00	---	---	---	---
	Income (₵)	0.00	0.00	0.18(5.09)**	±0.00	1.00	---	---	---	---

**p<0.001; *p<0.05; NW – neighbourhood walkability; HSC – health self-consciousness; ES – employment status; SE – standard error (of B); CI – confidence interval (of B)

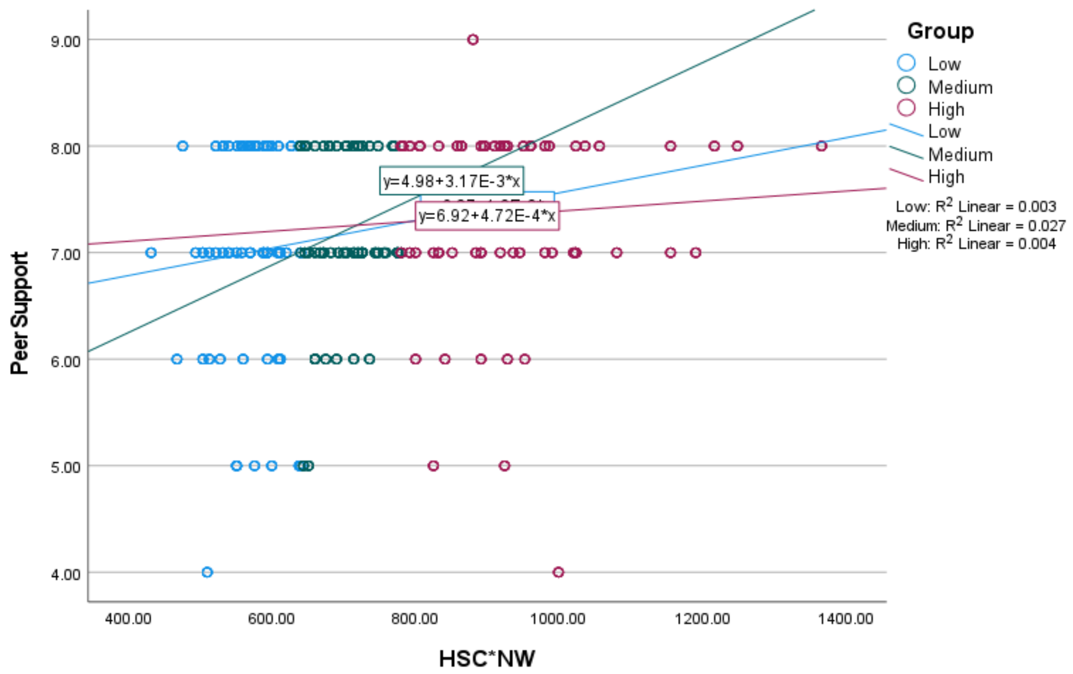

Fig 1. The association between peer support and the interaction between HSC and neighbourhood walkability (n = 923; low = 307; medium = 308; high = 308)

In Table 4, the baseline models (models 1, and 3) produce different standardized coefficients compared to the ultimate models. These differences are due to the influences of the confounding variables in the ultimate models; hence, it was important to adjust for the ultimate confounding variables. All models in Table 4 produced a significant F-test at a minimum of $p<0.05$. All multiple models also accounted for Durbin-Watson statistics that are approximately 2, which satisfies the independence-of-errors assumption. Each predictor in the multiple models also produced values of tolerance ≥0.9, which confirms the absence of multicollinearity among the predictors. Figure 1 shows the relationship between social support and the interaction between walkability and HSC. In the figure, the groups 'medium' and 'high' are associated with larger variances, which signifies the positive moderating role of HSC in the association between social support and walkability.

4.0 Discussion

This study evaluated the associations between neighbourhood walkability and social support. The moderating role of HSC in these relationships is also examined.

This study confirmed a positive association between neighbourhood walkability and social support, which means that older adults living in more walkable neighbourhoods reported higher support for their social network members. This result agrees with Cantor's (1975) P-E fit framework, which premises that neighbourhoods characterised by services, pavements, parks, and psychosocial factors (e.g., peace, safety) encourage residents to engage in social activities that provide opportunities for exchanging ideas and knowing about the needs of others. These social events are avenues for providing support to loved ones and peers, which means that people who live in isolation are unlikely to support people in need of support. This reasoning and our result are consistent with evidence from some studies conducted in the US, Australia, and Ghana (Loh et al., 2019; Lee & Tan, 2019; Asiamah et al., 2021b). Apart from the study of Asiamah and colleagues (2021b), nevertheless, the foregoing studies measured social support in terms of 'support received' rather than 'support provided', which means that the current study extends the scope of the literature and signifies the likelihood of walkable neighbourhoods enabling seniors to reach out to their peers with social support. This is to say that neighbourhood resources that form the core of walkability can facilitate the provision of essential social support in older adults.

The above result also suggests that older adults who like to participate in neighbourhood social activities and provide social support choose to live in more walkable neighbourhoods. This alternative explanation of the association between social support and walkability is based on our cross-sectional design (Asiamah et al., 2019), which could not establish causation between walkability and social support but accounts for only correlations between these variables. For a couple of reasons, this point of view reinforces the importance of walkable neighbourhoods and interventions aimed at creating or improving the walkability of every neighbourhood. First, improving the walkability of communities can improve social support provided and reduce social disengagement. Secondly, social support provided and opportunities to participate in social activities would be uniformly distributed if every neighbourhood is sufficiently walkable; older adults would not be compelled to move to places of higher walkability since their community is sufficiently walkable. This is to say that inequalities in walkability can result in overpopulation of highly walkable neighbourhoods since many people would abandon less walkable communities for the walkable ones.

HSC significantly moderated the association between neighbourhood walkability and social support. This result well aligns with Vahedian-Shahroodi et al.'s (2021) adaptation of the health belief model (HBM), which posits that people would pursue healthy habits if they were aware of the importance of health and what to do to remain healthy. Health literacy and HSC are indicators of individuals' awareness of the importance of health and actions that benefit health (Koch et al., 2022; Buja et al., 2020). Older adults with higher HSC are likely to know about the value of walkability factors (i.e., parks, services, pavements) and how to use these resources to maintain healthy habits (e.g., social activity, PA) and health. Earlier in this section, it was mentioned that older adults may move to places of higher walkability to savour opportunities for social activities and providing social support. According to Vahedian-Shahroodi and colleagues, this action is partly due to people including older adults being conscious of their health. So, the above confirmed moderating role signifies the importance of health self-consciousness in the utilization of neighbourhood resources for social activities and explains why seniors can relocate to places of higher walkability to maintain social engagement and provide social support.

The foregoing findings have several implications for health promotion. First, our results support community design interventions aimed at improving access to walkable resources in the community; more walkable neighbourhoods with their services, sidewalks, and psychosocial factors (e.g., peace, safety) better enable seniors to support social network members. A key lesson is that walkable neighbourhoods do not only provide access to support but also provides an opportunity for reaching out to peers with essential support. Secondly, neighbourhood walkability improvement would encourage social inclusion by providing resources that encourage ageing people to widen out and participate in events and activities with others. This viewpoint is premised around the idea that social activities are rich in social capital (e.g., social support, trust, reciprocity) that promote lifelong engagement in group and community events (Hand et al., 2012; Asiamah, 2021b). This being so, the design of neighbourhoods to encourage health-seeking behaviour and a sense of community is supported by our data and could be one of the ways forward in enabling people to age well in their communities. This effort is the core of the 'ageing in context' initiative (Black & Oh, 2021; Asiamah, 2021; Asiamah et al., 2021a; Asiamah et al., 2021b), which emphasises interventions enabling and encouraging ageing people to maintain optimal health in their preferred neighbourhoods. Moreover, health education programs intended to enhance the health literacy of seniors can enhance the utilization of walkable resources in the community. This outcome of the program would, in turn, improve opportunities for providing support to social network members. If seniors are sufficiently conscious about their health, they would value environmental resources that support health and utilize these resources to access and provide support.

Future applications of the above recommendations should be cognizant of the limitations of this study. For instance, our use of the cross-sectional design means that this study does not establish causation between the variables; hence, experimental designs such as cluster-randomized controlled trials are needed to improve our evidence. The above recommendations would be more significant after experimental studies have supported our findings. Even so, our study is important as it provides key information that future researchers may use to design their studies. For example, our regression weights (i.e., effect sizes) can be used in calculating the minimum sample size needed in future studies. Though this study was conducted after Coronavirus 2019 disease (COVID-19) restrictions including a lockdown were lifted, COVID-19 disruptions may have affected responses from participants. Possibly, older adults were not in the right mental and physiological conditions, which may have negatively impacted upon responses. Social engagement can be influenced by cultural norms, so responses from a Ghanaian sample may not be representative of other cultures, especially those in developed countries. Another limitation of our study is our utilization of relatively small sample as well as a non-probability sampling method, which can limit the generalizability of our findings. Even so, many previous studies (Roy et al., 2021; Wang et al., 2022; Asiamah et al., 2021a) had used similar samples and non-probability sampling methods under constraints like ours.

Despite the above limitations, our study is important and novel for some reasons. Firstly, it is the first to assess the association between social support provided (rather than social support received) and neighbourhood walkability. It is also the first to consider whether HSC moderates the association between walkability and social support in an African sample. It employs techniques that overcome or reduce the basic threats to the validity of cross-sectional studies, namely confounding and CMB. These techniques are consistent with the STROBE (i.e., Strengthening the Reporting of Observational Studies in Epidemiology), a standard checklist of items used to appraise cross-sectional designs (Hawwash & Lachat, 2019). We believe these techniques can be adopted by future researchers and make our study more replicable in other settings.

5.0 Conclusion

Higher neighbourhood walkability was associated with higher social support, which suggests that older adults in more walkable neighbourhoods were reported to have provided higher support for their peers. It can, therefore, be concluded that older adults' support for their peers and their engagement in social activities are higher in more walkable neighbourhoods. HSC enhanced the positive association between walkability and social support, which means that highly walkable neighbourhoods may better contribute to social support among those with higher HSC. Improving HSC through health education can, therefore, enhance the contribution of walkable neighbourhoods to social support.

References

Asiamah, N. (2021). Socially Active Neighborhoods for Older Adults: A Consolidation of Evidence from Psychometric Tests and Cross-Sectional Studies [Published Doctoral Dissertation], University of Portsmouth, School of Health and Care Professions, United Kingdom. https://researchportal.port.ac.uk/en/studentTheses/socially-active-neighbourhoods-for-older-adults

Asiamah, N., Conduah, A.K. & Eduafo, R. (2021a). Social Network Moderators of the Association between Ghanaian Older Adults' Neighborhood Walkability and Social Activity. *Health Promotion International, 36(1),* 1-9. https://doi.org/10.1093/heapro/daaa156

Asiaman, N., Kyriakos, K., Eduafo, R. & Borkey, R. (2021b). The influence of community-level built environment factors on active social network size in older adults: Social activity as a moderator. *International Quarterly of Community Health Education, 41(1),* 77-87. https://doi.org/10.1177/0272684X20915379

Asiamah, N., Mends-Brew, E., & Boison, B. K. T. (2019). A spotlight on cross-sectional research: Addressing the issues of confounding and adjustment. *International Journal* *of Healthcare Management*, 14(1), 183-196. https://doi.org/10.1080/20479700.2019.1621022

Berg-Weger, M. & Morley, J.E. (2020). Loneliness and Social Isolation in Older Adults during the COVID-19 Pandemic: Implications for Gerontological Social Work. *Journal of Nutrition, Health, and Ageing, 24,* 456–458. https://doi.org/10.1007/s12603-020-1366-8

Black, K., & Oh, P. (2021). Assessing Age-Friendly Community Progress: What Have We Learned? *The Gerontologist*, *62(1),* 6–17. https://doi.org/10.1093/geront/gnab051

Buja, A., Rabensteiner, A., Sperotto, M., Grotto, G., Bertoncello, C., Cocchio, S., Baldovin, T., Contu, P., Lorini, C., & Baldo, V. (2020). Health Literacy and Physical Activity: A Systematic Review. *Journal of Physical Activity and Health*, *17*(12), 1259–1274. https://doi.org/10.1123/jpah.2020-0161

Cantor, M. H. (1975). Life space and the social support system of the inner city elderly of New York. *The Gerontologist, 15,* 23–27. https://doi.org/10.1093/geront/15.1_part_1.23

Casson, R. J., & Farmer, L. D. M. (2014). Understanding and checking the assumptions of linear regression: A primer for medical researchers. *Clinical and Experimental Ophthalmology*, *42*(6), 590–596. https://doi.org/10.1111/ceo.12358

Geboers, B., De Winter, A. F., Luten, K. A., Jansen, C. J. M., & Reijneveld, S. A. (2014). The association of health literacy with physical activity and nutritional behavior in older adults, and its social cognitive mediators. *Journal of Health Communication*, *19*, 61–76. https://doi.org/10.1080/10810730.2014.934933

Hand, C., Law, M., Hanna, S., Elliott, S., & McColl, M. A. (2012). Neighbourhood influences on participation in activities among older adults with chronic health conditions. *Health and Place*, *18(4),* 869–876. https://doi.org/10.1016/j.healthplace.2012.03.004

Hawwash, D., & Lachat, C. (2019). Endorsing the STrengthening the Reporting of Observational Studies in Epidemiology-nutritional epidemiology (STROBE-nut) statement at Genes & Nutrition. *Genes Nutrition, 14,* 1-2. https://doi.org/10.1186/s12263-019-0655-5

Hofer-Fischanger, K., Fuchs-Neuhold, B., Müller, A., Grasser, G., & van Poppel, M. N. M. (2020). Health literacy and active transport in Austria: Results from a rural setting. *International Journal of Environmental Research and Public Health*, *17(4)*, 1-11. https://doi.org/10.3390/ijerph17041404

Jakobsen, M., & Jensen, R. (2015). Common method bias in public management studies. *International Public Management Journal*, *18*(1), 3–30. https://doi.org/10.1080/10967494.2014.997906

Kim, H. J., & Zakour, M. (2017). Disaster Preparedness among Older Adults: Social Support, Community Participation, and Demographic Characteristics. *Journal of Social Service Research*, *43*(4), 498–509. https://doi.org/10.1080/01488376.2017.1321081

Koch, P., Schillmöller, Z. & Nienhaus, A. (2022). How Does Health Literacy Modify Indicators of Health Behaviour and of Health ? A Longitudinal Study with Trainees in North Germany. *Healthcare, 10(1),* 1–15. https://doi.org/10.3390/healthcare10010002

Lee, J. H., & Tan, T. H. (2019). Neighborhood Walkability or Third Places? Determinants of Social Support and Loneliness among Older Adults. *Journal of Planning Education and Research, 0(0),* 1-14. https://doi.org/10.1177/0739456X19870295

Levasseur, M., Généreux, M., Bruneau, J. F., Vanasse, A., Chabot, É., Beaulac, C., & Bédard, M. M. (2015). Importance of proximity to resources, social support, transportation and neighborhood security for mobility and social participation in older adults: Results from a scoping study. *BMC Public Health*, *15*(1), 1–19. https://doi.org/10.1186/s12889-015-1824-0

Li, X., Rai, S.N., Rouchka, E.C., O'Toole, T.E. & Cooper, N.G.F. (2021). Adjusted Sample Size Calculation for RNA-seq Data in the Presence of Confounding Covariates. BioMedInformatics, 1(1), 47-63. https://doi.org/10.3390/biomedinformatics1020004

Liao, B., van den Berg, P. E. W., van Wesemael, P. J. V., & Arentze, T. A. (2020). How does walkability change behavior? A comparison between different age groups in the Netherlands. *International Journal of Environmental Research and Public Health*, *17*(2), 9–11. https://doi.org/10.3390/ijerph17020540

Loh, V. H. Y., Veitch, J., Salmon, J., Cerin, E., Thornton, L., Mavoa, S., Villanueva, K., & Timperio, A. (2019). Built environment and physical activity among adolescents: The moderating effects of neighborhood safety and social support. *International Journal of*

Behavioral Nutrition and Physical Activity, *16*(1), 1–8. https://doi.org/10.1186/s12966-019-0898-y

Mohd, T. A. M. T., Yunus, R. M., Hairi, F., Hairi, N. N., & Choo, W. Y. (2019). Social support and depression among community dwelling older adults in Asia: A systematic review. *BMJ Open*, *9*(7), 1-12. https://doi.org/10.1136/bmjopen-2018-026667

Mullenbach, L. E., Larson, L. R., Floyd, M. F., Marquet, O., Huang, J. H., Alberico, C., Scott Ogletree, S., & Aaron Hipp, J. (2022). Cultivating social capital in diverse, low-income neighborhoods: The value of parks for parents with young children. *Landscape and Urban Planning*, *219*, 1-10. https://doi.org/10.1016/j.landurbplan.2021.104313

Osborne, J. W., & Waters, E. (2003). Four assumptions of multiple regression that researchers should always test. *Practical Assessment, Research and Evaluation*, *8*(8), 1-5.

Roy, B., Hajduk, A. M., Tsang, S., Geda, M., Riley, C., Krumholz, H. M., & Chaudhry, S. I. (2021). The association of neighborhood walkability with health outcomes in older adults after acute myocardial infarction: The SILVER-AMI study. *Preventive Medicine Reports*, *23*, 1-8. https://doi.org/10.1016/j.pmedr.2021.101391

Sallis, J. F., Kerr, J., Carlson, J. A., Norman, G. J., Saelens, B. E., Durant, N., Ainsworth, B.E. (2010). Evaluating a Brief Self-Report Measure of Neighborhood Environments for Physical Activity Research and Surveillance: Physical Activity Neighborhood Environment Scale (PANES). *Journal of Physical Activity and Health, 7(4),* 533–540. https://doi.org/10.1123/jpah.7.4.533

Siemsen, E., Roth, A., & Oliveira, P. (2010). Common method bias in regression models with linear, quadratic, and interaction effects. *Organizational Research Methods*, *13*(3), 456–476. https://doi.org/10.1177/1094428109351241

Vahedian-Shahroodi, M., Tehrani, H., Robat-Sarpooshi, D., GHolian-Aval, M., Jafari, A. & Alizadeh-Siuki, H. (2021). The impact of health education on nutritional behaviours in female students: an application of health belief model. *International Journal of Health Promotion and Education, 59(2),* 70-82. https://doi.org/10.1080/14635240.2019.1696219

Wahl, H.-W., & Gerstorf, D. (2018). A conceptual framework for studying context dynamics in ageing (CODA). *Developmental Review, 50,* 155–176. https://doi.org/10.1016/j.dr.2018.09.003

Wang, Z., Zhang, H., Yang, X., & Li, G. (2022). Neighborhood streets as places of older adults' active travel and social interaction – A study in Daokou ancient town. *Journal of Transport & Health*, *24*, 1-12. https://doi.org/10.1016/j.jth.2021.101309

Wu, B. (2020). Social isolation and loneliness among older adults in the context of COVID-19: a global challenge. *Global Health Research and Policy, 5*, 1-3. https://doi.org/10.1186/s41256-020-00154-3