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Research article

Associations of financial inclusion with physical activity participation in later life

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ABSTRACT

Background: Physical activity (PA) is a vital modifiable psychosocial intervention for promoting healthy longevity but problematically decreases with age. Innovative community-based strategies are recommended by the World Health Organization (WHO) to improve PA but prior research has seldom considered the interactive effect of financial inclusion, social networks, and sex differences on PA. In this study, we examine the role of sex differences and resourceful social networks in relation to the association of financial inclusion with PA among older Ghanaian people.

Methods: The sample included 1201 adults aged ≥50 years who participated in the 2016-17 AgeHeaPsyWelHeaSeeB study. We assessed financial inclusion with an eight-item Financial Instrument Questionnaire Scale and PA with the International Physical Activity Questionnaire Short Form (IPAQ-SF). Linear regressions and moderation analysis were used to test the hypothesized associations.

Results: The mean financial inclusion and PA scores were 1.9(±1.8) and 9.0(±4.4) respectively. After full adjustment for potential confounders, a unit increase in financial inclusion was significantly and positively associated with increases in PA participation ($\beta = .308$, $p < .005$) and also notable among those aged ≥65 years ($\beta = .413$, $p = .023$). Crucially, the positive association between financial inclusion and PA was significantly modified by social networks ($\beta = .151$, $p < .001$). However, the role of sex in this association was not robust.

Conclusions: Findings emphasize the effect of financial inclusion on PA in old age, particularly when considering social networks. Programs to improve financial inclusion and social integration may benefit the acceptance and participation of PA among older adults.

1. Introduction

Physical activity (PA) is a leading health indicator with a profound impact on quality of life and well-being across life-course [1]. PA has been linked to improved health and reduced risk of morbidity and all-cause mortality [2]. Maintaining an active lifestyle potentially protects against the onset and progression of physical, mental, and chronic conditions such as cardiovascular diseases [3], ischemic stroke [4], diabetes [5], colon cancers [3], osteoporosis [6], depression [7], cognitive decline [8], and fall-related injuries [9]. Very importantly, regular PA improves the quality of life in later life and can promote active aging [1]. Despite the established PA-related health benefits, the amount and intensity of PA decline considerably and disproportionately with age [1]. Estimates have shown that more than 28% of adults do not meet the WHO global recommended PA for health (i.e. 150 min of moderate-intensity aerobic activity per week or 75 min of vigorous-intensity aerobic activity per week or an equivalent combination of both) [10, 11]. Problematically, the level of PA in low- and middle-income countries is relatively lower largely due to poor environmental conditions, rapid urbanization, and increased sedentary lifestyles [12].

Regular PA is associated with behavioral correlates and social environment [13]. Published literature, particularly from richer countries suggests that financial capabilities [14] and social networks [15] are important modifiable, social determinants of health with special

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relevance for PA. Notably, individuals with meaningful social interactions are more likely to regularly participate in PA [1, 8, 13, 15]. The role of community-based interventions to encourage increased PA behaviors among older people appears novel to enhance healthy aging and inform national health policy. However, it is not clear how financial inclusion (i.e. access to and use of a wide range of financial services) contributes to PA in old age as financial market participation and PA are both socially integrated activities [1, 16].

Financial inclusion has been recognized as a critical economic goal and an important policy tool with meaningful implications for achieving the health-related Sustainable Development Goals [10, 17]. Previous studies have found that access to health insurance for the uninsured and ownership of a basic bank account, potentially promotes financial capability and are likely to improve mental and physical health and well-being through financial protection and reduction in stress and anxiety [18, 19]. Crucially, financial inclusion is meaningful to health and well-being in old age [20, 21], and might, especially be needed to boost PA for older people. However, while more than 40% of adults especially in low- and middle-income countries are unbanked [22, 23], there is a paucity of research linking financial inclusion to PA in later life. In addition, sex differences have also been related to intensity and levels of PA as well as participation in the financial market [1, 16] with many favorable estimates for men compared to women [20, 22].

In this study, we investigate the respective effects of financial inclusion, social networks, and sex differences and their interactions with PA participation among older people in Ghana. We hypothesize that 1) financial inclusion would positively influence PA participation in older people; 2) the positive association between financial inclusion and PA would be modified by social networks i.e. financial inclusion will have a stronger association with PA among those who are socially connected; 3) the association between financial inclusion and PA would be stronger for men than women.

2. Methods

2.1. The survey and data

The analysis was conducted using cross-sectional data from the assessment of health outcomes, psychological well-being, and health-seeking behavior of community-dwelling men and women aged 50 years and older (AgeHeaPsyWel-HeaSeeB Study) in six districts of the Ashanti Region, Ghana. The selection of study communities has been previously described in detail and published elsewhere [24]. Participants were selected based on a probability-proportional-to-size sampling approach. The selection of the sampling strata took into account five major stages. First, we delimited the area into three sub-regional sectors based on geographic and locational uniqueness. Second, two districts were randomly selected from each sub-regional zone. Third, the selected districts were demarcated into rural and urban areas based on the Ghana Statistical Services' (2012) classification. Fourth, study communities were randomly selected from nine urban and 15 rural neighborhoods. Finally, we estimated the sample size using the formula: $n = design\ effect \times {\left[\left(Z\alpha_{/2}\right)^2 \times P(1-P)\right]}/{\varepsilon^2}$ [25], assuming a 5% margin of error, 95% confidence interval, design effect of 1.5, 5% type 1, 15% type 2, $p < .05$, and 50% conservative prevalence of adults aged ≥50 years. This sample size achieved a statistical power of 85% and a 5% (two-sided) level of significance to detect an odds ratio of ≥2. The required minimum sample size was 901. We oversampled by 346 to take care of potential non-responses and to improve generalizability. Therefore, 1247 older persons were recruited via a systematic random sampling technique. Persons who could not communicate with others due to mental and cognitive impairments were not considered in this study. We excluded those who were not available (n = 17) and declined to participate (n = 11) during data collection. Final analyses were performed for 1201 older adults after excluding participants whose essential data were missing (n = 15) or contained outliers (n = 3). The sampling frame and exclusion criteria are outlined in Figure 1. The survey questionnaire was developed in English, translated into Asante Twi (the main dialect in the study area), and back-translated into English. A face-to-face interview was conducted to collect data using interviewer-administered questionnaires given the high illiteracy rate among the sample. On average, each interview lasted about 40 min.

2.2. Ethics approval and consent to participate

Ethics approval for the study was granted by the Committee on Human Research Publication and Ethics (CHRPE), School of Medical Sciences, Kwame Nkrumah University of Science and Technology, and Komfo Anokye Teaching Hospital, Kumasi, Ghana (Ref: CHRPE/AP/507/16) as well as the Research Ethics Committee of Lingnan University, Hong Kong. All participants consented to participate in the study before the interview by providing written consent through either signing or thumb-printing the consent form to usher them to participate in this study.

3. Definitions and measurements

3.1. Financial inclusion

Financial inclusion was assessed using eight financial instrument indicators. During the survey, older people were asked to provide on a binary response scale (0 = *no*; 1 = *yes*), whether they had been involved in basic financial services over the past 12 months. The financial instruments included: 1) ownership of a personal bank account, 2) withdrawal of money from an account, 3) use of automatic teller machines, 4) membership in a credit union, 5) ownership of a 'Susu' account, 6) easy access to loans from financial or non-financial institutions, 7) ownership of a Mobile Money Service account and 8) having active National Health Insurance Scheme card [20]. A count variable was constructed based on

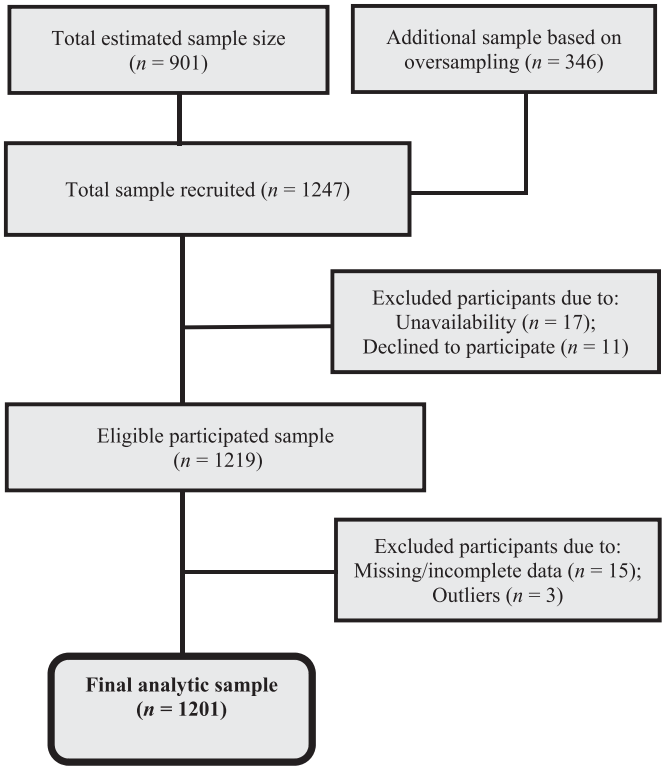

Figure 1. Flow diagram showing an overview of the study inclusion/exclusion process.

these items and higher scores reflected a more positive self-assessment of financial inclusion which provided a good internal consistency with Cronbach's alpha, α = 0.88. The composite measure of the construct is likely to provide a broader indicator compared to a single financial service such as ownership of a bank account used in some other studies [21].

3.2. Physical activity (PA)

The primary outcome of interest PA was assessed with the International Physical Activity Questionnaire short form (IPAQ-SF). The IPAQ is a validated screening tool with good psychometric properties that assesses three dimensions of intensity (low, moderate, and vigorous) of physical activity and sitting time during the last seven days among adults as part of their daily lives. This is used to estimate total physical activity per week [26]. Participants were asked the following: "During the last 7 days, on how many days 1) did you walk for at least 10 min at a time including walking at work, at home, and to travel from place to place? 2) did you do moderate physical activities like gardening, cleaning, bicycling at a regular pace, swimming, or other fitness activities? 3) did you do vigorous physical activities like heavy lifting, digging, heavier garden, or construction work, chopping woods, aerobics, jogging/running, or fast bicycling?" The responses were recorded on a continuous scale. The IPAQ has been validated in the older African population with good reliability and validity [27].

3.3. Moderators

Sex differences and social networks were included as the moderating variables in this analysis. Sex was measured on a dichotomous scale with response option 0 = men; 1 = women. Social networks were assessed using past 30-day involvement and interaction with neighbors and participation in social activities using the items, "How often in the last 30 days have you attended the following social activities: 1) family meetings, 2) religious services, 3) social clubs/organization meetings/sports/cultural activities and 4) political organizations meetings?" Each item was recorded on a 5-point scale (1 = never, 2 = less frequently, 3 = frequently, 4 = very frequently, 5 = every day). This overall score ranges from 1 to 20 with a higher score reflecting higher social networks with good internal consistency (Cronbach's α = .87).

3.4. Control variables

Following previous research [8, 11, 20, 24], we included the following sociodemographic variables as controls in the regression models: age (in years), and income (in Ghana Cedis) were measured in a continuous format. Also, locality (0 = *rural*; 1 = *urban*), marital status (0 = *married*; 1 = *unmarried*) and employment status (0 = *unemployed*; 1 = *employed*) were coded in a binary format while level of education was categorized into 0 = *primary or no attendance*; 1 = *secondary*; 2 = *post-secondary*). Health-related covariates included self-related health status assessed on four response scale after collapsing excellent and very good options from the original scale because of fewer count (0 = *excellent/very good*; 1 = *good*; 2 = *fair*; 3 = *poor*). Self-reported number of diagnosed chronic conditions (ranged 0–10 including hypertension, diabetes, stroke, arthritis, respiratory disease, chronic kidney disease, asthma, depression, ulcer, and cancers). Kessler Psychological Distress Scale (K-10) (ranged 10–50, with strong validity and internal consistency, α = .89), and activities of daily living (ADL) impairments (a scale ranged 0–18, α = .91). A high score on each of the health variables reflects more negative assessments of health status.

3.5. Statistical analysis

Categorical variables are reported as frequencies and proportions and continuous variables are reported as means with standard deviations (±SD). Descriptive statistics were followed by correlations of exposure variables with PA. The *p*-value was adjusted for the multiple correlations, which can increase the risk of a type 1 error using a Bonferroni correction, in which the threshold level of significance was divided by the number of comparisons [28]. Multivariable linear regressions were conducted to predict PA by the composite variable of financial inclusion controlling for potential confounders. In step 1 (Model 1), we evaluated the unadjusted association between financial inclusion and PA where financial inclusion only was included in the model and the second step (Model 2) estimated the main effect by adjusting for all the potential confounders.

Secondary analyses considered potential effect modification in the association of financial inclusion with PA participation by social networks (using a cut-off point; <10 versus ≥10 years) and sex (men versus women) by adding interaction terms: (financial inclusion score × sex; financial inclusion score × social networks) to Model 3 in the third step which controlled for other sociodemographic and health-related covariates. If the *p*-value for the interaction terms is significant, then the moderating effect can be identified. In addition, a simple slope test was performed by testing the conditional effects at one SD above and below the mean (Figure 1). In the additional analysis, age-stratified estimations were performed to test between-age heterogeneity in financial inclusion and PA nexus. In further sensitivity analysis, we constructed eight separate models in which each specific financial inclusion instrument was regressed upon PA. A number of diagnostic tests were performed to check the assumptions of multiple linear regression. The Shapiro-Wilk test for normality was ascertained ($p > 0.05$). Multicollinearity was performed using the Variance Inflation Factor (VIF). The VIF score ranged ≤ 1.6, indicating that no challenges of multicollinearity were present. All statistical analyses were performed by SPSS v.25.0 statistical package for Windows (SPSS Inc., IBM, Armonk) with a *p*-value less than 5% as statistically significant.

4. Results

Table 1 shows the descriptive statistics for the study variables. The full analytic sample included 1201 observations. The mean age of the sample was about 66 years (±12). The majority were women (63%) and about 55% resided in urban areas. The sample comprised mainly unmarried people (57%), those who had achieved up to primary education (86%), and unemployed (56%). The data revealed low-income levels with an average of GH¢ 308/UD$65 (±GH¢339/UD$71). About, 49% revealed worsening health status based on self-assessment. Mean chronic disease score (2 ± 0.8), psychological distress (15 ± 6), functional impairment (14 ± 5), physical activity (9 ± 4), social networks (6 ± 3), and financial inclusion score (2 ± 2) were reported. Bivariate associations following a Bonferonni correction for multiple correlations showed that financial inclusion was positively associated with PA (r =.127, $p <$ .001) (Table 2).

Table 3 presents the results of multivariable linear regressions applied to examine the contribution of financial inclusion to subsequent PA participation taking into account the modification effects of social networks and the sex of the respondent. Model 1 revealed a significant positive association between financial inclusion and PA ($\beta = .190$, $p <$ .001). The results found that 3.5% of the variance in the model was explained by financial inclusion. After controlling for potential confounders, financial inclusion was significantly associated with increases in regular PA ($\beta = .308$, $p < .001$). Interaction analysis showed that social networks moderated the association of financial inclusion with PA ($\beta =$ .151, $p < .001$). This suggests that social networks reinforced the positive association of financial inclusion with PA (Figure 2). However, there was no evidence of effect modification of the association between financial inclusion and PA by sex (interaction term: sex × financial inclusion: $p =$ .121) did not reach statistical significance suggesting that the effect of financial inclusion on PA did not differ by sex.

Additional analysis to investigate between-age variation showed a stronger association of financial inclusion with PA for the ≥65 age group

Table 1. Descriptive characteristics of the study sample.

	M (±SD)	Valid N (%)
Variables		
Age (in years)	66.15 (11.85)	
Sex (women)		759 (63.3)
Residence (urban)		660 (55.0)
Marital status (not married/partnered)		679 (56.6)
Educational level		1034 (86.2)
None or Primary		104 (8.7)
Secondary		62 (5.2)
Tertiary		667 (55.6)
Employment (not employed)		
Income (in Ghana Cedis)[§]	308.18 (338.89)	
Self-rated health		
Very good/excellent		239 (19.9)
Good		369 (30.8)
Fair		348 (29.0)
Poor		244 (20.3)
Social networks score	6.10 (2.68)	
PA score	9.03 (4.41)	
Chronic disease count	1.67 (0.79)	
Psychological distress score	14.87 (6.21)	
Functional impairment score	13.70 (5.09)	
Financial inclusion score	1.91 (1.79)	

Note: M – mean; SD – standard deviation; N – valid frequency; PA – physical activity.

[§] Exchange rate: $1 ~ ¢4.8 as of the time of data collection.

Table 2. Correlations of PA with independent variables included in the regression analysis.

Variable	PA score
Physical activity score	1
Functional impairment score	−.399***
Age (in years)	−.309***
Sex	.164***
Rural residence	−.081***
Marital status	−.255**
Higher education	.023
Employment	.275***
Income level (in Ghana Cedis)	.132***
Self-rated health	−.309***
Social networks score	−.089**
Chronic disease count	−.218***
Psychological distress score	−.156***
Financial inclusion score	.127***

Note: PA – physical activity.
Pearson product-moment correlations were used to calculate the association between continuous variables, point-biserial correlations were used to assess the relationship between continuous and dichotomous variables, and phi correlations were used to assess the relationship between dichotomous variables.
**$p < .001$; ***$p < .005$.

($\beta = .413$, $p = .015$) compared to the 50–64 age group ($\beta = .180$, $p = .021$) (Table 4). Finally, the sensitivity analysis performed to investigate service-specific effect on PA participation showed that having a bank account ($\beta = .392$, $p = .018$), automatic teller machine card ($\beta = .653$, $p = .031$), credit union account ($\beta = .807$, $p < .001$) and mobile money account ($\beta = .298$, $p = .046$) were associated with increased PA but contraction of a loan ($\beta = -.491$, $p = .021$) decreased PA participation (Table 5).

5. Discussion and conclusions

5.1. Key findings

Using data from aging adults in an innovative sub-Saharan African context, the present study showed three principal findings. First, multivariable linear regressions showed that financial inclusion was independently associated with increases in PA in the overall sample and also across all age groups. Second, we found that the direct relationship of financial inclusion with PA was significantly moderated by social networks. For persons who were highly socially connected, access to financial services was associated with regular PA, confirming the hypotheses addressed in this study. Finally, specific financial services revealed differential impacts and relative strength on PA engagement. Our study sheds light on how financial inclusion impacts PA through direct and indirect mechanisms, an under-explored subject with meaningful implications for future research and aging and health policy frameworks in low- and middle-income settings.

5.2. Plausible mechanistic pathways and explanations

To our knowledge, this is the first analysis to evaluate the complex interrelationships of financial inclusion, social networks, and sex differences with PA participation, particularly in low- and middle-income countries. The dearth of research on this topic makes it difficult to directly compare the current study to prior published literature. However, findings from the present study support the previous and growing body of literature providing evidence to shape our understanding of the impact of financial inclusion on health outcomes and well-being and this knowledge continues to evolve [16, 20, 29]. The mechanisms underpinning the association between financial inclusion and regular PA among the older populations are not entirely clear although several potential hypotheses are outlined. Using longitudinal analysis among Hispanic ethnic minority groups in the US, Aguila et al. [21] found that the ownership of a bank account reduces stress, protects mental health, and promotes well-being among older adults. Finkelstein et al. [19] propose that having health insurance, particularly among the vulnerable groups can improve well-being and mental stability through financial protection. Other studies have also reported a positive correlation between the ability to manage and take control of one's finances and psychological well-being [20, 30]. In India, Singh et al. [31] found that having a bank account improved the use of maternal health services and behavior. More recent studies based on our previous analyses have shown several beneficial effects of easy and safe access to financial services on food insecurity [32] and physical health functioning measured with activities of daily living and instrumental activities of daily living [33]. For vulnerable people in low- and middle-income settings, the pecuniary advantage, and self-control associated with financial inclusion may improve their self-efficacy, mastery, and self-assurance which may promote overall health outcomes and in turn, improve PA participation meaningfully [21, 39]. While these observations are exciting, the underlying factors linking financial inclusion to PA are not fully understood. Future research will benefit from exploring this topic further.

Social networks moderated the positive PA effect of financial inclusion in our study. In line with our hypothesis, financial inclusion directly showed a stronger relationship with PA in persons who are socially connected and embedded in a denser constellation of social networks. This indicates that social networks encourage some amount of PA engagement. This finding is consistent with several previous studies [15, 34, 35] and also emphasizes the mechanisms of the biopsychosocial model which explains the positive health impacts of interpersonal relationships [36, 37]. Our analysis contributes to published literature by extending the model to PA participation. Social ties, companionship, and emotional support during old age are important social resources that might shape behavioral control and increase financial market participation. This finding is particularly crucial for older people as they are at a

Table 3. Multivariable linear regressions predicting PA with a composite score of financial inclusion.

	Model 1		Model 2		Model 3	
	β	(SE)	β	(SE)	β	(SE)
Step 1: Main effects						
Age			−.036***	(.007)	−.036***	(.007)
Sex (ref: Males)						
Females			−.115	(.163)	−.065	(.184)
Residence (ref: rural)						
Urban			−.588***	(.151)	−.601***	(.162)
Marital status (Married)						
Not married			−.704***	(.161)	−.689***	(.162)
Education (ref: Primary/none)						
Secondary			−.335	(.265)	−.336	(.266)
Higher			−.782*	(.318)	−.798*	(.319)
Employment (ref: unemployed)						
Employed			.374*	(.155)	.381*	(.155)
Income			.481**	(.185)	.479*	(.185)
Social networks			−.287*	(.150)	−.324*	(.164)
Self-rated health (ref: Very good)						
Good			−.079	(.212)	−.082	(.213)
Fair			−.262	(.214)	−.266	(.215)
Poor			−1.220***	(.251)	−1.234***	(.252)
Comorbidities			−.253*	(.099)	−.250*	(.099)
Psychological distress score			−.349*	(.149)	−.350	(.150)
Financial inclusion (0–8; higher values indicating higher levels)	.190	(023)***	.308**	(.163)	.341*	(.180)
Step 2: Interaction effects						
Financial inclusion × sex					−.202	(.351)
Financial inclusion × social networks					.151***	(.314)
Constant	2.715*** (.061)		2.457*** (.487)		2.426***(.491)	
Adjusted R^2	.035		.292		.303	

PA – physical activity; Beta-Coefficients are reported; Cluster-robust standard errors in parentheses.
Model 1 was the unadjusted model which contained the financial inclusion variable only. Model 2 was adjusted for age (in years), sex, rural/urban residence, marital status, educational status, employment status, income levels, social networks, self-rated health, chronic disease count, and psychological distress score. Model 3 added the interaction terms (financial inclusion × sex; financial inclusion × social networks).
***$p < .001$; **$p < .005$; *$p < .05$.

greater risk of financial exclusion in the context of declining levels of PA compared to younger adults [16, 38, 39].

It is important to emphasize that our analysis did not find evidence of effect modification between financial inclusion and sex differences in relation to PA participation. Several explanations for this unexpected finding are plausible. First, it is possible that during older age, the duration and intensity of PA defy sex-specificity and, therefore, become similar between older men and their female counterparts [11]. Indeed, declining health status remains common in later life, and both males and females are equally encouraged to engage/maintain healthy lifestyles including regular PA [1]. It is also possible that the lack of effect modification of the association between financial inclusion and PA by sex may be unique to the participants involved in our study. An alternative explanation is that different financial instruments currently abound among the general population through formal and informal financial institutions [38], making access to financial services ubiquitous among all groups of people, including women. Today, both men and women are becoming technologically savvy and more agile in participating in the financial market [16]. This implies that many opportunities to be financially included are possible, making it more difficult to parse the magnitude of effects in relation to sex differences. Health policy and clinical practices should be guided by the implications of this finding as regards the programs to improve both financial inclusion and PA for older adults. However, future studies should explore further the potential role of sex in these associations in later life.

Interestingly, our data revealed that the effect of financial inclusion on PA was more pronounced among the ≥65 age group than those in the 50–64 age group. The between-age heterogeneity in the association between financial inclusion and PA is, particularly important and directs policy and applied efforts on the intensification of financial inclusion as age increases. Policymakers should be aware that old age defies uniformity such that different age groups may require different considerations of financial inclusion strategies and programs in an attempt to improve both PA participation and financial inclusion. Moreover, our analysis showed that specific financial services such as ownership of a bank, credit union, and mobile money accounts and the use of automatic teller machines positively influenced PA while a contraction of a loan significantly decreased PA engagement. These findings provide empirical evidence to support the theory that certain financial instruments are important [16], and should be highlighted in improving the quality of life of older people [39]. This knowledge presents critical implications for policies targeted at promoting regular PA participation in later life through financial inclusion.

Despite the novelty and potential contribution of this study to the research literature, a few limitations should be acknowledged. Our analysis was based upon cross-sectional data and it was practically not possible to discuss findings in directional and causal terms. The determination of temporal order between financial inclusion, social networks, and PA could not be factored in. We propose that future analyses of this relationship should employ longitudinal data and approaches. In addition, recall and social desirability biases are

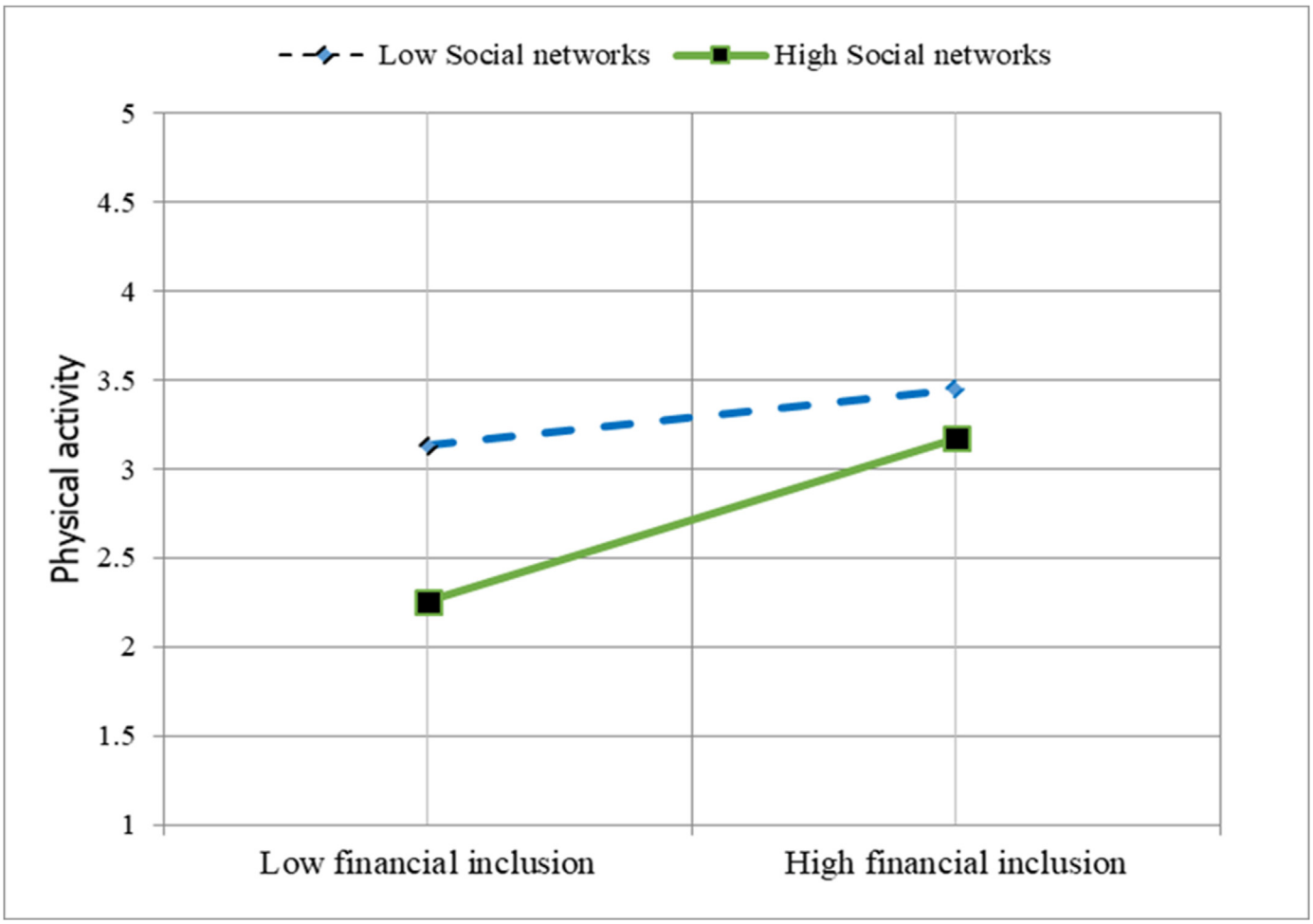

Figure 2. Simple slope test on the specific moderating effect of social networks. Social networks strengthen the positive association of financial inclusion with physical activity.

Table 4. Multivariable linear regressions predicting PA with composite financial inclusion: Age-stratified analysis.

	50-64 age group	≥65 age group
	β (SE)	β (SE)
Potential confounders	√	√
Financial inclusion (0–8; higher values indicating higher levels of financial inclusion)	.180*	.413**
	(.268)	(.216)
Constant	2.619*	1.168**
	(1.543)	(.927)
Adjusted R^2	.361	.166

PA – physical activity; Beta-Coefficients are reported; Cluster-robust standard errors in parentheses.
All models were adjusted for age (in years), sex, rural/urban residence, marital status, educational status, employment status, and income levels, social networks, self-rated health, chronic disease count, and psychological distress score.
**$p < .005$; *$p < .05$.

inevitable due to over-reliance on self-reporting of retrospective events during data generation which may undermine the veracity of findings. However, this procedure could be most appropriate for obtaining subjective and socially oriented reports. The study was based upon non-clinical measures, which implies that any clinical implications of our findings are imprecise. We finally note that the potential mechanisms supporting the associations of financial inclusion and social networks with the engagement of PA were not well understood in this study.

In summary, our study demonstrates that financial inclusion through financial market participation is a crucial modifiable resource for regular PA. The data further indicate that following access to financial services, it is important to embed older adults in stronger and more meaningful social networks to reinforce PA engagement in later life. These findings provide empirical evidence for new knowledge of practice, clear public health, and policy relevance in enhancing regular PA and improving the quality of life of older people in low- and middle-income countries. More research is warranted to understand the pathways underlying the complex interplay between financial inclusion and social networks and its contribution to regular PA participation in old age.

6. Note

An informal credit and savings scheme between a small group of people such as family members and friends which has been popularized in most parts of West Africa and the Caribbean. In its operation, each member of the group makes a standard contribution to a common fund once per time period (mostly daily or weekly), and the total contribution is reimbursed to a single member of the group within a specified time frame. The model provides an important alternative means of accessing capital when traditional lending is not readily available particularly among low-income groups in the informal sector.

Table 5. Multivariable linear regressions predicting PA with specific financial inclusion instruments.

	1	2	3	4	5	6	7	8
	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)
Withdrawal of money from a bank	.253 (.153)							
Ownership of a bank account		.392** (.166)						
Use of automatic teller machine card			.653* (.302)					
Ownership of a credit union				.807*** (.228)				
Ownership of "susu" account					.237 (.168)			
Access to loan from financial institution						−.491* (.213)		
Ownership of Mobile Money account							.298* (.149)	
Having active NHIS card								.010 (.274)
Potential confounders	√	√	√	√	√	√	√	√
Constant	2.558*** (.478)	2.576*** (.476)	2.820*** (.481)	2.687*** (.477)	2.682*** (.474)	2.689*** (.475)	2.476*** (.484)	2.674*** (.482)
Adjusted R^2	.291	.294	.293	.301	.290	.293	.292	.288

PA – physical activity; Beta-Coefficients are reported with cluster-robust standard errors in parentheses.
All Models were adjusted for theoretically relevant confounders (√): age, sex, rural/urban residence, educational level, employment status, living arrangement, social networks score, self-rated health, psychological distress, and chronic conditions.
***$p < .001$; **$p < .005$; *$p < .05$.

Declarations

Author contribution statement

Razak M. Gyasi: Conceived and designed the study; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Siaw Frimpong: Performed the experiments; Contributed materials, analysis tools or data; Wrote the paper.

Richard Bruce Lamptey, Gershim Asiki: Contributed materials, analysis tools or data; Wrote the paper.

Gilbert Kwabena Amoako, Anokye M. Adam: Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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