

Article

The Reciprocal Relationship Between Neighborhood Social Cohesion and Leisure-Time Physical Activity for Older Adults

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Abstract: This study examines reciprocal relationships between neighborhood social cohesion and leisure-time physical activity among older adults (65 years and older) and compares the findings with those of the general adult population (18 years and older). Using data from the 2021 National Health Interview Survey (NHIS) (N = 7714 older adults and 34,412 general adults), a cross-sectional analysis was conducted with structural equation modeling in Mplus 7.31. Results indicate that older adults engage in significantly less leisure-time physical activity but report higher neighborhood social cohesion than the general adult population. Notably, the relationship between light or moderate leisure-time physical activity and neighborhood social cohesion was observed only among older adults. These findings highlight the value of creating group programs that simultaneously foster social cohesion and encourage physical activity as an effective strategy for promoting well-being in older adults.

Keywords: social cohesion; physical activity; older adult; structural equation modeling

1. Introduction

Enhancing the health of older adults is more critical than ever, given the rapid growth of the aging population in recent decades [1,2]. Research consistently demonstrates that regular physical activity provides substantial health benefits, including obesity prevention, cardiovascular health improvement, and reduced risk of type 2 diabetes [3–5]. Despite these well-documented advantages, older adults remain significantly less active than other age groups [6,7] and are more likely to adopt sedentary lifestyles [8]. This widespread inactivity poses serious public health concerns, underscoring the urgent need for targeted interventions to promote physical activity and improve overall well-being among older adults.

Social cohesion is a critical determinant of health for older adults, directly influencing their well-being and longevity [9–11]. As a key component of social capital [12], it encompasses strong social ties, mutual trust, and reciprocity [13]. Higher levels of social cohesion are associated with greater community involvement, volunteerism, and frequent social interactions with neighbors and friends [14], all of which contribute to improved health outcomes and lower mortality rates [15]. As mobility declines and independence diminishes, the role of social networks—particularly friendships and neighborhood connections—becomes even more vital, often surpassing family ties in shaping health and overall quality of life for older adults [9,16]. Strengthening social cohesion within communities is essential for fostering healthier, more resilient aging populations.



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The reciprocal relationship between physical activity and social cohesion is evident, as strong social networks both encourage and sustain active lifestyles. Individuals with greater social support are more likely to initiate and maintain regular physical activity, reducing feelings of vulnerability to crime and violence when engaging in outdoor activities [8,17]. Conversely, those who participate in consistent leisure-time physical activity often build stronger connections with their neighbors, fostering a greater sense of social cohesion and expanding their support networks [18]. This dynamic reinforces the importance of designing communities that promote both physical activity and social engagement to enhance overall well-being.

Participation in physical activity has the potential to strengthen social cohesion by fostering communication, encouraging collaborative action, and building community networks [19]. However, despite this bidirectional relationship, limited evidence exists on how physical activity and social cohesion mutually influence one another. Moreover, research in this area has primarily focused on the general adult population, leaving a significant gap in understanding how these dynamics operate specifically among older adults. Addressing this gap is crucial for developing targeted interventions that enhance both physical well-being and social connectedness in aging populations.

The relationship between these two variables may be particularly pronounced for older adults, who face heightened health risks due to retirement, declining mobility, chronic illness, disability, and the loss of social networks [20]. These factors can significantly impact their ability to stay physically active and maintain social cohesion, making targeted interventions crucial. Despite this, research remains limited in understanding how these dynamics interact. This study directly addresses this critical gap by investigating the reciprocal relationship between social cohesion and leisure-time physical activity, specifically comparing older adults (65+) with the general adult population (18+). The findings provide essential insights for developing evidence-based policies and interventions that promote active aging and strengthen social connections in later life. It emphasizes how the built and social fabric of neighborhoods can encourage or hinder healthy aging, providing evidence for planners and policymakers to design inclusive, walkable, and community-oriented spaces. By revealing the mutual reinforcement between social cohesion and physical activity, the study supports urban development strategies that prioritize both physical infrastructure and community engagement to promote well-being among older residents.

2. Materials and Methods

This study developed a robust conceptual framework (Figure 1) grounded in the modified socio-ecological model [21,22] and supported by extensive prior research [1,8,18,19,23–27]. The framework integrates four key domains: socio-demographic factors and health status, neighborhood environments, neighborhood social cohesion, and leisure-time physical activity. It systematically examines the reciprocal relationship between neighborhood social cohesion and leisure-time physical activity while controlling for socio-demographic characteristics and health status across both older adults and the general adult population. Additionally, this framework investigates how socio-demographic factors influence neighborhood social cohesion through leisure-time physical activity, as well as how socio-demographic factors impact leisure-time physical activity, mediated by neighborhood social cohesion.

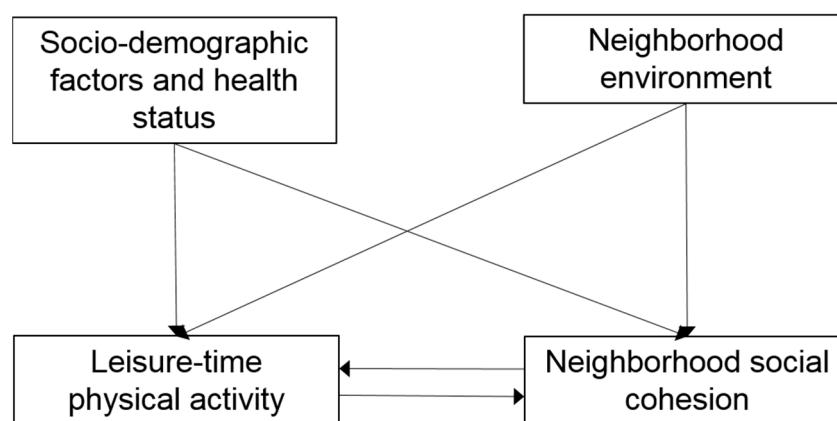


Figure 1. Conceptual framework for this study.

2.1. Sample Selection

This study utilized national survey data from the 2021 National Health Interview Survey (NHIS), a cross-sectional, face-to-face household survey designed to monitor the health status of the civilian, non-institutionalized U.S. population [28]. The sampling process followed a multistage area probability design to ensure national representativeness [28]. The multistage sampling and weighting procedures involved three steps: selecting respondents based on primary sampling units (PSUs), stratifying by state, and applying individual adjustments for each respondent. Three weighted variables from each stage were incorporated into the analysis to enhance accuracy and representativeness.

One adult (aged 18 or older) per family was randomly selected to provide information on health status, healthcare services, and health-related behaviors. Respondents with certain physical conditions (e.g., pregnancy or physical or mental impairments/limitations) were excluded. After these exclusions, the final sample consisted of 34,412 adults aged 18 and older, including 7714 adults aged 65 and older.

2.2. Variables and Measurements

Table 1 presents the selected variables, measurements, and their descriptive statistics. Since data on neighborhood environments (both subjective and objective) were not available in the 2021 NHIS, this study could not include this domain. Neighborhood social cohesion was measured using a four-item latent factor, with respondents indicating their level of agreement with statements about neighborhood relationships. These statements assessed whether people in their neighborhood helped one another, could be counted on or trusted, and whether they considered their neighborhood to be close-knit. Responses were recorded on a 4-point scale, ranging from 1 (definitely disagree) to 4 (definitely agree).

The survey collected data on three levels of leisure-time physical activity: vigorous, light or moderate, and strengthening [29]. Vigorous activity was defined as exercise that causes heavy sweating and a significant increase in breathing or heart rate. Light or moderate activity involved only light sweating and a slight to moderate increase in breathing or heart rate [29]. Strengthening activities referred to exercises that build muscle strength, such as weight training and calisthenics.

The NHIS survey gathered data on the frequency (times per week) and duration (minutes per session) of both vigorous and light-to-moderate leisure-time physical activity, both measured as continuous variables. To calculate the total minutes per week for these activities, this study multiplied the reported frequency by the duration per session. However, for leisure-time strengthening activities, only the frequency per week was included, as this was the only information collected by the survey.

Table 1. Variables, measurements, and descriptive statistics.

Variable	Measurement	General Adult (N = 34,412)		Older Adult (N = 7714)		
		Weighted % (n) or M (SD)	95% CI	Weighted % (n) or M (SD)	95% CI	p-Value
Neighborhood social cohesion (L)						
How much do you agree or disagree with the following statements about your neighborhood?						
People in this neighborhood help each other out	1 = definitely disagree; 2 = somewhat disagree; 3 = somewhat agree; 4 = definitely agree	3.09 (0.90)	3.08–3.10	3.27 (0.87)	3.25–3.29	<0.001 ***
There are people I can count on in this neighborhood		3.17 (0.96)	3.16–3.18	3.42 (0.85)	3.40–3.44	<0.001 ***
People in this neighborhood can be trusted		3.14 (0.93)	3.13–3.15	3.39 (0.84)	3.37–3.41	<0.001 ***
This is a close-knit neighborhood		2.77 (1.02)	2.76–2.78	2.96 (0.99)	2.94–2.99	<0.001 ***
Leisure-time physical activity						
Vigorous leisure-time physical activity	Minutes per week (continuous)	103.72 (223.14)	101.33–106.12	57.57 (174.27)	53.57–61.57	<0.001 ***
Light or moderate leisure-time physical activity	Minutes per week (continuous)	126.34 (238.25)	123.78–128.90	116.22 (233.07)	110.88–121.55	<0.001 ***
Leisure-time strengthening activity	Times per week (continuous)	1.13 (2.73)	1.10–1.16	0.87 (2.55)	0.81–0.92	<0.001 ***
Socio-demographic factors and health status						
Male		44.61 (15,351)	44.08–45.13	40.20 (3101)	39.11–41.29	<0.001 ***
Race/ethnicity						
Non-Hispanic white		59.50 (20,474)	58.98–60.02	70.72 (5455)	69.70–71.73	<0.001 ***
Non-Hispanic black		14.91 (5130)	14.53–15.28	13.18 (1017)	12.43–13.94	
Hispanic		17.19 (5916)	16.79–17.59	9.92 (765)	9.25–10.58	
Other		8.40 (2892)	8.11–8.70	6.18 (477)	5.65–6.72	
Education level						
Less than high school		13.07 (4488)	12.71–13.43	18.72 (1439)	17.85–19.60	<0.001 ***
High school		47.76 (16,400)	47.23–48.29	49.08 (3772)	47.96–50.20	
College		24.96 (8571)	24.50–25.42	18.43 (1416)	17.56–19.29	
Graduate school		14.21 (4880)	13.84–14.58	13.77 (1058)	12.99–14.54	
Married		42.97 (14,749)	42.45–43.50	41.57 (3199)	40.47–42.67	
Family income						
\$0–\$34,999		43.00 (13,909)	42.46–43.54	53.53 (3726)	52.36–54.71	<0.001 ***
\$35,000–\$74,999		30.85 (9979)	30.34–31.35	30.45 (2119)	29.36–31.53	
\$75,000–\$99,999		9.91 (3205)	9.58–10.23	6.68 (465)	6.09–7.27	
\$100,000 and over		16.24 (5256)	15.85–16.65	9.34 (650)	8.66–10.02	
Weight status						
Normal weight	BMI < 25	36.91 (11,505)	36.38–37.45	36.03 (2508)	34.91–37.16	<0.001 ***
Overweight	BMI ≥ 25 and < 30	35.45 (11,047)	34.91–35.98	37.37 (2601)	36.23–38.51	
Obesity	BMI ≥ 30	27.64 (8615)	27.14–28.14	26.59 (1851)	25.56–27.63	

M: Mean; SD: Standard deviation; CI: Confidence interval. L: Latent factor. *** *p* < 0.001.

This study examined socio-demographic factors and health status, including gender, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or other), education level (less than high school, high school, college, or graduate school), marital status (married or other), household income (\$0–\$34,999, \$35,000–\$74,999, \$75,000–\$99,999, or \$100,000 and above), and weight status (normal, overweight, or obese). All data were sourced from the 2021 NHIS. However, certain variables related to outcome measures, such as lifetime physical activity habits and length of residence in the neighborhood, were not available in the dataset.

2.3. Statistical Analyzes

To compare differences between the aging and general adult populations, this study reports the weighted percentage or mean and 95% confidence interval for each selected variable, using chi-squared tests and t-tests (Table 1).

Two measurement models were constructed to validate the factor structure of the latent variable neighborhood social cohesion for both groups. Internal consistency was assessed by calculating Cronbach's α for the four items in the neighborhood social cohesion construct (Table 2). Additionally, two structural equation models (SEMs) were conducted to examine the reciprocal associations between neighborhood social cohesion and leisure-time physical activity, controlling for socio-demographic factors (Table 3). SEM was chosen for this study because it allows for the simultaneous examination of direct and indirect relationships between neighborhood social cohesion and physical activity while accounting for measurement errors. Unlike multilevel modeling (MLM), which is well-suited for nested data structures, SEM provides a more flexible framework for modeling complex reciprocal relationships and latent constructs.

Table 2. Measurement model.

	General Adult (N = 34,412)		Older Adult (N = 7714)	
	Factor Loading	S.E.	Factor Loading	S.E.
Neighborhood social cohesion ^a				
People in this neighborhood help each other out	0.860 ***	0.002	0.865 ***	0.004
There are people I can count on in this neighborhood	0.849 ***	0.002	0.839 ***	0.005
People in this neighborhood can be trusted	0.814 ***	0.002	0.799 ***	0.005
This is a close-knit neighborhood	0.786 ***	0.003	0.772 ***	0.006
Cronbach's α	0.896		0.888	

*** $p < 0.001$. ^a 4-point scale (1 = definitely disagree; 2 = somewhat disagree; 3 = somewhat agree; 4 = definitely agree). S.E.: Standard error.

Table 3. Structural model.

Predictor	Dependent Variable	General Adult (N = 34,412)		Older Adult (N = 7714)	
		Standardized Coefficients	R ²	Standardized Coefficients	R ²
Vigorous leisure-time physical activity	Neighborhood social cohesion	0.005	0.069	0.012	0.043
Light or moderate leisure-time physical activity		0.023		0.023 *	
Leisure-time strengthening activity		0.003		0.024	
Gender (male)		−0.003		−0.035	
Race/ethnicity					
Non-Hispanic white		Ref.		Ref.	
Non-Hispanic black		−0.106 ***		−0.091 ***	
Hispanic		−0.153 ***		−0.119 ***	
Other		−0.064 ***		−0.033 **	

Table 3. Cont.

Predictor	Dependent Variable	General Adult (N = 34,412)		Older Adult (N = 7714)	
		Standardized Coefficients	R ²	Standardized Coefficients	R ²
Education level	Neighborhood social cohesion		0.069		0.043
Less than high school		Ref.		Ref.	
High school		0.026 **		0.025 *	
College		0.021 *		0.032 *	
Graduate school		0.021 *		0.056 *	
Marital status (married)		0.071 ***		0.050 *	
Family income					
\$0–\$34,999		−0.135 ***		−0.058 *	
\$35,000–\$74,999		−0.070 ***		−0.019	
\$75,000–\$99,999		−0.018 *		0.004	
\$100,000 and over		Ref.		Ref.	
Weight status					
Normal weight		Ref.		Ref.	
Overweight		0.002		−0.025	
Obesity		−0.029 ***		−0.037 *	
Neighborhood social cohesion	Vigorous leisure-time physical activity	0.004	0.172	0.011	0.104
Light or moderate leisure-time physical activity		0.227 ***		0.221 ***	
Leisure-time strengthening activity		0.266 ***		0.141 ***	
Gender (male)		0.088 ***		0.056 ***	
Race/ethnicity					
Non-Hispanic white		Ref.		Ref.	
Non-Hispanic black		0.016 **		0.029 *	
Hispanic		0.028 **		0.022 *	
Other		0.021 *		0.027 *	
Education level					
Less than high school		Ref.		Ref.	
High school		0.029 **		0.039 *	
College		0.046 ***		0.052 **	
Graduate school		0.030 **		0.065 ***	
Marital status (married)		0.008		0.010	
Family income					
\$0–\$34,999		−0.065 ***		−0.058 *	
\$35,000–\$74,999		−0.034 ***		−0.042	
\$75,000–\$99,999		−0.003		0.016	
\$100,000 and over		Ref.		Ref.	
Weight status					
Normal weight		Ref.		Ref.	
Overweight		−0.022 **		−0.018 *	
Obesity		−0.037 ***		−0.023 *	

Table 3. Cont.

Predictor	Dependent Variable	General Adult (N = 34,412)		Older Adult (N = 7714)	
		Standardized Coefficients	R ²	Standardized Coefficients	R ²
Neighborhood social cohesion	Light or moderate leisure-time physical activity	0.022 ***	0.098	0.022 ***	0.091
Vigorous leisure-time physical activity		0.248 ***		0.224 ***	
Leisure-time strengthening activity		0.102 ***		0.099 ***	
Gender (male)		0.024 *		0.048 ***	
Race/ethnicity					
Non-Hispanic white		Ref.		Ref.	
Non-Hispanic black		−0.048 ***		−0.045 **	
Hispanic		−0.036 ***		−0.022 *	
Other		−0.010		−0.005	
Education level					
Less than high school		Ref.		Ref.	
High school		0.023 *		0.011	
College		0.026 **		0.02 *	
Graduate school		0.018 *		0.024	
Marital status (married)		0.004		0.005	
Family income					
\$0–\$34,999		−0.014		−0.069 **	
\$35,000–\$74,999		−0.002		−0.044	
\$75,000–\$99,999		−0.001		−0.031	
\$100,000 and over		Ref.		Ref.	
Weight status					
Normal weight		Ref.		Ref.	
Overweight		−0.006		−0.014	
Obesity		−0.022 **		−0.031 *	
Neighborhood social cohesion	Leisure-time strengthening activity	0.003	0.129	0.024	0.058
Vigorous leisure-time physical activity		0.280 ***		0.148 ***	
Light or moderate leisure-time physical activity		0.099 ***		0.102 ***	
Gender (male)		0.042 ***		0.030 *	
Race/ethnicity					
Non-Hispanic white		Ref.		Ref.	
Non-Hispanic black		0.009		−0.013	
Hispanic		0.001		−0.005	
Other		−0.012		−0.009	
Education level					
Less than high school		Ref.		Ref.	
High school		0.032 **		0.024 *	
College		0.073 ***		0.041 *	
Graduate school		0.060 ***		0.052 **	

Table 3. Cont.

Predictor	Dependent Variable	General Adult (N = 34,412)		Older Adult (N = 7714)	
		Standardized Coefficients	R ²	Standardized Coefficients	R ²
Marital status (married)	Leisure-time strengthening activity	−0.021	0.129	−0.024	0.058
Family income					
\$0–\$34,999		−0.068 ***		−0.084 **	
\$35,000–\$74,999		−0.054 ***		−0.067 **	
\$75,000–\$99,999		−0.021 **		−0.021 *	
\$100,000 and over		Ref.		Ref.	
Weight status					
Normal weight		Ref.		Ref.	
Overweight		−0.025 ***		−0.014	
Obesity		−0.049 ***		−0.038 *	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. S.E.: Standard error. Ref.: Reference group.

Model fit was evaluated using the following indices: Bentler Comparative Fit Index (CFI) (>0.90 indicates acceptable), Tucker-Lewis Index (TLI) (>0.90 indicates acceptable), and Root Mean Square Error of Approximation (RMSEA) (<0.05 indicates acceptable) [30]. All statistical analyses were weighted according to the NHIS sampling scheme to ensure nationally representative estimates and were performed using Mplus 7.31.

3. Results

Data from 34,412 adults aged 18 and older, including 7714 adults aged 65 and older, were analyzed. Table 1 presents descriptive statistics for the selected variables, along with weighted chi-squared and t-tests. The mean age of the general adult group was 48.72 years (SD: 18.22), while the mean age of the older adult group was 74.13 years (SD: 6.71).

Regarding neighborhood social cohesion, older adults reported significantly higher mean scores (on a 4-point scale) than general adults on measures such as “help each other out”, “people can be counted on”, “people can be trusted”, and “a close-knit neighborhood”. This finding suggests that older adults in this study experience stronger social bonds and a greater sense of trust and support within their communities. These higher levels of social cohesion may be due to longer residency in their neighborhoods, established relationships over time, and greater reliance on local social networks for support and companionship. This underscores the importance of fostering and maintaining social connections to enhance well-being among aging populations.

However, older adults engaged in significantly less vigorous, light, or moderate, muscle-strengthening leisure-time physical activity per week compared to general adults, highlighting potential barriers to physical activity in later life, such as age-related mobility limitations, health conditions, or lack of tailored fitness opportunities. Demographic differences were also notable. The percentage of older male adults was significantly lower than in the general adult group (general: 44.61%; older: 40.20%), which may reflect longer life expectancy among women or gender differences in survey participation. Additionally, a higher percentage of older adults were non-Hispanic white (general: 59.50%; older: 70.72%), while lower percentages were non-Hispanic Black (general: 14.91%; older: 13.18%) or Hispanic (general: 17.19%; older: 9.92%). Older adults also had significantly higher percentages of individuals with less than a high school education (general: 13.07%; older: 17.72%) and those with a family income between \$0 and \$34,999 (general: 43%; older:

53.53%) compared to general adults. These disparities underscore the need for targeted interventions to address barriers to physical activity and promote inclusive community programs that support older adults in maintaining an active lifestyle.

Table 2 presents the standardized item-to-factor loadings for neighborhood social cohesion in both the general adult population and older adults. All loadings exceeded 0.770 and were statistically significant, indicating strong internal consistency for the construct. Additionally, the Cronbach's α for neighborhood social cohesion was 0.896 for the general adult population and 0.888 for older adults, further demonstrating good internal reliability.

Table 3 presents the structural model, demonstrating a good fit for both the general adult population (CFI = 0.95, TLI = 0.94, RMSEA = 0.03) and older adults (CFI = 0.94, TLI = 0.94, RMSEA = 0.04). Regarding the relationship between neighborhood social cohesion and leisure-time physical activity, only light to moderate physical activity was significantly associated with neighborhood social cohesion (standardized coefficient = 0.023, $p < 0.05$), and this relationship was observed exclusively among older adults. This suggests that a socially connected neighborhood may encourage older adults to engage in lower-intensity activities, such as walking or light exercises, which are more accessible and socially oriented. In contrast, vigorous and strength-based activities showed no significant association with neighborhood social cohesion in either group. This may indicate that higher-intensity physical activities are influenced more by individual motivation, physical ability, or access to structured exercise programs rather than social support within the neighborhood. Additionally, all three types of leisure-time physical activity were positively correlated with one another for both general and older adult populations. This suggests that individuals who engage in one form of physical activity are more likely to participate in others, reinforcing the importance of promoting well-rounded exercise routines to encourage an active lifestyle.

Male respondents exhibited significantly higher levels of vigorous leisure-time physical activity (general: standardized coefficient = 0.088, $p < 0.001$; older: standardized coefficient = 0.056, $p < 0.001$), light or moderate leisure-time physical activity (general: standardized coefficient = 0.024, $p < 0.05$; older: standardized coefficient = 0.048, $p < 0.001$), and leisure-time strengthening activity (general: standardized coefficient = 0.042, $p < 0.001$; older: standardized coefficient = 0.030, $p < 0.05$). This suggests that men are generally more active than women, potentially due to greater encouragement toward sports and fitness, differences in perceived physical ability, or social norms surrounding exercise participation. However, there were no significant differences between male and female respondents in terms of neighborhood social cohesion. This suggests that social connectedness within a neighborhood is experienced similarly by both men and women, regardless of their levels of physical activity. It highlights the potential for community-based interventions to equally engage both genders, even if their participation in specific physical activities differs.

Regarding education level, both general and older adults with high school, college, and graduate-level education had higher levels of neighborhood social cohesion, vigorous leisure-time physical activity, light or moderate leisure-time physical activity, and leisure-time strengthening activity compared to those with less than a high school education. This may be due to greater awareness of the health benefits of physical activity, better access to fitness facilities, and more opportunities to participate in structured exercise programs. These findings highlight the importance of targeted health promotion efforts for individuals with lower education levels, ensuring they have the necessary resources and support to engage in physical activity and foster stronger social connections within their communities.

Married respondents reported higher levels of neighborhood social cohesion (general: standardized coefficient = 0.071, $p < 0.001$; older: standardized coefficient = 0.050, $p < 0.05$) than their unmarried counterparts, though marital status was not significantly associated

with any of the three types of leisure-time physical activity. This indicates that while being married may enhance social connectedness within a neighborhood, it does not necessarily translate into higher engagement in physical activity.

For family income, both general and older adults with lower household incomes (\$0–\$34,999, \$35,000–\$74,999, or \$75,000–\$99,999) exhibited lower levels of neighborhood social cohesion, vigorous leisure-time physical activity, and leisure-time strengthening activity compared to those with incomes of \$100,000 or higher. This suggests that higher-income individuals may have greater access to resources that facilitate both social engagement and physical activity, such as safer neighborhoods, community organizations, fitness facilities, and recreational programs.

Finally, overweight and obese respondents had lower levels of neighborhood social cohesion and engaged in less leisure-time physical activity across all categories than those with normal weight. This suggests that weight status may influence both social engagement and physical activity participation, potentially due to reduced mobility, social stigma, or lower perceived safety and comfort in engaging in outdoor or group activities.

4. Discussion and Conclusions

The key contribution of this study is its examination of the reciprocal relationship between neighborhood social cohesion and leisure-time physical activity. Findings indicate that neighborhood social cohesion is significantly associated with light to moderate leisure-time physical activity across all adult age groups. The findings align with previous research that stronger social ties within a community encourage physical activity by fostering a sense of safety, accountability, and shared motivation [30]. This suggests that participation in physical activity may depend on social connections and the supportiveness of one's neighborhood. Since light to moderate physical activities, such as brisk walking, typically occur within neighborhood settings, social support from the community plays a critical role [19]. This aligns with Putnam's work [31], which emphasizes the decline of social capital and its impact on community engagement. Putnam argues that strong social ties foster trust, reciprocity, and collective action, all of which can contribute to increased participation in social and recreational activities, including physical exercise. The findings reinforce this notion by demonstrating that older adults who perceive stronger neighborhood social cohesion are more likely to engage in physical activity, suggesting that fostering social capital within communities can have tangible health benefits.

These findings highlight the need for strategies and policies that foster neighborhood social cohesion across all age groups as a means of promoting leisure-time physical activity. These findings underscore the importance of implementing strategies and policies that enhance neighborhood social cohesion to promote leisure-time physical activity. Public health agencies and local governments can organize neighborhood fitness initiatives, such as outdoor group yoga sessions or community exercise challenges, to promote social connections alongside physical activity. Intergenerational activity programs organized by schools and community centers can encourage physical activities between different age groups. Youth-led exercise sessions for seniors can help foster connections while promoting active lifestyles.

Effective approaches include establishing a "buddy system", encouraging shared physical activity goals, and maintaining walking groups that foster friendships and accountability [26]. A review study has shown that such social support interventions in neighborhood settings can effectively increase overall physical activity levels [32]. Another study [33] highlights the success of community-based walking programs that encourage older adults to participate in structured walking groups, which not only improve physical health but also create strong social bonds that support long-term engagement in physical

activity. These programs can be particularly effective in urban settings where accessibility and safety concerns often discourage older adults from exercising outdoors. Additionally, volunteer “friendly visitor” programs and psychosocial group rehabilitation initiatives have proven to be successful [20], helping older adults build new social connections, cultivate a sense of belonging [34], and ultimately enhance their engagement in active leisure. Local governments can further support these efforts by offering financial or material incentives for older adults to collaborate on community projects that improve neighborhood aesthetics, such as planting trees or flowers [35]. These initiatives not only enhance social cohesion but also create inviting, active spaces that encourage physical activity. Investing in infrastructure improvements can also play a crucial role in promoting both social interaction and physical activity. Designing safe, walkable spaces with accessible paths, benches, and shaded areas can encourage outdoor gatherings and increase participation in everyday movement [36]. Leyden’s (2003) research [14] on walkability provides further context for the relationship between the built environment, social cohesion, and physical activity. Leyden found that walkable neighborhoods promote social interaction, increase social capital, and encourage active lifestyles, as residents in pedestrian-friendly environments are more likely to engage with their neighbors and participate in outdoor activities.

Light to moderate leisure-time physical activity was significantly associated with neighborhood social cohesion among older adults but not the general adult population. The finding aligns with existing research [37] that older adults who perceive higher neighborhood social cohesion are more likely to engage in physical activity, which in turn enhances their mental health. This relationship is particularly pronounced in older populations, as social cohesion fosters environments that encourage active lifestyles. This may be because older adults are more likely to engage in these activities in group settings, fostering social interaction, strengthening neighborhood networks, and encouraging collective efforts for physical activity promotion, such as “fun walks.” Moderate-intensity activities that are simple, accessible, affordable, and social are particularly appealing to older adults [38,39]. However, the increasing focus on in-home care services for older adults [20] may reduce leisure-time physical activity and weaken neighborhood cohesion. To counteract this, community-based group programs and events that promote both social interaction and physical activity should be prioritized. Initiatives like neighborhood walking groups could also integrate neighborhood watch-style activities, offering older adults a safe, accessible, and socially supportive way to stay active and engaged [32,40].

This study found that older adults had significantly lower levels of leisure-time physical activity but higher levels of neighborhood social cohesion compared to the general adult population. This finding aligns with previous research indicating that older adults tend to engage in lower levels of leisure-time physical activity while experiencing higher levels of neighborhood social cohesion. A study has shown that physical activity declines with age due to factors such as mobility limitations, health concerns, and environmental barriers [41]. The lower engagement in physical activity among older adults may not necessarily stem from social isolation but rather from a decline in physical condition and mobility [20]. Previous research has identified poor physical health as a common barrier to physical activity for seniors [42–44]. Additionally, older adults may be more affected by obstacles such as lack of motivation, limited transportation, or illness/disability compared to middle-aged and younger adults [26].

The differences observed between older adults and the general population in terms of neighborhood social cohesion and leisure-time physical activity align with the broader aging-in-place discussion. Wiles’s study [45] defines aging-in-place as the ability of older adults to remain in their homes and communities safely, independently, and comfortably, which is closely tied to both social connectivity and access to physical activity opportunities.

The findings suggest that older adults experience higher levels of neighborhood social cohesion compared to the general population, reinforcing the idea that strong social ties play a critical role in enabling individuals to successfully age in place. However, their lower participation in vigorous and strength-based physical activity raises concerns about how aging-in-place environments can better support sustained physical activity and mobility. To strengthen aging-in-place strategies, policymakers and urban planners should focus on enhancing social infrastructure and designing age-friendly communities. Initiatives such as walkable neighborhood designs, accessible parks, and structured community fitness programs can provide older adults with safe and socially engaging spaces for physical activity. Additionally, leveraging existing community networks and volunteer programs can foster opportunities for peer support and intergenerational physical activity, further reinforcing both social cohesion and active living for older residents.

To overcome these barriers, instruction in cognitive and behavioral strategies—such as positive self-talk about walking, goal-setting, contingency management, and relaxation techniques—delivered through individual face-to-face sessions or group instruction has been effective in promoting physical activity participation [46,47]. Additionally, measuring exercise-related self-efficacy by assessing whether older adults feel confident in their ability to engage in regular physical activity could provide valuable insights into their perceived physical condition and capabilities [48]. Research has shown a strong link between self-efficacy and walking behavior among older adults in Portland, Oregon [35], while another study found that initial self-efficacy significantly influenced long-term exercise participation rates [49]. Since most routine physical activities take place within neighborhoods [19], an unwelcoming walking or biking environment near one's home can serve as a significant environmental barrier to physical activity.

This study found that the three types of leisure-time physical activity were strongly interconnected. This suggests a behavioral synergy, where targeting one type of leisure-time activity in an intervention may also enhance participation in others. Additionally, programs or events promoting any of these activities could potentially boost engagement in the other two.

Lower levels of social cohesion and leisure-time physical activity indicate the need for targeted interventions and programs that focus on specific socio-demographic groups, including women, non-Hispanic Black individuals, Hispanics, those with less than a high school education, low-income populations, and overweight or obese adults. These groups are at higher risk of experiencing negative health outcomes and should be prioritized in efforts to promote neighborhood social cohesion and physical activity. Future research should focus on these high-risk populations to better understand the factors contributing to lower levels of social cohesion and leisure-time physical activity.

This study has several limitations that should be acknowledged. First, the NHIS only collects data on leisure-time physical activity and does not account for total physical activity, including transportation-related activity. This limitation restricts a comprehensive understanding of overall physical activity, despite the increasing importance of leisure-time physical activity over time [26,50,51]. Second, the NHIS relies on self-reported data from selected respondents, which may introduce recall and respondent bias. Future research should consider incorporating objective measures such as accelerometers to track physical activity levels more accurately and GIS data to analyze neighborhood environments, such as walkability, access to recreational spaces, and infrastructure quality [52]. These objective methods would enhance measurement precision and provide a more comprehensive understanding of how environmental factors influence physical activity and social cohesion among older adults. Third, the study employs a cross-sectional survey design,

preventing an analysis of behavioral change phases and the evolving interaction between neighborhood social cohesion and leisure-time physical activity over time [8].

This study advances the understanding of how neighborhood social cohesion and leisure-time physical activity interact among older adults, highlighting the importance of inclusive and community-driven interventions. Special attention is given to socio-demographic groups such as women, non-Hispanic Black and Hispanic individuals, low-income populations, and overweight or obese adults, as they may face unique barriers to participation. The findings provide valuable insights for designing targeted programs and policies that promote social cohesion and physical activity, ultimately improving the health and well-being of the aging population.

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