Neighborhood Environment Walkability and Functional Health Status in Community-Dwelling Older Adults: A Descriptive Correlational Study

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Abstract

Background: *Functional health status is paramount for older adults residing in the community, serving as a cornerstone for independence and enhancing their quality of life. Given the reduced functional capacities of older individuals, they are notably more susceptible to the impacts of their immediate environments. To facilitate a healthy, secure, and active lifestyle for older adults within the community, it is imperative that their neighborhood fosters a harmonious person-environment relationship and encourages heightened physical activity. Walkable neighborhoods play a pivotal role in promoting the physical activity of older individuals.* ***Objective:*** *This study aimed to identify the relationship between perceived neighborhood environment walkability and the functional health status of community-dwelling older adults.* ***Settings:*** *The study was conducted at five outpatient clinics within Matrouh General Hospital, affiliated with the Egyptian Ministry of Health and Population.* ***Subjects:*** *the study included 260 individuals aged 60 years and older with no or mild cognitive impairment and did not rely on assistive walking aids.* ***Tools:*** *Four tools were used to collect data, older adults' Socio-demographic and Clinical data Structured interview schedule, the Saint Louis University Mental Status (SLUMS) Examination, Neighborhood Environment Walkability Scale-Abbreviated (NEWS-A), and The Dartmouth COOP functional status assessment charts/WONCA (COOP/WONCA) charts.* ***Results:*** *A statistically significant correlation was noticed between functional health status and neighborhood walkability in terms of land-use mix-access, street connectivity, aesthetics, and the absence of cul-de-sac roads ($r = 0.140$, $p = <0.001$; $r = 0.189$, $p = <0.001$; $r = 0.158$, $p = <0.001$; and $r = 0.159$, $p = <0.005$, respectively).* ***Conclusion****: The study highlighted a significant relationship between older adults' perception of neighborhood walkability domains including street connectivity, aesthetics, and the presence of cul-de-sac roads, and their functional health status.* ***Recommendations:*** *Disseminate the research findings concerning the impact of a walkable neighborhood environment on the functional health status of older adults through scientific conferences and mass media platforms to be a guide for the development of future age-friendly communities.*

Keywords: Functional health status, Neighborhood environment, older adults, Walkability.

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Introduction

Population aging is expected to be one of the most significant social transformations of the twenty-first century, as people live longer and at an unprecedented rate (Cunningham et al., 2020). The number of people aged 65 years and older is expected to reach two billion by 2050, representing 22% of the world's population (Cheng et al., 2020). Aging population is linked to an increase in chronic non-communicable diseases such as heart disease, cancer, and diabetes mellites, which may result in rising health and social costs associated with managing increased rates of severe disability (World Health Organization [WHO], 2015). Promoting healthy aging is an effective way to improve the health and well-being of older adults (Kim et al., 2021). In light of that, the World Health Organization's 2015 World Report on Ageing and Health defines "healthy aging" as the "ongoing process of developing and maintaining the functional ability that enables wellbeing in old age". This notion of healthy aging is delineated into three key dimensions: intrinsic capacity, functional ability, and environmental factors (WHO, 2021). Furthermore, the ecological theory of aging states that behavior is governed by an individual's competence and environmental demands (Menassa et al., 2023). As a result, broadening the definition of aging in place to include "remaining living in the community, with some level of independence, rather than in residential care," aims to meet the needs of older adults and shows the importance of a suitable environment to avoid unwilling relocation (McGoldrick, 2023).

The area surrounding older adults' homes within a 10–15-minute walk or a 500-metre radius is known as the Neighborhood Environment (NE) (Zhang & Li, 2020). Recent research has shown a strong correlation between the quality of the NE and health outcomes in older adults since older individuals typically spend a significant amount of time in their NE (Chippendale, 2020; Li et al., 2022). Enhancing the NE has been recognized as a crucial strategy for improving public health, leading to the implementation of numerous health-promoting projects (Bonaccorsi et al., 2020). Age-friendly programs have been developed to enhance older individuals' physical and social environments, supporting their well-being, health, and capacity to live autonomously in the community (van Hoof et al., 2021). Also, according to the Copenhagen Consensus Conference Statement of 2019, "maintaining older adults' physical activity is essential for preserving health and the proper functioning of physiological systems throughout life" (Bangsbo et al., 2019). Moreover, walking is the preferred physical activity for older individuals and can be easily integrated into their daily routines (Lee et al., 2022). Based on this, the concept of "walkability," as defined by Gan et al. (2021), refers to the extent to which the built environment promotes and supports walking. Various NE factors, such as residential density (the type and number of dwelling units in a neighborhood), street connectivity, land use diversity (various structures within a neighborhood, which may include homes, grocery stores, etc.), proximity to recreational areas, availability of street amenities, and the presence of green spaces, significantly influence walkability (Otsuka et al., 2021).

Gerontological nurses must acknowledge the influence of the built environment and community factors on older adults' health behaviors and well-being. They should encourage older individuals to assess their surroundings, identify elements that impact healthy living, and advocate for policies and initiatives that encourage health-promoting environments (Wood et al., 2022). Thus, the results of the current study can offer valuable guidance for urban planning and developing age-friendly environments that consider the perceptions and experiences of older adults to enhance their functional health and encourage healthy and active aging while remaining in their familiar living environments.

Aim of the Study

This study aimed to identify the relationship between perceived neighborhood environment walkability and the functional health status of community-dwelling older adults.

Research Questions

What is the relationship between perceived neighborhood environment walkability and the functional health status of community-dwelling older adults?

Materials and Method

Materials

Design:

This study followed a descriptive correlational research design.

Settings:

The present study was conducted at the

outpatient clinics within Matrouh General Hospital, affiliated with the Egyptian Ministry of Health and Population. These clinics operate from 9 a.m. to 2 p.m. on all weekdays except Fridays.

Subjects:

A convenient sample of two hundred and sixty (260) older adults aged 60 years or above of both genders, voluntarily enrolled in the study. They did not rely on assistive walking devices and exhibited either no or mild cognitive impairment.

Tools: Four tools were used for data collection:

Tool I: Saint Louis University Mental Status (SLUMS) Examination.

The SLUMS Examination questionnaire, developed by Tariq et al. (2006), is a widely employed tool for assessing the presence and severity of cognitive impairment. Consisting of 11 items, the questionnaire utilizes a scoring system with a maximum total of 30 points. Scores for each item are contingent upon the individual's educational background. For respondents with a high school education, a score between 27 and 30 points indicates normal cognitive function, 21 to 26 points suggest mild neurocognitive disorder, and 1 to 20 points signify dementia. Conversely, for those who didn't finish high school, normal cognitive function falls within the range of 25 to 30 points, scores between 20 and 24 points indicate mild neurocognitive disorder, and dementia is reflected by scores ranging from 1 to 19 points. In a previous study by Abdelrahman and Gaafary (2014) involving the Egyptian population, with a Cronbach's alpha coefficient of 0.723, the Arabic version of this instrument demonstrated strong reliability.

Tool II: Older Adults' Socio-demographic and Clinical Data Structured Interview Schedule

This tool was developed by the researchers and comprised two parts:

Part 1: Sociodemographic data encompassed gender, age, marital status, living arrangement, monthly income, duration of residency in the present neighborhood, educational attainment, and pre-retirement and current employment status.

Part 2: Clinical data of the studied older adults included their medical history, medication consumption, and participation in exercises.

Tool III: Neighborhood Environment Walkability Scale-Abbreviated (NEWS-A).

Cerin et al. (2007) developed the NEWS-A tool to assess how the participants' living environment influences their walking behaviors and physical activity. It comprises 54 self-reported items with 8 multi-item subscales (including residential density, land use mix-access, land use mix-diversity, street connectivity, infrastructure and safety for walking, traffic hazards, aesthetics, and crime) and 4 single-item subscales that assess access to parking, lack of cul-de-sacs, hilliness, and physical barriers. All subscales except residential density and land use mix-diversity, are rated on a 4-point Likert scale (from 1=strongly disagree to 4=strongly agree). Residential density items were assessed on a 5-point Likert-like scale and weighted relative to the average residential density, weighted values were summed to provide a subscale score (for example, 7–12 story apartments and condominiums were thought to be 50 times more person-dense than single-family homes). The perceived walking proximity from home to 23 distinct types of destinations was used to measure the diversity of the land-use mix. Responses ranged from 1- to 5-minute walking distance (coded as 5) to > 30-minute walking distance (coded as 1). As for the NEWS-A scoring system, higher scores in a domain indicate a higher perception of walkability, except in the traffic hazards, crime, hilliness, and physical barriers domains. In these domains, higher scores correspond to lower walkability perceptions. The NEWS-A demonstrated high test-retest reliability (ICC > 0.73).

Tool IV: The Dartmouth COOP functional status assessment charts/WONCA (COOP/WONCA) charts.

The COOP/WONCA charts, initially developed by Nelson et al. (1987) and subsequently updated and endorsed by the World Organization of Family Doctors (Van Weel et al., 2012), with further revisions by Bentsen et al. (1999), evaluate six domains of functional health: physical activities, daily tasks, emotions, social engagements, health changes, and overall well-being. A single question on a five-point Likert scale, with responses ranging from "no limitation at all" to "severely limited," is used to evaluate each domain, except for the "change in health" domain, which ranges from 'much better' (scored as 1) to 'much worse' (scored as 5). Consequently, a higher mean score within a domain indicates poorer functional health status. The assessment period covers two weeks and is facilitated by a visual aid depicting the response options. Scores are computed individually for each domain using the respective chart. Madian et al. (2021) applied this tool to Egyptian older adults after translating it into Arabic and confirming its reliability (r = 0.87).

Method:

- Approval was obtained from the Research Ethics Committee of the Faculty of Nursing at Alexandria University.
- An official letter was sent from the Faculty of Nursing at Alexandria University to the director of Matrouh General Hospital and the head of the outpatient clinics. This letter informed them about the study's objectives and requested their approval for data collection at specified dates and times.
- The Arabic version of Tool I (Saint Louis University Mental Status Examination) was utilized to include subjects with no or mild cognitive impairment.
- The sociodemographic and clinical data of older adults were collected through a structured interview schedule (Tool II) developed by the researcher.
- Tool III (NEWS-A) was translated into Arabic and tested for content validity by five experts in Gerontological Nursing, community health, and physical education. Modifications were made to the tool based on feedback, including the addition of two elements to the second dimension, land use mix–diversity, resulting in a total of 25 different types of destinations, including places of worship and bakeries.
- The Arabic version of Tool IV (COOP/WONCA charts) was used in the study to assess the functional health status of the studied older adults
- The reliability of Tools I, III, and IV were assessed using Cronbach's alpha method, yielding coefficients of 0.72 for Tool I, 0.91 for Tool III, and 0.84 for Tool IV.
- A pilot study involving 26 older adults from the study setting was conducted to evaluate the applicability and clarity of the study tools. Feedback from the pilot study led to necessary adjustments.
- The researcher conducted interviews at the outpatient clinics' waiting area during the morning shift at 9 am, three to four days per week, following each clinic's schedule.
- Data collection took place between November 2022 and February 2023, with the completion time of the study tools varying from 30 to 40 minutes based on the cooperation level of the elderly individuals and the presence of a conducive environment. The number of older adults interviewed per visit ranged from 5 to 10.

Ethical considerations.

Approval was obtained from the Research Ethics Committee at the Faculty of Nursing, Alexandria University. Informed consent was obtained from each older adult before they participated in the study after a comprehensive explanation of the study's objectives. The anonymity and privacy of the study subjects and the confidentiality of the collected data were maintained. Additionally, participants were informed of their right to withdraw from the study at any time without penalty.

Statistical Analysis.

Following data collection, the data was reviewed, encoded, and digitized utilizing the Statistical Package for Social Sciences (SPSS) software version 26.0. Quantitative data was analyzed using statistical measures such as range (minimum and maximum values), mean, and standard deviation. The reliability of the assessment tools was assessed through the Cronbach's alpha coefficient test. For comparing more than two variables within normally distributed quantitative data, an F-test (ANOVA) was applied. The strength of linear association between two normally distributed quantitative variables was determined using the Pearson correlation coefficient. Furthermore, the paired t-test was utilized to compare two variables within normally distributed quantitative data. The significance level for the findings was established at ≤0.05.

Results

Table I presents the socio-demographic characteristics and clinical data of the older adults included in the study. The study comprised 260 older adults, with females accounting for 51.2% and males for 48.8%. Their ages ranged from 60 to 86 years, with a mean of 65.51±5.40 years. Marital status indicated that 65.8% were married, and 28.1% had completed university education. Pre-retirement, 68.9% were employed, while currently, 89.6% were not working. 69.2% reported having sufficient financial income, and 86.1% lived with their families, with 50.4% having resided in the same neighborhood for 20–40 years. chronic illnesses were reported by 93.8% of the participants, and 81.5% of the studied older adults were practicing exercises.

Table II displays the mean scores for the neighborhood environment walkability domains. Except for the domains related to traffic hazards, crime, hilliness, and physical barriers, which indicate a lower walkability, a higher mean score across all domains according to the NEWS-A scoring system, indicates a more walkable neighborhood environment. The residential density of the older adults under study had a mean score of 280.18 ±59.13, which was lower than the NEWS-A range (173–865) and indicated a lower walkability. In addition, the land-use mix diversity mean score was higher than the NEWS-A range (1.0–5.0), at 3.254 ±0.428. Additionally, in comparison to the NEWS-A range of 1.0-4.0, the mean scores for infrastructure (2.415 ±0.615), street connectivity (3.623 ±0.615), land use mix access (3.081 ±0.749), absence of cul-de-sacs (2.311 ±1.361), and lack of parking (2.173 ±1.308) are all considered high, indicating greater walkability. Also, walkability is higher because of perceived low traffic hazards (1.768 ±0.969), crime (1.482 ±0.655), and physical barriers (1.331 ±0.799). Furthermore, low perception of walkability is indicated by the mean aesthetics and hilliness scores (1.899 ±0.768 and 2.046 ±1.118, respectively).

Table III illustrates the distribution of the studied older adults based on their functional health status. The COOP/WONCA scoring system indicates that each domain with a greater score indicates a poorer functional health condition. So, the most affected domains were physical fitness, overall health status, change in health, feelings, and the domain of daily activities (76.46%, 52.69%, 48.46%, 48.23%, and 47.69% respectively). On the other hand, the domain of social activities had a better-scored domain (39.85%) of the functional health state.

Figure I shows the distribution of the studied older adults based on their functional health status. 77.31% of them had a moderate functional health status, while 15.38% of them had a high functional health status, and only 7.31% of them had a low functional health status.

A Pearson correlation analysis demonstrated a statistically significant relationship (**Table IV)** between functional health status and the NEWS-A subscales of land-use mix-access, street connectivity, aesthetics, and lack of cul-de-sac roads ($r = 0.140$, $p < 0.001$; $r = 0.189$, $p < 0.001$; $r = 0.158$, $p < 0.001$; and $r = 0.159$, $p < 0.005$, respectively).

Discussion

The environment in which an older person lives is central to their functional health status, and research has consistently shown that the neighborhood has an important influence on their ability to live independently. Maintaining functional independence and lowering the need for human assistance are important policy challenges in the context of gerontological nursing (Laborde et al., 2022). Due to their diminished functional capacity, older adults are most sensitive to the influences of immediate environmental situations. As proof of that, the ecological theory of aging states that behaviors are influenced by the individuals' competence and their environmental press; as the environmental pressures grow, the individual's functional status decreases (Nahemow & Lawton, 2016), particularly at the neighborhood level, where older adults spend most of their daily time in their residential neighborhood (Diez Roux, 2016).

A critical issue for the multidisciplinary team members (e.g., health professionals, community health educators, social workers, and policymakers) is how to plan and construct a supportive living environment to encourage healthy aging in place and maintain the independence of older adults (van Hoof et al., 2021). Therefore, this study aimed to discuss the relationship between perceived neighborhood walkability and the functional health status of community-dwelling older adults in Matrouh, Egypt.

The NE characteristics can influence older people's active aging and physical activity (PA) (Nordin & Nakamura, 2020). In this regard, the current study explored that, the NEWS-A score on the residential density subscale in this sample (Table II) indicates low walkability. This can be justified because the majority of housing types in Matrouh range from detached single-family residences to apartments that are 4-6 stories (Ayad et al., 2013; Mohammed, 2022). This can be supported by Tamura et al. (2019), who found that, even in the United States, active people choose less populated and mixed regions for recreational walking. Contrary to our findings, Habibian and Hosseinzadeh (2018) found that Walking became easier in neighborhoods with a high resident density and a variety of land uses.

Furthermore, according to the NEWS-A subscale score on land use mix access, land use mix diversity, street connection, traffic hazards, crime, infrastructure, access to parking, a lack of cul-de-sacs, and physical barriers (Table II), there is a greater perception of NE walkability among the investigated older people. This means that the NE, which has a wide range of facilities, easier access, and better-connected streets, is easy to walk, is safe from traffic and crime, and has other paths and parking spaces, encourages physical activity and walking. Consistent with our findings, Lai et al. (2021) in Taiwan concluded that walking among older adults may be promoted in neighborhoods with plenty of sidewalks, easy access to destinations, and public transportation. Similarly, Nyunt et al. (2015) in Singapore concluded that A higher frequency of walking was linked to older individuals living in well-connected streets, a diverse land use mix, being close to services and amenities, and having an attractive surroundings.

Moreover, the NEWS -A hilliness and aesthetics subscale scores (Table II) were linked to a lower perception of NE walkability. This could be explained by the presence of a population that lives in the periphery neighborhoods of the city, which are characterized by rocky hills and a lack of beautiful views that make it difficult for the elderly to walk or get around (Ayad et al., 2013; Mohammed, 2022). Supporting that, Moura et al. (2017) concluded that high slopes characterized the less walkable areas. Contrary to our finding, in Colombia, high slopes were found to be associated with increased walking (Kerr et al., 2013). Furthermore, Lui and Wong (2022) in China, reported that the perceived walkability of the environment (the aesthetics subscale) is positively associated with gait speed.

The current study also highlighted that the majority of the studied older adults had a moderate functional health status ability (77.31%) (Figure 1), where physical fitness was the most affected domain and social activity was the least affected (Table III). As people age, they may experience physical limitations such as decreased mobility, strength, and balance, which can affect their ability to perform daily activities independently (Freiberger et al., 2020). This explanation is congruent with the findings of a study done in Finland by

Juopperi et al. (2021), who concluded that chronic comorbidities that increase in old age were correlated with faster degradation of physical capability in the elderly.

However, these circumstances had no bearing on the social-functional status of the studied older adults (Table III). This could be explained from a sociocultural perspective; in Matrouh traditions, most families are extended (86.1% of the studied older adults were living with their families (Table 1)), which supports them in maintaining their social participation. This explanation can be supported by Dombrowsky (2017), who stated that higher social support is associated with a higher level of functional status. On the other hand, Adhikari (2017) in South Asia showed that social health was the lowest domain among older adults. Also aligned with the current study findings, Bansal et al. (2018) in India and Lima et al. (2018) in Brazil found that functional health status is low in older persons with diabetes mellitus (DM), with the physical and social domains showing the lowest and highest mean scores, respectively.

In the present study, a statistically significant relationship has emerged between the older adult's perception of NE and their functional health status in terms of land-use access, street connectivity, and aesthetics (Table IV). Easy access to facilities and the nearest grocery stores could promote older adults' functional health status. Consistent with the current findings, in the UK, Kenyon and Pearce (2019) found that destination accessibility was more conducive to walking than high residential density among the elderly population. Also, Bonaccorsi et al. (2020) in Italy argue that overall access to facilities, destinations, and services promotes physical activity and overall health in older people.

Contrary to the current study finding, Stappers et al. (2020) in South Limburg concluded that the facilitating features in the physical environment, such as access to facilities and appealing aesthetics, might not positively affect individuals with health-related problems. Similarly, Nordin and Nakamura (2020) in Malaysia reported respondents in the upper part of the neighborhood tended to be further from the main facilities, so they might not choose to walk, whereas respondents in the lower part were closer to the main facilities; they were obstructed by the main road and the grass-strip boundary, so they might not choose to walk.

Furthermore, street connectivity can provide shorter distances between crossings and more alternative routes in the NE, which can affect older adults' functional abilities. Congruent with the current findings, Nichani et al. (2022) showed a positive association between intersection density and the functional health state of the studied older adults. Also, in the UK, Kenyon and Pearce (2019) discovered that walking was more facilitated by roadway connection and destination accessibility than by high residential density. Similarly, Clarke et al. (2017) mention that a well-connected pedestrian network may enhance the overall health of older adults by lowering their dependency on cars. While some studies showed the opposite, Moran et al. (2018) found that pedestrians are more likely to select routes with fewer crossings for safety-related reasons. Also, in Canada, Engel et al. (2016) discovered that shorter intervals between junctions and various alternate routes were associated with lower capability well-being.

As known, the aesthetic features of the environment have an impact on human well-being (Zhang & Tu, 2021). In line with the current study results (Table IV), Tiraphat et al. (2017) concluded that one of the predictors of older adults' quality of life was neighborhood aesthetics. Similarly, Dennis et al. (2020) found that older adults with low functional health status usually prefer to live in equipped neighborhoods with services and natural landscapes (green space) available. Contradicting our finding, Van Van Cauwenberg et al. (2022) concluded that shorter objective distances to the better-perceived aesthetic areas were associated with decreases in physical HRQoL. Similarly, a study conducted in Korea by Seo et al. (2021) discovered a substantial correlation between physical frailty in elderly people living in rural areas and aesthetics and recreational facilities.

Also, in the present study, the lack of cul-de-sac roads (dead-end streets) was linked to the functional health status of the studied older adults (Table IV). This can be justified in light of the geographic characteristics of Matrouh city, as most of its streets are long with few dead ends (Ayad et al., 2013; Mohammed, 2022). This finding was supported by Mills (2017) in San Diego, who found that fewer dead-end streets were associated with a decreased likelihood of self-reported impairments. Similarly, Nordin and Nakamura (2020) in Japan discovered that a lack of cul-de-sac roads promotes the health of elderly people. Moreover, Fogal et al. (2019), reveal that older adults' capacity to function can be affected by a suitable and adequate walking environment.

Limitations of the study:

The present study highlights some limitations. Firstly, despite using the NEWS-A (short version) it was still exhausting for many older adults in the study, Secondly, the assessment of neighborhood walkability relied on the subjective perceptions of older adults, potentially leading to variability in responses even within the same locality. Thirdly, the unique coastal geography and cultural characteristics of Matrouh raise concerns regarding the generalizability of the findings to other governorates across Egypt.

Conclusion

The present study revealed a significant relationship between older adults' perception of neighborhood environment walkability in terms of street connectivity, aesthetics, and lack of cul-de-sac roads and their functional health status.

Recommendations

Based on the findings of this study, the following recommendations were suggested:

- Perform a comprehensive health assessment of older adults' living environment by the gerontological nurse to identify factors affecting their walkability and tailor specific care plans for addressing these environmental challenges.
- Disseminate the research findings concerning the impact of a walkable neighborhood environment on the functional health status of older adults through scientific conferences and mass media platforms to be a guide for the development of future age-friendly communities.
- Repeat the study on a larger scale and broaden its scope to encompass all governorates of Egypt to enhance the generalizability of the findings.

Table (I): Distribution of the studied older adults according to their sociodemographic characteristics (n=260).

Socio-demographic characteristics	n =260	
	No.	(%)
Sex		
Female	133	51.2
Male	127	48.8
Age (years)		
60-70 years	219	84.2
71 - 80 years	38	14.6
> 80 years	3	1.2
Min. – Max.	60-86	
Mean ± SD.	65.51±5.40	
Marital status		
Married	171	65.8
Widows/ Widowers	81	31.2
Divorced	8	3.0
Level of education		
Illiterate	51	19.6
Read and write	40	15.4
Basic education	38	14.6
Secondary education	52	20.0
University education	73	28.1
Postgraduate education	6	2.3
Occupation before retirement		
Employee	179	68.9
Housewife	56	21.5
Skilled work	25	9.6
Current work		
With no work	233	89.6
Worker	27	10.4
Monthly Income		
Enough	180	69.2
Not enough	80	30.8
Living arrangement		
With family	224	86.1
Alone	28	10.8
With one of the sons at his house	8	3.1
Length of stay in the current neighborhood		
less than 20 years	83	31.9
20-40 years	131	50.4
41-60 years	40	15.4
More than 60 years	6	2.3
Min. – Max.	5.0-72.0	

Mean ± SD.	26.79±15.21	
Presence of chronic diseases		
Yes	244	93.8
No	16	6.2
Prescribed medications consumed		
Yes	230	88.5
No	30	11.5
Participation in exercise		
Yes	212	81.5
No	48	18.5

Table (II): Older adults' perceptions of the neighborhood environment's walkability (n= 260).

Neighborhood environment's walkability domains	n= (260)	
Residential density (range 173-865)	Min -Max	174.00.0 - 595.0
	Mean ± SD	280.18 ±59.13
Land use mix diversity (range 1-5)	Min -Max	1.96.0 – 4.32
	Mean ± SD	3.254 ±0.428
Land use mix access (range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	3.081 ±0.749
Street connectivity (range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	3.623 ±0.615
Infrastructure and safety for walking (range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	2.415 ±0.615
Aesthetics (range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	1.899 ±0.768
Traffic hazards (range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	1.768 ±0.969
Crime (range 1-4)	Min -Max	1.0 – 3.67
	Mean ± SD	1.482 ±0.655
Lack of parking (single item: range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	2.173 ±1.308
Lack of cul-de-sacs (single item: range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	2.311 ±1.361
Hilliness (single item: range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	2.046±1.118
Physical barriers (single item: range 1-4)	Min -Max	1.0 - 4.0
	Mean ± SD	1.331 ±0.799

Table (III) Older adults' functional health status using COOP/WONCA (n=260).

Functional health status domains	n= (260)	%	Mean ± SD.	Percent score
Physical fitness				
Very heavy	3	1.2	**3.82±0.85**	76.46%
Heavy	6	2.3		
Moderate	84	32.3		
Light	108	41.5		
Very light	59	22.7		
Feelings				
Not at all	87	33.5	**2.41±1.25**	48.23%
Slightly	49	18.8		
Moderately	67	25.8		
Quite a bit	44	16.9		
Extremely	13	5.0		
Daily activities				
No difficulty at all	77	29.6	**2.38±1.18**	47.69%
A little bit of difficulty	68	26.2		
Some difficulty	63	24.2		
Much difficulty	42	16.2		
Could not do	10	3.8		
Social activities				
Not at all	132	50.8	**1.99±1.22**	39.85%
Slightly	50	19.2		
Moderately	37	14.2		
Quite a bit	30	11.5		
Extremely	11	4.2		
Change in health				
Much better	66	25.4	**2.42±1.06**	48.46%
A little better	55	21.2		
About the same	113	43.5		
A little worse	15	5.8		
Much worse	11	4.2		
Overall health				
Very good	62	23.8	**2.63±1.26**	52.69%
Good	65	25.0		
Fair	58	22.3		
Poor	56	21.5		
Very poor	19	7.3		

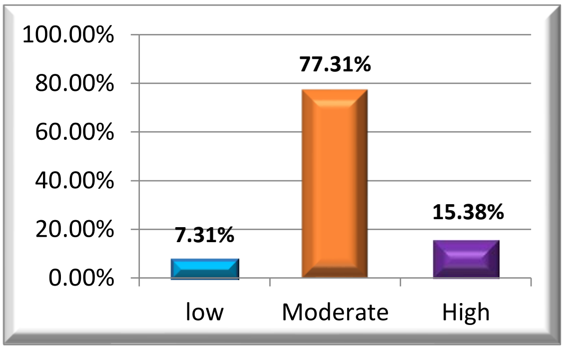

Figure (1): Older adults' distribution according to the functional health status levels (n= 260).

Table (IV) The correlation between older adults' perceptions of the neighborhood environment's walkability and their functional health status.

		Physical fitness	Feelings	Daily activities	Social activities	Change in health	Overall health	Total COOP
Residential density	r	0.006	0.064	0.022	0.015	0.014	0.040	0.031
	P	0.929	0.301	0.726	0.814	0.818	0.516	0.617
Land use mix-diversity	r	0.053	0.089	0.012	0.010	0.066	0.000	0.039
	P	0.394	0.153	0.847	0.879	0.290	0.998	0.529
Land use mix-access	r	0.158	0.066	0.168	0.023	0.022	0.124	0.140
	P	0.011*	0.289	0.007*	0.710	0.729	0.046*	0.024*
Street connectivity	r	0.032	0.112	0.196	0.137	0.065	0.114	0.189
	P	0.606	0.073	0.001*	0.027*	0.294	0.067	0.002*
Infrastructure and safety for walking	r	0.032	0.023	0.012	0.045	0.069	0.110	0.019
	P	0.603	0.715	0.843	0.471	0.270	0.077	0.758
Aesthetics	r	0.050	0.011	0.103	0.114	0.034	0.238	0.158
	P	0.424	0.862	0.097	0.067	0.587	0.000*	0.011*
Traffic hazards	r	0.014	0.004	0.011	0.089	0.053	0.061	0.024
	P	0.821	0.952	0.862	0.151	0.392	0.324	0.695
Crime	r	0.050	0.013	0.019	0.010	0.028	0.057	0.041

	P	0.423	0.835	0.761	0.875	0.657	0.362	0.509
Lack of parking	r	0.052	0.020	0.073	0.050	0.069	0.053	0.039
	P	0.400	0.747	0.238	0.424	0.265	0.396	0.534
Lack of cul-de-sacs	r	0.165	0.145	0.067	0.087	0.054	0.166	0.159
	P	0.008	0.020*	0.281	0.161	0.384	0.007*	0.010*
Hilliness	r	0.036	0.097	0.048	0.082	0.085	0.138	0.080
	P	0.561	0.118	0.440	0.187	0.172	0.026*	0.196
Physical barriers	r	0.053	0.107	0.057	0.022	0.061	0.136	0.092
	P	0.399	0.085	0.359	0.720	0.328	0.028*	0.140

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