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Research article

Comparison of falls and risk factors among older adults in urban villages, urban and rural areas of Shantou, China

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ABSTRACT

Objective: To investigate and compare the differences between the incidence of falls, balance and living environment among older persons in urban villages and other types of residential areas.
Methods: We surveyed 580 older adults living in different types of residential areas in Shantou, China, surveying basic information, fall incidence, balance ability testing of older persons, home environment safety assessment.
Results: The incidence of falls among older people in urban villages (19.54 %) was between urban areas(26.63 %) and rural areas(16.91 %). The influencing factors of falls in different residential types were different. Near-fall, abnormal bowel movement, and impaired balance ability were the risk factors of falls among older persons in urban villages. Divorce/single, fair and poor hearing loss and near-fall were the risk factors of falls in urban older adults. Frailty and impaired balance ability were the risk factors of falls in rural older people.
Conclusions: Risk factors for falls in older people vary according to the characteristics of their living areas and relevant interventions should be targeted according to the characteristics of falls occurring in different residential areas.

1. Introduction

The health of older persons has become a global concern. As they age and their body functions deteriorate, older adults are more vulnerable. Falls, as a common unintentional injury event in older persons [1], are the seventh leading cause of death among older adults [2].

Falls occur in approximately one third of community-dwelling older persons over the age of 65 each year, and the rate of falls increases with age [3,4]. Age, disease, medication, balance abnormalities and dysfunction are common intrinsic causes of falls in older people. Not only are there intrinsic causes, environmental factors including environmental obstructions and living conditions are also associated with increased fall risk and fall rates [5,6]. Studies have shown that 30 % ~ 50 % of older persons falls were related to environmental factors [7]. Differences in residential types may lead to large differences in the surrounding environment and home buildings of older adults, which in turn affect the occurrence and frequency of falls in older adults.

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Currently, the main types of residential areas in China include urban residential areas, rural residential areas and urban villages. Urban residential community is a high-rise residence with complete living facilities. Traditionally, older persons in China are cared for by their children [8], so most along with their children to move to a new urban city, and are relatively unfamiliar to their new neighbors. In rural areas of China, the buildings are mainly bungalows and low-rise buildings with poorly designed interiors, and the majority of older people in rural areas are still engaged in agricultural production. Urban village is the result of China's unique land ownership system and the historical product of the rapid industrialisation and urbanisation with the reform and opening up of the countryside [9]. It formed when a large number of rural villages on the edge of the city were gradually surrounded or semi-encircled by the expanding city [10]. There is no unified internal planning for the buildings in urban villages, and the population density and floor area ratio are high [11]. Elderly people in urban villages rely on clan bloodlines to form communities of villagers and interact with each other more frequently. There are significant differences in the home environment, construction and placement of indoor infrastructure among different housing types, which may also lead to differences incidence of falls among older persons under different housing types.

The health of the elderly has become an important public health issue, and fall-related problems are a serious threat to the health of older people. Effective fall prevention strategies can reduce and control the incidence of falls in older adults and improve their quality of life. At present, fall prevention for the elderly has been emphasized by the relevant governments and scholars, and has had some success so far, but it still needs to be further strengthened. This study makes up for the current lack of data on falls among older people in different types of residential areas, and is of great significance for scholars to further research related to falls prevention in different types of residential areas, especially in urban villages. In this sense, it's necessary to carry out research on the fall study in different types of residential areas of the elderly.

Therefore, this study selected older persons in different types of residential areas in Shantou, China to investigate and to compare the differences between the prevalence of falls, living environment and balance among older adults in urban villages and other types of residential areas, so as to provide basic data and theoretical basis for future targeted intervention research and the formulation of fall prevention strategies for older persons, which will help to reduce the incidence of falls in older persons and ensure the health and safety of older persons.

2. Methods

2.1. Study design and study setting

This cross-sectional study was carried out from March 2021 to October 2021 in Shantou city, China, after obtaining approval from the Ethics Committee of Shantou University Medical College. (project no. SUMC-2021-88)

2.2. Participants

Shantou is a typical urban-rural integration area, so this study randomly selected 2 urban villages and 6 residential community in the central urban areas and 4 rural areas as the research objects in Shantou, China.

According to the Chinese law, the elderly people are defined as those aged 60 years and above. Therefore, the definition of the elderly in this study refers to Chinese citizens aged 60 years old and above.

The following inclusion and exclusion criteria were developed for this study.

The inclusion criteria were used: 1) aged 60 years and above; 2) living in Shantou City for at least one year; 3) able to walk alone or walk with the aid of assistive tools; 4) gave informed consent and voluntarily participate in this relevant questionnaire survey and home environment safety assessment.

The exclusion criteria for this study were used: 1) with cognitive and communication impairments or unconsciousness; 2) had lived in the locality for less than 12 months; 3) completely unable to self care.

2.3. Sample size

The sample size for this study was determined using the Kish Leslie formula for cross-sectional studies.

$$n = \frac{z_\alpha \times p(1-p)}{d^2}$$

where n = desired sample size, z = standard deviation (1.96 at 95 % confidence interval), p = estimated incidence rate of falls among the elderly population of 60 years old and above in Shantou City (0.2727) [12], d = tolerable error (0.15*p = 0.040905), n = 456. To cater for non-respondents, 10 % of the sample size was added; 456 + 46 = 502 people. Stratified by type of settlement, at least 168 individuals should be sampled from each of the urban residential neighborhoods, urban villages, and rural areas for the survey.

2.4. Outcome variables

The survey program consists of three main parts: basic information, incidence of falls, balance ability testing, and home environment safety assessment.

Basic information: This part included gender, age, marital status, education level, residential areas, live alone, abnormal bowel movement, frailty status, the number of chronic diseases, the numbers of medications, hearing status and visual status, foot diseases, nocturia of three times nightly or more, using electronics.

Incidence of falls: The 1-year incidence of falls, fall-related injury and near-fall that occurred in the past year were investigated as primary outcomes in this study and were determined by asking participants if they had fallen in the past year using a self-report questionnaire. A fall is defined as an event that causes a person to unintentionally come to rest on the ground, floor, or other lower level [13]. A near-fall is defined as an event when the individual slips, trips or loses balance but uses the hand(s) or leg(s) or any body part to regain balance and prevent a complete fall [14].

Balance ability testing of older persons: The X16 balance testing scale(X16- BS) was used to assess the balance ability of older persons, which was divided into 3 dimensions with 16 items, namely static balance (4 items), postural stability (4 items), and dynamic balance (8 items). The full scores for the static balance, postural stability, and dynamic balance domains were 4, 8, and 8 points, respectively; therefore, the full score for balance performance was 20 points. The overall Cronbach's alpha coefficient of the scale was 0.933, and all correlations between each item and dimension were significant, indicating that the X16-BS has good reliability [15]. The scale was scored on a Likert-4 scale, with 17–20, 13–16, 7–12, and 0–6 representing intact balance, mildly impaired, moderately impaired, and severely impaired, respectively.

Home environment safety assessment: There are significant differences in home environments and residents' living habits between China and other countries, so the feasibility of directly adopting foreign assessment tools is low. Therefore, this study designed the Home environment safety assessment based on the "Home Environment Risk Factor Assessment Scale for Preventing Falls in the Elderly" [16], combined with the home environment questionnaires designed by Zhao M [17] and Xia QH [18]. The content was divided into 34 entries in 6 dimensions: General indoors (e.g, lighting, tidiness) (8 entries), living room (5 entries), bathroom (7 entries), bedroom (6 entries), kitchen (4 entries), and home surroundings (4 entries). Scoring scale: "Yes" scored 1, "No" and "Not applicable" scored 0. The overall Cronbach's alpha coefficient was 0.779, KMO was 0.750, and the Chi-square value of Bartlett's Test was 4131.06 ($P < 0.001$), indicating good reliability and validity of this brief questionnaire. This scale is scored positively, with higher scores indicating a safer home environment.

2.5. Quality control

The investigators were uniformly trained before the survey to standardize the methodology. This study strictly followed the inclusion and exclusion criteria for the research subjects. Using a door-to-door survey, after the investigator explained the purpose and significance of the study to the older adults, the investigator asked about basic information and incidence of falls, tested the older adults' balance ability, and assessed the home environment. Once the survey was completed, data completeness and consistency were checked.

Table 1
Descriptive characteristics of the sample.

Variable	Urban villages ($n = 174$)	Urban areas ($n = 199$)	Rural areas ($n = 207$)	χ^2/F	*P*-value
Gender				0.323	0.851
Male	77(44.25)	87(43.72)	96(46.38)		
Female	97(55.75)	112(56.28)	111(53.62)		
Age($\bar{x} \pm s$)[a]	71.10 ± 7.70	70.94 ± 6.78	69.90 ± 7.90	1.490	0.226
Education				61.796	<0.001
Primary school and Uneducated	134(77.01)	79(39.70)	131(63.29)		
Junior middle school	28(16.09)	53(26.63)	33(15.94)		
Above secondary school	12(6.90)	67(33.67)	43(20.77)		
Marital status[b]					0.317
Married	134(77.01)	164(82.41)	155(74.88)		
Widowed	38(21.84)	31(15.58)	48(23.19)		
Divorced/single	2(1.15)	4(2.01)	4(1.93)		
Live alone				9.584	0.008
No	157(90.23)	186(93.47)	174(84.06)		
Yes	17(9.77)	13(6.53)	33(15.94)		
Fall				6.111	0.047
No	140(80.46)	146(73.37)	172(83.09)		
Yes	34(19.54)	53(26.63)	35(16.91)		
Fall-related injury				4.609	0.100
No	143(82.18)	152(76.38)	175(84.54)		
Yes	31(17.82)	47(23.62)	32(15.46)		
Near-fall [c]				8.358	0.015
No	158(90.80)	159(81.96)	167(80.68)		
Yes	16(9.20)	35(18.04)	40(19.32)		

Note.
[a] ANOVA test was used.
[b] Fisher's exact probability test was used.
[c] Near-fall data missing 5 cases.

2.6. Data analysis

SPSS 25.0 (IBM) was used for data cleaning as well as statistical analysis, and measurement data were statistically described by mean ± standard deviation, comparison between multiple groups was performed by Analysis of Variance (ANOVA), and further two-way comparison was performed by LSD-*t* if significant. Count data were statistically described by rate, and analyzed by χ^2 test, fisher's exact probability method, and one-way logistic regression. Multi-factor analysis was performed using forward stepwise regression, and variables with univariate significance ($P < 0.05$) as well as home environment scores were included for the study to screen for factors influencing falls in older adults and described using Odds Ratio (OR) as well as 95 % confidence interval (95 % *CI*), with inclusion level of $\alpha = 0.05$ for variables and exclusion level. Stratified analysis was performed for different types of residential areas, and $P < 0.05$ was considered a statistically significant difference.

3. Results

The response rates were 99.32 % (580 of 584 older adults). As shown in Table 1, there were 199 older persons living permanently in urban residential community (34.31 %), 174 in urban villages (30.00 %) and 207 older persons living in rural areas (35.69 %). The age range of the older people surveyed was between 60 and 99 years old, with an average age of (70.62 ± 7.48) years, and there were more female (55.17 %) than male (44.83 %). No statistically significant differences were found between three groups, with the exception of education and living alone.

The incidence of falls was 19.54 %, 26.63 %, and 16.91 % in urban village, urban areas, and rural areas respectively, with a statistically significant difference in the incidence of falls between the different types of settlements ($\chi^2 = 6.111$, $P < 0.05$). The incidence of near-falls was 9.20 %, 18.04 %, and 19.32 % in urban village, urban areas, and rural areas respectively, with a statistically significant difference ($\chi^2 = 8.358$, $P < 0.05$).

Balance ability among different types of settlements were significantly different. The LSD multiple comparison results showed that the balance performance of the rural older adults was better than that of the urban and urban village older adults ($P < 0.05$). Details were included in Table 2.

A comparison of the sub-dimensions revealed statistically significant differences ($P < 0.05$) in the home environment of older people by type of residential area. The total home environment safety scores were (22.37 ± 4.43), (23.87 ± 4.43), and (19.69 ± 4.90) for urban village, urban, and rural areas respectively. Post-hoc LSD multiple comparisons showed that the total home environment safety score for older people in urban areas was higher than in urban villages than in rural areas. Details were included in Table 3.

Being aged 80 years or over, widowed, live alone, having chronic diseases, taking medications, fair and poor visual status, fair and poor hearing status, being pre-frailty and frailty, near-fall, foot diseases, abnormal bowel movement, nocturia of three times nightly or more, and impaired balance were all associated with the incidence of falls among elderly adults in urban villages($P < 0.05$). Being divorced/single, having 3 or more diseases, taking medications, fair visual status, fair and poor hearing status, being pre-frail, near-fall, nocturia of three times nightly or more, not using electronics and impaired balance were all associated with the incidence of falls in urban areas($P < 0.05$). Being aged 80 years or over, widowed, having single disease or more than 3 chronic diseases, fair and poor visual status, being pre-frailty and frailty, near-fall, foot disease, abnormal bowel movement, not using electronics, and impaired balance were all associated with the incidence of falls in rural areas($P < 0.05$).

Variables that were statistically significant in the one-way logistic analysis and the scores of home environment safety assessment were included as independent variables in the multi-factor logistic regression analysis. The multivariate logistic regression analysis in Table 4 demonstrated the risk factors for falls among older people in different types of residential settlements (urban village/urban areas/rural areas).

4. Discussion

Our study showed that the incidence of falls and fall-related injuries among the elderly in Shantou was 21.03 % and 18.97 %, respectively. The overall fall incidence rate was higher than the fall incidence rate of older people aged 60 and above in Guangdong Province (11.9 %) [19] and in a multistage random sampling survey in Shenzhen (10.70 %) [20]. This may be due to the relatively serious ageing phenomenon in Shantou. According to the 7th Census [21], Shantou's elderly population aged 60 and above accounted

Table 2
Comparison of balance ability among older persons in urban villages and urban and rural areas ($\bar{x} \pm s$, score).

Balance ability	Urban villages (UV)	Urban areas (U)	Rural areas (R)	*F*-value	*P*-value	Pairwise comparison
Static balance	3.30 ± 1.02	3.20 ± 1.11	3.33 ± 1.05	0.856	0.425	–
Postural stability	5.86 ± 2.24	5.92 ± 2.49	6.88 ± 2.06	12.557	<0.001	U vs. R[b]; UV vs. R[b]
Dynamic balance	6.65 ± 2.01	6.71 ± 2.05	6.80 ± 1.98	0.258	0.773	–
Balance performance	15.83 ± 4.53	15.83 ± 5.06	17.00 ± 4.68	4.027	0.018	U vs. R[a]; UV vs. R[a]

Note.
[a] :$P < 0.05$.
[b] :$P < 0.001$.

Table 3
Comparison of safety assessment of the home environment among older persons in urban villages and urban and rural areas ($\bar{x} \pm s$, score).

	Urban villages (UV)	Urban areas (U)	Rural areas (R)	*F*-value	*P*-value	Pairwise comparison
General indoors	5.31 ± 1.26	5.20 ± 1.37	4.31 ± 1.41	32.370	<0.001	U vs. R[c]; UV vs. R[c]
Living room	3.01 ± 1.30	3.38 ± 1.14	2.57 ± 1.04	25.023	<0.001	U vs. UV[b]; U vs. R[c]; UV vs. R[c]
Bathroom	3.63 ± 1.46	4.07 ± 1.50	2.84 ± 1.42	37.021	<0.001	U vs. UV[b]; U vs. R[c]; UV vs. R[c]
Bedroom	4.22 ± 1.29	4.52 ± 1.14	3.87 ± 1.33	13.367	<0.001	U vs. UV[a]; U vs. R[c]; UV vs. R[b]
Kitchen	3.19 ± 0.85	3.39 ± 0.78	3.03 ± 1.13	7.401	0.001	U vs. UV[a]; U vs. R[c];
Home surroundings	3.01 ± 0.93	3.32 ± 0.92	3.07 ± 1.00	5.762	0.003	U vs. UV[b]; U vs. R[b];
Total	22.37 ± 4.43	23.87 ± 4.43	19.69 ± 4.90	43.483	<0.001	U vs. UV[b]; U vs. R[c]; UV vs. R[c]

Note.
[a] :$P < 0.05$.
[b] :$P < 0.01$.
[c] :$P < 0.001$.

Table 4
Multi-factor logistic regression analysis of falls in older people with different types of residence.

Type of residential area	Variable	Fall (%)	*OR*(95%*CI*)	*P*-value
Urban village				
	Near-fall			
	No	23(14.56)	1.000	
	Yes	11(68.75)	8.829(2.290, 34.043)	0.002
	Abnormal bowel movement			
	No	16(11.85)	1.000	
	Yes	18(46.15)	3.421(1.159, 10.096)	0.026
	Balance ability			
	Intact balance	3(3.70)	1.000	
	Mildly impaired	11(19.64)	5.556(1.418, 21.760)	0.014
	Moderately impaired	16(53.33)	12.975(2.982, 56.453)	0.001
	Severely impaired	4(57.14)	13.808(1.712, 111.365)	0.014
Urban areas				
	Marital status			
	Married	38(23.17)	1.000	
	Widowed	12(38.71)	1.774(0.717, 4.387)	0.215
	Divorced/single	3(75.00)	12.165(1.158, 127.795)	0.037
	Hearing status			
	Good hearing	25(19.08)	1.000	
	Fair hearing	23(37.70)	2.523(1.208, 5.267)	0.014
	Poor hearing	5(71.43)	6.498(1.027, 41.124)	0.047
	Near-fall			
	No	35(22.01)	1.000	
	Yes	18(51.43)	3.554(1.579, 8.001)	0.002
Rural areas				
	Frailty status			
	Non-frail	16(10.60)	1.000	
	Pre-frailty	14(28.00)	1.898(0.729, 4.945)	0.190
	Frailty	5(83.33)	19.325(1.807, 206.721)	0.014
	Balance ability			
	Intact balance	13(8.39)	1.000	
	Mildly impaired	6(31.58)	4.453(1.385, 14.320)	0.012
	Moderately impaired	11(52.38)	8.348(2.746, 25.379)	<0.001
	Severely impaired	5(41.67)	3.612(0.797, 16.370)	0.096

Note: Only significant variables were listed for multiple factors.

for 15.52 % of the total population, which was a higher proportion of the elderly population than other large cities in the province where it is located (Guangdong Province), such as Guangzhou (11.41 %), Shenzhen (5.36 %) and Zhuhai (10.00 %). It may also be that the big cities (Shenzhen, Guangzhou and Shanghai) have been conducting fall-related health education for the elderly for a longer period of time and have achieved some success in reducing the incidence of falls among the elderly to a certain extent. Therefore, the data on falls in small cities can provide some reference for health education of the elderly.

According to different types of residential areas, this study divided the data of falls among older adults in Shantou into three residential settlements. Similar to earlier reports [6], we have also reported that the incidence of falls was higher in urban residential areas (26.63 %) than in urban villages (19.54 %) and in rural areas (16.91 %). That was, the incidence of falls among older people in urban villages was between urban and rural areas. The possible reason why the incidence of falls among older adults in urban villages was higher than that in rural areas may be attributed to the fact that older people in rural areas still retain their farming lifestyle and certain physical activity capacity can exercise their skeletal muscle function and balance [22], which may reduce the degeneration of the locomotor system, fear of falling, and reduce the incidence of falls and injuries. The reason why the incidence of falls among urban villages' older adults was lower than that in urban areas was that the buildings in urban-village and rural areas are mostly cottages and low rise houses with more spacious interiors. But, the urban environment is generally a densely populated building, and the crowded housing environment causing older adults to have greater risk of falling in urban areas than in urban villages and in rural areas [23]. In addition, unlike the urban villages in Chinese big cities such as Shanghai and Guangzhou, the urban villages in medium-sized cities, represented by Shantou, are still in the transitional phase between urban and rural areas, so there are still a small number of older persons in urban villages in small cities continue their farming life and exercise, just like the rural older adults. So the incidence of falls among older people in urban villages and rural areas is lower than among older people in cities. Nevertheless, further studies would be conducted to explore the difference in older persons fall from different residential areas.

We used the X16-BS to assess the static balance, postural stability and dynamic balance of older people. No differences in static balance and dynamic balance were found in this study for older people in different types of residential areas, but the differences in postural stability were statistically significant. Postural stability refers to an individual's ability to balance during postural changes (including from standing to sitting, sitting to standing, standing to squatting, squatting to standing). Postural control is one of the most common causes of falls in older adults, and low postural stability often leads to injury, disability and reduced quality of life [24]. This may go some way to explaining the low levels of falls among rural older people. The findings showed that 40 % of older people had varying degrees of impaired balance and older adults in rural areas had better balance than in urban areas and in urban villages. A nine-month prospective nested case control study in Tehran showed that poor balance increased patients' risk of falling by 6.41 times [25]. An important factor in the fall of lower limb muscle strength and balance/coordination ability. The muscle quality (muscle strength/skeletal muscle quality) of older adults decreases with age [26]. The body maintains balance by integrating the signal flow from the vestibular, visual and proprioceptive systems [27]. Impaired balance and reduced gait stability result in older adults being less able to adjust their gait to avoid obstacles, making them more susceptible to falls. Previous studies [28–30] [28–30] [28–30] have suggested that balance exercise could improve the balance ability of older persons. The American College of Sports Medicine (ACSM) proposed [31] that adults aged 18–65 years should engage in moderate intensity exercise for at least 30 min per day, at least 5 days per week, or vigorous intensity exercise for at least 20 min per day, at least 3 days per week. Although there were no specific physical activity guidelines for older adults, research recommended that older adults are suitable for multicomponent physical activity [32]. So, it is recommended that younger older people should get a certain amount of exercise every day, while older people should engage in less stimulating exercises according to their physical abilities. Older people can develop a safe and progressive exercise programme based on their habits and preferences, with the help of professionals, to improve their balance, strengthen their body and prevent falls, such as the Otago Exercise Programme (OEP), traditional Chinese exercises (Tai Chi, Baduanjin, and Wuqinxi) and Pilates.

In recent years, an increasing number of scholars have focused on near falls in the field of research on falls in older people. The prevalence of near falls in older people in this study was 15.69 %, which is lower than the 52.5 % in Basler's [33] survey of black older people in the community, which may be due to some methodological differences between this study and his. This study used a retrospective survey method and may have some recall bias. Studies [34–36] [34–36] [34–36] have found that near falls, which may occur earlier than falls and can be used to predict the risk of falls, is quite common and occur more frequently than fall among older adults. In other words, many falls may develop from near-falls as postural control declines over time in older people. A study of 106 older people with hip pain showed that 45 % of respondents reported at least one fall in the past year, with a higher incidence of near falls at 77 % [37]. In addition, Nagai et al. [34] conducted a three-month prospective cohort study in older persons community flats and found that a history of near falls was significantly associated with the occurrence of future falls, with or without adjustment for confounding variables. The risk of near falls, like falls, increases with the presence of individual risk factors and with age, but there is currently less research on near-fall. Probably because the brief event of a near fall is often underestimated and easily overlooked, and surveys are prone to some recall bias. This suggests that studies of near falls could be explored in a prospective cohort study. If the participants cannot provide relevant information, the researchers can consider the use of wearable sensors to obtain accurate data [38].

Our study assessed the home environment safety scores of older persons in different residential areas in in six categories such as general indoors, living room, bathroom, bedroom, kitchen, and home surroundings. We found that the overall rating of the safety of the home environment for older people is low and that the safety of the home environment is better in urban residential areas, followed by urban villages and then rural areas. There are two reasons for the low overall rating of safety in the home environment for older people in this study. On the one hand, the practice of aging housing transformation in China is limited and in its infancy, and the general public lacks awareness of the renovation and construction of the relevant indoor environment and does not understand and believe in the importance of ageing-friendly environment. This may be due to the lack of awareness of aging housing transformation

among older persons, especially in rural areas. For example, during our site survey, we found that houses in rural areas lacked rational construction, such as houses without constructed toilets. On the other hand, because of the large human and financial resources required to assess and adapt the environment, projects to improve the safety of the community and home environment are more difficult to undertake. This may be partly contribute to the low overall rating of safety in the home environment for older people in small and medium-sized cities in China. In order to improve the living conditions of older persons and to meet their psychological, physical and service needs, Chinese government has issued the "The Code for design of residential building for the aged" in 2016 to provide a reference for the construction of the home environment, such as regulating the lighting in the house, recommending toilets to be equipped with toilets and anti-slip materials.

5. Advantages and limitations

The current situation of falls among older people in urban villages, a type of settlement, is often overlooked and falls data was mostly included in urban analysis. But, the urban village, which is a special product of China's urbanisation process, has its own special characteristics in terms of falls among elderly, as its living environment differs significantly from that of the urban and rural areas. In addition, the combination of individual and environmental factors allows for a better analysis of the incidence of falls among older people in different types of settlements (urban villages, urban housing estates and rural areas).

Our study had some limitations. Firstly, due to the nature of cross-sectional design, we were unable to establish causal relationships between variables, limiting the ability to draw definitive conclusions about the underlying mechanisms. Secondly, the use of self-reporting to measure fall history may introduce recall bias, particularly among older individuals, given that they tend to overlook transient events such as falls and near-falls. By relying on self-reporting, we may have underestimated or misinterpreted the true frequency and circumstances of falls among the elderly population in our study. To enhance the reliability of data, future research endeavors should emphasize the adoption of more robust data collection methods, such as the use of monthly fall diaries. This approach can effectively mitigate recall bias and ultimately strengthen the validity of the study's findings.

6. Conclusion

The incidence of falls among older people in urban villages (19.54 %) was between urban areas(26.63 %) and rural areas(16.91 %). Risk factors for falls in older people vary according to the characteristics of their living areas and relevant interventions should be targeted according to the characteristics of falls occurring in different residential areas. The main risk factors for fall in urban areas were divorce/single, fair and poor hearing status and near-fall. The main risk factors for falls in urban villages were near-fall, abnormal bowel movement, and different degrees of impaired balance. The main risk factors for falls in rural areas were frailty and mild and moderate impairment of balance.

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Ethics statement

The Ethics Committee of Shantou University Medical College has approved this study under project number SUMC-2021-88. An informed consent was obtained from each participant involved in the study.

Data availability statements

Data will be made available on request.

CRediT authorship contribution statement

Kaiting Zhang: Writing – original draft, Investigation, Formal analysis, Data curation. **Zidan Yang:** Writing – review & editing, Investigation. **Xiaowei Zhang:** Writing – review & editing, Data curation. **Liping Li:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e30536.

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