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ORIGINAL ARTICLE

Functional mobility and its contributing factors for older adults in different cities in Taiwan

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Background/purpose: Impaired mobility is one of the primary causes of declined functional capacity in old age. The timed up-and-go test (TUG), a common mobility test, has been studied extensively in Western countries. The purposes of this study were to compare and identify factors associated with TUG performance in older adults with impaired mobility and living in different cities in Taiwan.
Methods: Older adults living in Taipei, Tainan, and Niaosong cities were screened for mobility impairments and then recruited. A series of questionnaires and physical and functional tests were used to obtain information and measurements for potential contributing factors and TUG. Regression analysis was conducted to determine factors contributing to TUG.
Results: A total of 413 older adults participated in the study. The mean TUG was 14.3 seconds for participants across the three cities, and was significantly shorter in Tainan. Age, number of medications, fear of falling, depression, high intensity activity time, reaction time, single leg stance time, and functional reach distance were found to have significant contribution. These factors accounted for approximately half of the variance in TUG. The regression equations were not equal for the different cities, with depression being the only common determinant.

Conflicts of interest: The authors have no conflicts of interest relevant to this article.

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Conclusion: Taiwanese older adults with mobility problems living in different cities performed differently in TUG and the contributing factors were also different. These findings indicate a need of further studies examining older adults in different environments.

Introduction

Aging is inevitably accompanied by changes in the functions of many systems of the body. As a result, deterioration in health and functional capacity is often seen in older adults. How best to reduce these age-related problems and healthcare costs is of crucial importance, especially for developing countries.[1]

Taiwan has become an aging society in the past 15 years.[2] Since then, the older population in Taiwan has been increasing at a rate that is twice of that in the USA.[3] With such a rapid growth, there is no doubt that the promotion of health and functional capacity of Taiwanese elderly deserves special attention. However, in spite of a large number of studies focusing on health promotion in Taiwan, research pertaining to a better understanding of functional capacity is scarce. Particularly lacking is information that could help to identify the underlying risk factors for declined functional capacity of older adults living in different environments or cities.

One of the primary causes of declined functional capacity is impaired mobility. The ability to move from one place to another safely is the building block of activities of daily living, and thus is crucial to independent living. Impaired mobility is common in old age and has been found to be associated with a greater risk of falling within the following year, further deterioration of functional capacity, and subsequent institutionalization.[4–12] These findings suggest that older adults who already have mobility problems are likely to suffer greater adverse effects of aging and thus it is reasonable to view such a population as the prime target for functional capacity promotion.

A variety of performance-based tests are used clinically and in research to measure mobility. The timed up-and-go test (TUG) is among the most frequently used. The TUG measures the time taken to rise from a seated position, walk 3 m at a natural pace, walk back to the chair, and sit down.[13,14] The test requires only a stopwatch and a chair and is easy to administer. The reliability of the TUG has been demonstrated in the literature to be good.[14–16] When tested against other mobility tests, such as Tinetti Mobility Index or Barthel Index, the TUG was also found to have good validity.[14,15]

In studies from the USA, the range of TUG performance varies widely. When individuals who did not have histories of diabetes mellitus, substantial neurological disorders, or acute musculoskeletal disorders were instructed to walk quickly during the test, the mean TUG time ranged from 7.27 seconds to 8.54 seconds for metropolitan adults aged 60–79 years.[17] A much longer time (15 seconds) was reported when 60–90-year-old individuals in an inner city were instructed to walk at a self-paced speed for 10 feet (3.05 m).[18] In studies from the USA that instructed participants to walk at their self-selected pace for 3 m during the TUG, the performance also ranged widely: for 60–89-year-old participants, excluding those with conditions that could affect the test performance, the mean TUG time ranged from 8 seconds to 11 seconds.[19,20] It is not clear what type of environment the participants were recruited from in the above studies.

The TUG is also used widely in Taiwan to measure mobility of older adults clinically and in research. In 2004, a study tested 1200 Taiwanese older adults living in a rural area and reported a mean TUG time of 13.3 seconds.[16] As for older adults who have impaired mobility or live in different cities, information pertaining to performance of the TUG and its contributing factors is lacking. The purposes of this study were to compare the performance of TUG and identify its contributing factors in older adults with impaired mobility living in Taipei, Tainan, and Niaosong, three cities differing in their level of urbanization in Taiwan. The findings will help to provide information for intervention planning for the promotion of functional capacity for older adults in Taiwan.

Methods

Participants

This was a cross-sectional study conducted simultaneously in Taipei, Tainan, and Niaosong district, in Kaohsiung, Taiwan. Participants were recruited on a voluntary basis via posters at local senior leisure activity centers and news releases to local newspapers and radio stations. Specially trained research assistants first interviewed the volunteers to screen for their qualifications. The inclusion criteria were older than 65 years, living in the community, and having any of the following conditions: (1) histories of multiple falls or seeking medical help for fall-related problems in the past year; (2) difficulties in sit-to-stand transfer; or (3) unsteady, asymmetrical or slow gait. Those who were unable to comprehend simple movement instructions, with acute pain or inflammation that would affect mobility, or required hands-on assistance in transfer or walking 3 meters were excluded. The screening tests and subsequent measurements were conducted in the community senior leisure activity centers or research facilities that were near the participants' homes or could be easily accessed via public transportation. This study was approved by the institutions where the study was conducted and written informed consent was obtained from all participants.

Procedures

Participants first were inquired about their basic information on age, marital status (single or married), education (years in school), living arrangement (alone or with people; house type, and duration), and the number of medication and comorbidity using a structured questionnaire. The Mini Mental Status Examination (MMSE)[21] and Geriatric Depression Scale (GDS)[22,23] were used to measure cognitive function and depression symptom, respectively. The International Physical Activity Questionnaire Short Form[24] was used to measure the level of physical activity, and the time (in min/wk) conducting moderate or high intensity activity within the past week was calculated. Fear of falling was measured using a 5-level Likert scale, with 1 being no fear at all to 5 being extremely fearful. Participants then went through a series of performance tests, including physical function, balance, and mobility.

Physical function

Visual contrast sensitivity: The Melbourne Edge Test was used to measure visual contrast sensitivity.[25]

Proprioception: A leg matching task was used to measure the knee joint position sense.[26] The participant was seated in a high chair with the thighs completely supported and both lower legs dangling freely without contacting each other, and eyes closed. The participant was instructed to simultaneously move both lower legs up and place the two big toes at the same level. The angle difference (°) between the two lower legs was read from a transparent plastic protractor board erected vertically between the two legs. The test was repeated five times and the means were used for data analysis.

Leg strength: A spring gauge tensiometer was used to measure the isometric strength of knee extension and flexion of the dominant leg. The participant was seated in a high chair that allowed the lower leg to dangle vertically while the thigh completely supported by the seat. A strap connected to the spring gauge was attached around the lower leg immediately above the malleolus. The participant was instructed to extend or flex the leg as forcefully as possible. The test was repeated three times and the means were used for data analysis.

Reaction time: A simple reaction time paradigm that required the participant to press a button with a finger upon seeing a light was used to measure the reaction time. The test was repeated 10 times and the means were used for data analysis.

Balance

Static standing balance: The ability to remain standing on one leg was used to measure static balance ability. The participant first stood upright with the arms across the chest, then raised the nondominant leg off the ground. A stopwatch was used to record the time the participant was able to remain standing on one leg (up to 30 seconds).

Dynamic standing balance: The Functional Reach Test was used to measure the ability to reach one's limits of stability.[27] The participant first stood next to a yardstick suspended horizontally at the height equal to the acromion process. The participant then raised one arm to 90° and reached forward as far as possible without moving the feet or losing balance. The reach distance was read from the yardstick and recorded.

Mobility

The TUG test was used to measure mobility. A stopwatch was used to record the time taken for the participant to stand up from a standard chair (43 cm), walk 3 m at natural pace, turn around, and sit back down to the chair.

Statistical analysis

Descriptive analysis was conducted to demonstrate the basic characteristics of the participants in the three areas. The between-area difference in age was tested with one-way analysis of variance with *post hoc* least significant difference test as indicated. For nominal variables, including sex, marital status, and living arrangement, Chi-square tests were used to test the differences in distribution between the three cities. Because the distribution for reaction time and TUG data were skewed, their log transformed data were used for inferential statistical analysis.

To investigate between-area differences, multivariate ANOVA with age and sex entered as covariate and *post hoc* least significant difference test were used for continuous variables, including body mass index (BMI), education, activity level, leg muscle strength, proprioception, reaction time, single leg stance time, functional reach distance, and TUG time. For ranking variables, including number of medications and comorbidity, MMSE, GDS, fear of falling, and visual contrast, the Kruskal–Wallis test with follow-up pairwise Mann–Whitney *U* test was used for between-area comparisons.

An enter-mode regression analysis with TUG as dependent variable and all potential factors as independent variables was first conducted for all participants across the three areas to look for common significant contributing factors. The potential factors included age, sex (female), BMI, marital status (married), living arrangement (living with people, house type, and duration), education, numbers of medications and comorbidities, fear of falling, MMSE, GDS, moderate and high intensity activity, visual contrast, strength of knee extension and flexion, reaction time, proprioception, single leg stance time, and functional reach distance. The factors that had significant β coefficients were selected, then entered sequentially in a step-wise manner with modifiable sensorimotor factors in the first block, life-style, and other modifiable variable in the second block and nonmodifiable factors last, to determine their contribution to the TUG time. The significance level was set at $p < 0.05$.

Results

During the experimental period from July 2008 to May 2009, 168, 129, and 116 older adults (age, 65–95 years) completed the tests in Taipei, Tainan, and Niaosong, respectively. Participants in Niaosong were significantly younger than those in the other two cities but had fewer years of education. The percentages of female or unmarried participants were significantly greater in Taipei than in the other two cities, but did not differ between Tainan and Niaosong. In terms of living arrangement, Taipei had a significantly greater number of participants living alone or in apartments without elevators, while Niaosong had a significantly greater number of participants living in stand-alone multiple story houses but fewer in apartments with elevators, than the other two cities. Participants in Niaosong also have been living significantly longer in their current house (Table 1). Although participants in the three cities differed substantially in their TUG time, after adjusting for age and sex, only Tainan participants differed from those in Taipei and Niaosong (Figure 1).

In terms of their health and functional status, nonparametric analysis showed that individuals in Niaosong had significantly lower MMSE, GDS, fear of falling, and number of comorbidity, and those in Taipei had greater number of medication, compared to the other two cities (Tables 1 and 2). In terms of visual contrast sensitivity, participants in Tainan scored significantly better than those in the other two cities (Table 2).

After controlling for age and sex, it was found that older adults in the three cities differed in all of the variables investigated, except for BMI, moderate intensity activity time, and functional reach distance (Table 2). Compared to the other two cities, participants in Niaosong had significantly longer high intensity activity time, better knee flexion strength and proprioception, and longer single leg stance time, and those in Tainan had significantly greater knee extension strength and shorter reaction time. Participants in Taipei scored poorest in high intensity activity, knee flexion strength, proprioception, and single leg stance time (Table 2).

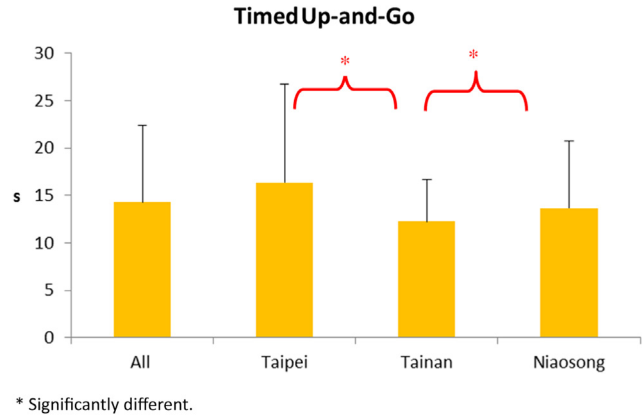

Figure 1 The performance of the timed up-and-go test. After adjusting for sex and age, Tainan city participants showed significantly better performance than the other two cities.

Regression analysis conducted across all participants showed that all the factors altogether explained half of the variance in the TUG time, with age, BMI, number of medications, GDS, high intensity activity, knee extension strength, reaction time, single leg stance, and functional reach having significant contribution (Table 3). These

Table 1 Information on anthropometrics, housing, and health of the participants.

	All ($n = 413$)	Taipei ($n = 168$)	Tainan ($n = 129$)	Niaosong ($n = 116$)
Age (y)**,***	76.10 (7.25)	77.52 (7.61)	77.42 (6.81)	72.50 (5.84)
Female (%)*,**	55.47	68.45	41.09	52.63
Married (%)*,**	62.04	51.79	72.87	64.91
Living alone (%)*,**	17.03	30.54	10.85	4.39
House type (%)				
Stand-alone multistory house*,**,***	38.7	6.0	42.6	81.9
Apartment without elevator*,**	17.4	36.9	3.9	4.3
Apartment with elevator**,***	38.7	54.8	46.5	6.9
Others	2.2	0.6	4.6	1.7
Duration in current house (y)**,***	20.4 (17.5)	19.9 (16.7)	15.4 (14.4)	26.6 (19.8)
Education (y)**,***	7.30 (4.69)	8.22 (4.62)	7.80 (4.83)	5.39 (4.08)
Body mass index	24.45 (3.55)	24.42 (3.81)	24.90 (3.45)	23.99 (3.22)
Medication (*n*)	5.6 (5.4)	6.7 (5.7)	4.1 (5.1)	4.8 (4.9)
Comorbidity (*n*)	1.4 (1.1)	1.5 (1.0)	1.6 (1.2)	.98 (1.1)
Chronic disease (%)				
Cardiovascular	47.9	54.8	55	29.8
Gastrointestinal	9.7	10.1	14.7	3.5
Genitourinary	7.5	1.8	21.7	0
Neurologic	5.8	4.8	6.2	7
Musculoskeletal	29.9	32.7	24.8	4.4
Psychiatric	6.1	6	7.8	31.6
Metabolic	21.9	25.6	23.3	14.9

*$p < 0.05$ for Taipei versus Tainan comparison.
**$p < 0.05$ for Taipei versus Niaosong comparison.
***$p < 0.05$ for Tainan versus Niaosong comparison.

Table 2 Results of mental and emotional status, activity level, and physical and functional tests. For mental and emotional status, fear of falling, and visual contrast, nonparametric analysis was used, while multivariate analysis of variance with age and sex as controlled variables was used for other variables.

	All	Taipei	Tainan	Niaosong
Mini mental status examination**,***	25.82 (4.34)	26.14 (4.08)	25.98 (4.85)	25.17 (4.06)
Geriatric depression scale**,***	2.81 (3.17)	3.40 (3.41)	3.09 (3.39)	1.64 (2.06)
Fear of falling (%)**,***				
Not at all	34.79%	27.38%	33.33%	47.37%
Slightly	15.57%	11.90%	6.98%	30.70%
Moderately	20.92%	29.76%	20.93%	7.89%
Highly	14.84%	15.48%	17.05%	11.40%
Extremely	13.63%	14.88%	21.71%	2.63%
Moderate intensity activity (min/wk)	154 (291)	108 (279)	138 (209)	239 (363)
High intensity activity (min/wk)*,**	33.5 (120.2)	7.1 (59.2)	47.2 (137.3)	56.5 (155)
Visual contrast sensitivity*,***	18.41 (3.06)	18.08 (3.07)	18.99 (3.48)	18.23 (2.39)
Proprioception (°)*,**,***	1.67 (1.33)	2.29 (1.50)	1.55 (1.02)	0.91 (0.87)
Knee extension strength (kg)*,***	20.57 (8.03)	17.32 (7.07)	24.06 (8.00)	21.42 (7.60)
Knee flexion strength (kg)*,**,***	10.40 (4.68)	7.58 (3.24)	11.62 (4.92)	13.11 (3.96)
Reaction time (s)*,**,***	336.1 (141.4)	340.34 (171.4)	307.1 (107.7)	363.9 (118.5)
Single leg stance time (s)**	11.83 (10.54)	8.60 (8.46)	11.99 (10.65)	16.20 (11.50)
Functional reach distance (cm)	24.29 (8.96)	23.41 (8.80)	24.99 (8.33)	24.79 (9.80)

*$p < 0.05$ for Taipei versus Tainan comparison.
**$p < 0.05$ for Taipei versus Niaosong comparison.
***$p < 0.05$ for Tainan versus Niaosong comparison.

Table 3 Results of regression analysis for the performance of the timed up-and-go test for participants across the three cities. All the factors were entered and remained in the equation.

R^2	Factors	Beta coefficient	*p*
0.502			
	Age	0.193	<0.001
	Female	−0.027	0.624
	BMI	0.089	0.042
	Married	−0.029	0.551
	Living with people	−0.059	0.236
	House type	0.084	0.068
	House time	−0.062	0.226
	Education	0.025	0.568
	No. of medication	0.098	0.027
	No. of comorbidity	0.021	0.640
	Fear of falling	0.079	0.087
	MMSE	−0.016	0.725
	GDS	0.121	0.009
	Moderate intensity activity	−0.034	0.415
	High intensity activity	−0.128	0.002
	Visual contrast sensitivity	−0.036	0.404
	Knee extension strength	−0.116	0.033
	Knee flexion strength	−0.046	0.407
	Reaction time	0.183	<0.001
	Proprioception	0.063	0.161
	Single leg stance	−0.105	0.039
	Functional reach	−0.169	<0.001

BMI = body mass index; GDS = geriatric depression scale; MMSE = mini mental status exam; No. = number.

significant factors were entered into the regression analysis for the individual cities based on the principle described in the methodology, i.e., modifiable sensorimotor function (knee extension strength, reaction time, single stance, and function reach) in the first block, other modifiable factors and lifestyle (BMI, number of medications, GDS, and high intensity activity) in the second block, and age in the third block. The results are shown in Table 4. For Taipei, functional reach, BMI, and depression were significant determinants and together with single stance and reaction time explained approximately 50% of the variance in TUG performance. For Tainan, single stance, functional reach, high intensity activity, and depression were significant determinants and together explained approximately one-third of the variance. For Niaosong, single stance, reaction time, depression, and age were significant determinants and together explained approximately 40% of the variance.

Discussion

Identification of factors contributing to functional capacity in older adults can provide information for the planning and implementation of functional capacity promotion programs. This study investigated the performance of a basic mobility task and its contributing factors in older adults who had mobility problems and lived in cities where the level of urbanization was different. It was found that both the mobility performance and contributing factors were different for individuals living in different cities.

The task of TUG involves standing up and sitting down without using the arms for support, straight-line walking, and turning. Compared to Western studies[17–20] or a large scale study conducted previously in Taiwan,[16] the mean

Table 4 Results of regression analysis for the performance of the timed up-and-go test in Taipei, Tainan, and Niaosong.

	R^2	β	*p*	CI
Taipei	0.484			
Functional reach		−0.260	<0.001	−0.007 to −0.002
Single leg stance		−0.130	0.071	−0.005 to 0.000
Reaction time[a]		0.107	0.083	0.00002145 to 0.0002567
Body mass index		0.166	0.007	0.002 to 0.011
Depression		0.229	<0.001	0.005 to 0.016
Tainan	0.344			
Single leg stance		−0.372	<0.001	−0.006 to −0.002
Functional reach		−0.242	0.003	−0.006 to −0.001
High intensity activity[a]		−0.160	0.043	−0.0002402 to −0.0000388
Depression		0.195	0.017	0.001−0.012
Niaosong	0.390			
Single leg stance		−0.259	0.003	−0.006 to −0.001
Reaction time[a]		0.250	0.003	0.00008313−0.0004003
Depression		0.168	0.034	0.001−0.027
Age		0.272	0.001	0.003−0.012

[a] For reaction time and high intensity activity, log transformed data were entered into the regression.
CI = confidence interval.

TUG time in the current study (14.3 seconds) appeared to be longer. This finding is not surprising since the current study targeted individuals with mobility problems. What is surprising is the large performance gap between the three cities.

The three cities investigated in this study were substantially different in their level of urbanization, with Taipei being a metropolitan area, Niaosong a rural area, and Tainan in between. The differences in the environment, lifestyles, and socioeconomic background might render their residents to have different functioning levels. Compared to those living in Taipei and Niaosong, Tainan participants performed TUG significantly better by 4 seconds and 1 second faster, respectively, after adjusting for age and sex. Significantly stronger knee extension strength, a key underpinning factor for TUG, was also found in the Tainan participants, and could thus possibly be explained the between-city difference. The gaps in the TUG performance between the different cities suggest that the promotion of functional capacity could benefit from city-specific assessment and planning, instead of a central unified model.

The primary underpinning functions for TUG include lower limb muscle strength and coordination, dynamic balance, and locomotion control. Studies based on Western populations have shown that older age, female sex, greater BMI, and poorer cognitive function and ankle muscle strength had significant contribution to the TUG time.[19,28] For a general population of 280 Taiwanese older adults, poorer knee extension strength, greater postural sway, visual contrast sensitivity and number of comorbidities, longer reaction time, lower MMSE, and older age were independent predictors of longer TUG time.[29] These previous findings show that the number of potential determinants for TUG is large and for different populations the determinants might be different.

The current study focused on older adults who have already had mobility impairments. Across all the participants, nine factors had a significant contribution to the TUG performance and were then entered into the regression analysis for the individual city. Overall, these variables explained 34–48% of the variance and the only independent determinant shared by all the cities was depression. Depression is commonly reported in community-dwelling older adults[30,31] and has also been shown to predict limitations in walking and chair rise in various older populations.[32–35] Although the mechanisms underlying the association between depression and mobility are not yet fully understood, it is possible that the two conditions share some common mediators, such as poor health or deterioration in physical function.[36–38] The findings in this study further indicated that the impact of depressive mood might not be limited to specific cities and its management may need to be considered in order to improve mobility.

Demographically, participants in the metropolitan Taipei area had a significantly greater percentage of women, not married, and living alone and in apartments without elevators, compared to the other two cities. They also spent significantly less time in high-intensity activity. For Taipei participants, in addition to depression, functional reach distance, and BMI were found to have significant and independent contribution to TUG performance. As stated above, balance ability is one of the underpinning ability of TUG. This study specifically pointed out that the ability to move the body's center of mass forward, as measured by the functional reach test, was an independent determinant, possibly because both standing up from a seated position and walking involve moving the body's center of mass forward.

Obesity (BMI > 30 kg/m^2) has been consistently shown to link to limitations in walking, stair climbing, and chair rising.[39–41] Specifically, BMI has been found to predict or correlate with TUG performance in healthy older adults.[42,43] Furthermore, declines in physical activity, increases in the number of comorbidities, and knee pain have been proposed to be among the underlying causes of obesity-related disability.[39] This study further noted that for older adults with impaired mobility, greater BMI significantly contributed to poorer TUG performance. It should be noted that in this study, the mean BMI of the Taipei participants fell into the "overweight" category, suggesting that weight control to prevent declines in mobility may need to begin even before the individual has become obese.

Compared to those in Taipei and Tainan, participants in Niaosong were younger and had been living longer in their current houses, and had a greater percentage living in stand-alone multistory houses but fewer in apartments with elevators. They also had fewer years of education, and scored poorer in MMSE and reaction time but better in GDS, and knee proprioception and flexion strength. For this group, in addition to depression, older age and shorter single leg stance were significant contributors to poorer TUG performance. These findings are not surprising since aging is universally accepted to be related to deteriorations in mobility and the ability to maintain balance during single leg stance is crucial for walking. It is interesting, however, that longer reaction time was an independent determinant of poorer TUG performance. This finding supported the notion that information processing is important in mobility tasks.[29,44]

For participants in Tainan, their demographic features appeared to be between the metropolitan Taipei and rural Niaosong areas, although their physical function, including visual contrast sensitivity and knee extension strength, were better. For these participants, the independent determinants of TUG performance included depression, single leg stance, functional reach, as well as high intensity activity. There is sufficient evidence showing that moderate or vigorous physical activity improves health, functional capacity, and life expectancy of older adults.[45–50] This study further showed that engaging in more high, but not moderate, intensity activities contributed significantly to better basic mobility in older adults with mobility impairments.

Although age-related changes in physical function or mobility can largely be attributed to intrinsic factors, it is possible that extrinsic factors could also contribute. Chinese older adults living in different countries (Taiwan, Hong Kong, Australia) were found to differ in their postural stability, stepping ability, and reaction time: Australian Chinese performed better than those in the other two countries.[51] This study further showed that older adults living in different cities of the same country also differed in their sensorimotor function and mobility performance. These findings together strongly suggest that environment could have a strong impact on mobility performance.

This study is limited in several ways. First, it is a cross-sectional study and thus temporal cause—effect relationships cannot be established. Longitudinal studies to determine how physical function predicts future mobility performance are needed. Second, participants were all volunteers and might not be representative of the population of each city. Third, some lifestyle factors were not investigated but have the potential to affect mobility performance. Certain aspects of lifestyle, such as physical activity level, diet, and smoking, are known to be associated with physical function in older adults.[52] This study investigated the level of physical activity using the International Physical Activity Questionnaire, and indirectly examined the impact of dietary patterns by reporting the BMI. However, smoking, which could lead to impaired pulmonary function and increased mortality, was not investigated and might contribute to mobility performance. Future studies that examine the impact of first- and second-hand smoking are needed to clarify this issue.

In conclusion, Taiwanese older adults with mobility problems who live in cities of different levels of urbanization differed in their basic mobility performance. Depressive mood was the only common independent contributor to mobility and may be targeted in nationwide intervention. Balance, age, BMI, reaction time, and high intensity also had a significant contribution, although their contributions varied for different cities. These differences in performance and contributing factors among older adults living in different cities suggest that plans for the promotion of mobility function of older adults with mobility impairments might need to be city-specific. There is also a need of further studies examining older adults of different functional capacity, environment, and lifestyle.

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