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Functional fitness norms for community-dwelling older adults in Hong Kong

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ABSTRACT

Objective: This study aimed to establish normative data for older adults in Hong Kong and explore age and sex differences in functional fitness.
Methods: A sample of 944 independent community-dwellers, aged 65–74 years, was evaluated using the Senior Fitness Test battery in addition to hand grip and single leg stance tests. Normative data were reported for the 10th, 25th, 50th, 75th, and 90th percentiles in 5-year age groups.
Results: Except for upper extremity muscle strength in women and body mass index (BMI) in both sexes, ageing-associated degradation was observed in all testing parameters especially in flexibility, balance, and agility. Significant sex differences were found in all testing parameters with the exception of BMI and static balance with eyes open. Moreover, men demonstrated higher capacities for muscle strength, agility, balance, and aerobic endurance, whereas women showed superior flexibility.
Conclusion: The normative values enable the evaluation of individual performance regarding the fitness status of older adults in Hong Kong.

1. Introduction

The worldwide ageing population has grown significantly in the past several decades (Callen, McKibbin, & Batini, 2006). In Hong Kong, the average life expectancy of men has increased from 67.8 years in 1961 to 80.2 years in 2014; the respective values for women are 70.2 to 85.7 years. Thus, the average life expectancy has increased by nearly 16 years in the past half-century (Census and Statistics Department of Hong Kong, 2015). Consequently, Hong Kong has been among the countries and territories with the highest longevity for numerous years. Along with the increasing life expectancy and decreasing birthrate, the absolute number and percentage of older adults in the total population have increased rapidly. In 2014, Hong Kong contained 1,065,900 older adults, accounting for 14.7% of the entire population. By 2041, it is estimated that one in three persons will be an older adult. Such demographic transition is likely to exacerbate ageing-related problems and produce more burdens on social security system for older adults (Cheng, Lum, Lam, & Fung, 2013). However, this is not a unique Hong Kong problem. Similar issues were reported in either developed countries such as Japan (Harper, 2014) and Portugal (Gouveia et al., 2013), or developing countries like China (Woo, Kowk, Sze, & Yuan, 2002).

Among various ageing-related issues, health-related quality of life in later years is frequently a major concern among older adults. Functional fitness, which is defined as the physical capacity required to safely and independently perform common daily activities without fatigue, has been found to be the key prerequisite for higher quality of life among older adults (Ando, Asakawa, Koyano, & Shibata, 2000; Chodzko-Zajko, 2013). Normative data on functional fitness can enable the evaluation of individual performance, thereby assisting in identifying functional weaknesses in risk-prone older adults. Functional fitness norms for older adults have been well established in numerous countries and territories, such as the United States (Rikli & Jones, 1999a), Brazil (Krause et al., 2009), Taiwan (Chen, Lin, & Yu, 2009), Norway (Langhammer & Stanghelle, 2011), Spain (Gusi et al., 2012), and Portugal (Gouveia et al., 2013). Because of cultural and racial differences, generalising normative data between various countries and territories is not effective (Chow, Frey, Cheung, & Loubie, 2005). To gain a more comprehensive understanding of the functional fitness of Hong Kongese older adults, establishing a local normative standard that suits practical demands is necessary. Therefore, the purposes of this study were to establish normative data for community-dwelling older adults

Abbreviations: SFT, Senior Fitness Test; BMI, body mass index; AC, arm curl test; CS, chair stand test; BS, back scratch test; UG, 8 ft up and go test; Step, 2-min step test; HG, hand grip test; SLS, single leg stance test; AG, age group; SD, standard deviation; ES, effect size.

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in Hong Kong and to explore pertinent age and sex differences regarding functional fitness.

2. Methods

2.1. Study design

This is an explorative, cross-sectional study on functional fitness of independent older adults in Hong Kong. Participants were recruited from community senior service centres which are located in different districts of Hong Kong. Data were collected between March 2014 and April 2015 by 24 professional fitness assessors. Each assessor completed a 3-h training course, aiming to homogenise and standardise the assessment methods to reduce inconsistencies among assessors. All tests were conducted in senior service centres within reasonable distances of the participants' homes. Written informed consent was obtained from each participant. This study was approved by the Committee on the Use of Human and Animal Participants in Teaching and Research of University.

2.2. Participants

Participants were recruited from community senior service centres located in three districts of Hong Kong (i.e., Hong Kong Island, Kowloon, and New Territories). Recruitment, for which proactive and passive approaches were adopted, began 6 months prior to the formal test. The inclusion criteria were that participants be (a) independent and apparently healthy adults, (b) aged 65–84 years, and (c) living in community. The Physical Activity Readiness Questionnaire, designed by the Canadian Society for Exercise Physiology (1994), was used to exclude prospective participants with health risks. Those with congestive heart failure, severe bodily pain, dizziness, or uncontrolled high blood pressure (exceeding 160/100 mm Hg) were excluded from this study. Eligible participants were informed of the research purposes and guaranteed confidentiality regarding their personal information.

2.3. Measurements

Functional fitness was assessed using the Senior Fitness Test (SFT) battery. The SFT was developed and validated by Rikli and Jones (1999b) for early identification of older individuals that are at risk of losing functionality. The SFT includes seven testing items that assess the following five dimensions of functional fitness: body mass index (BMI) for body composition; the 30-s arm curl test (AC) and 30-s chair stand test (CS) for upper and lower extremity muscle strength, respectively; the back scratch test (BS) and chair sit-and-reach test (SR) for upper and lower body flexibility, respectively; the 8-foot up-and-go test (UG) for agility and dynamic balance; and the 2-min step test (Step) for aerobic endurance. Each testing item was strictly conducted according to the Senior Fitness Test Manual (2nd version; Rikli & Jones, 2013).

In addition, we also employed the hand grip test (HG) for forearm strength and the single leg stance test (SLS) with eyes open and closed for static balance, both of which are frequently used in Asian countries and territories. For the HG test, participants were required to use a grip device. Two practice trials were conducted before the three formal HG tests, from which the highest-rated performance was recorded as the final score. In the SLS, participants were required to stand statically, first on both feet, then on one foot, bending their free leg backwards. A practice trial was conducted before the formal SLS test. The time (measured in seconds) that elapsed before the participant became unbalanced (e.g., bent leg touching the ground) was considered as the final score.

2.4. Data collection

At the start of each testing session, participants who signed the consent form were informed of the procedure and risks for each test. After a 10–15-min rest, the participants received a series of measurements of blood pressure, heart rate, height, weight, and body fat percentage (using a body composition analyser; TBF-410; Tanita; Tokyo, Japan). A 10-min warm up was then conducted, after which the participants were given pretest instructions to ensure maximum safety and performance. The participants were instructed to do the best they could, but not to push themselves to a points of overexertion or beyond what was easy for them. Tests were to be stopped at any time that participants showed signs of discomfort, such as pain, dizziness, or fatigue.

2.5. Data analysis

Data analysis was conducted using the SPSS v23.0. Participants were divided into four 5-year age groups (AGs): AG 1, 65–69 years; AG 2, 70–74 years; AG 3, 75–79 years; and AG 4, 80–84 years. Descriptive data were calculated for mean, standard deviation (SD), and five-rank percentile (10th, 25th, 50th, 75th, and 90th). Given the potential effect of data outliers on mean and percentile values, any scores greater than 5 SDs from the mean were deleted after a reevaluation of input accuracy.

A two-way mixed-design ANOVA was used to explore the interaction effect of AGs and sex on each testing parameter. A one-way ANOVA was then performed to determine the AG effect on each testing parameter for men and women separately. A planned contrast was used to explore the differences between any two adjacent AGs (i.e., AG 1 vs. AG 2, AG 2 vs. AG 3, and AG 3 vs. AG 4). Because three comparisons were included, the significant p value was adjusted to .017. The decline rate in each testing parameter was calculated using the mean differences between AG 4 and AG 1, relative to AG 1, for men and women separately. In addition, an independent t test was performed to explore the differences in each testing parameter between men and women, with an adjusted p value equal to .005. Effect size (ES) was calculated using the mean differences relative to the pooled SD (S_p) to evaluate the magnitude of the differences between men and women as well as among AGs: $S_p = \sqrt{S_1{}^2(n_1 - 1) + S_2{}^2(n_2 - 1)/n_1 + n_2 - 2}$. An ES ratio $\geq$.80 is considered high; an ES ratio of .30–.70 is moderate; and an ES ratio $\leq$.20 is low (Tomas, Nelson, & Silverman, 2005).

3. Results

Fig. 1 presents the participants flow during this study. A total of 1025 older adults were recruited from local community senior service centres (n = 22; Kowloon = 8; New Territories = 10; Hong Kong Island = 4), among which 944 (422 men and 522 women) were qualified to participate in this study. Each AG contained at least 100 men and 100 women. Table 1 shows the demographic characteristics of the participants. The women had slightly lower blood pressure and heart rate as well as higher body fat percentage than the men did.

The results of a two-way mixed-design ANOVA revealed significant interaction effects of AG and sex in HG (F [3922] = 8.38; $p < .001$; partial η^2 = .027), CS (F [3872] = 3.01; p = .029; partial η^2 = .010), and AC (F [3875] = 6.43; $p < .001$; partial η^2 = .022). This indicates that men and women differed