Adherence to physical exercise recommendations in people over 65—The SNAC-Kungsholmen study

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Background: There is limited knowledge regarding to what extent the older population meet the recommendations of physical exercise, especially fitness-enhancing exercise. This study assessed participation in health- and fitness-enhancing exercises in people aged >65, and explored to what extent the possible differences in meeting current recommendations differs by age, gender and education. Methods: The study population was derived from the Swedish National study on Aging and Care, and consisted of a random sample of 2593 subjects, aged 65+ years. Participation in health- and fitness-enhancing exercise according to the WHO and the American College of Sports Medicine’s recommendations in relation to age, gender and education was evaluated using multinomial logistic regression adjusted for health indicators and physical performance. Results: According to the recommendations, 46% of the participants fulfilled the criteria for health-enhancing and 16% for fitness-enhancing exercises. Independent of health indicators and physical performance, women <80 years of age were less likely than men to participate in fitness-enhancing exercise, but they participated more in health-enhancing exercise. In the advanced age group (80+ years), women were less likely to participate both in fitness- and health-enhancing exercise. Advanced age and low education were negatively related to participation in both health- and fitness-enhancing exercise independent of health indicators, but the association was not observed among people with fast walking speed. Conclusion: Promoting physical exercise and encouraging participation among older adults with lower education, especially among those with initial functional decline, may help to reduce adverse health outcomes.

Introduction

Physical activity has been related to a reduced risk of mortality,1 cardiovascular morbidity2–4 and cognitive decline.5 Owing to the growing evidence of a beneficial health effect from physical activity, several health organizations have published and continuously promote specific recommendations. Health- and fitness-enhancing exercises have been recommended by different health organizations. Both exercise levels improve health; however, health-enhancing exercise does not improve physical fitness.6 According to the World Health Organization (WHO) recommendation, health-enhancing exercises are physical activities performed 30 min daily or most days of the week.7 In accordance with the recommendations made by the American College of Sports Medicine (ACSM), fitness-enhancing exercise is defined as engagement in moderate to intense physical exercise at least two to three times per week.8–10 Fitness-enhancing exercises have been shown to be important to reduce age-related decline in muscle strength, endurance and balance which in turn is related to the ability to perform activities of daily living without undue fatigue.11–12

Although a strong association between low physical activity level and functional decline among older people has been consistently reported,10–12 few studies have evaluated the adherence to these recommendations of the general population, especially among older adults. One British study reported that only 2.5% of the subjects above the age of 65 perform sufficient health-enhancing exercise according to recommendations from health organizations such as the WHO.12 A Swedish study reported that 31% of women aged 56–75 years achieved the health-enhancing level of recommendation.13

Several factors have been reported to be negatively associated with participation in physical activity/exercise in older people, such as female gender, increasing age, lower levels of education, obesity, chronic conditions, smoking and higher levels of psychological distress.12,13 Gender differences have also been reported. Women seem to participate more in light activities such as household activities, whereas men participate more in physical exercise activities,16 but no gender differences have been detected in walking habits.17,18

Therefore, there clearly needs to be an expansion of knowledge regarding to what extent the older population meets the recommendations made by health organizations concerning physical exercise, particularly fitness-enhancing exercises. Likewise, there needs to be an elucidation of the factors associated with the degree of adherence to these recommendations. Hence, this study aimed: (i) to study to what extent adults aged >65 meet the recommendations for health- and fitness-enhancing exercise, according to the WHO and the ACSM; (ii) to examine to what extent participation in these activities is influenced by age, gender and education; and (iii) to explore whether the possible differences owing to age, gender and
education can be explained by health indicators and physical performance.

**Methods**

**Study population**

The Swedish National Study on Aging and Care (SNAC) is an ongoing longitudinal study in four research centres in different parts of Sweden. Kungsholmen, Stockholm (SNAC-K), is one of the centres. The study population consists of a random sample of 5111 persons aged 60+ living in a central part of Stockholm, either at home or in institutions. The baseline data collection was conducted during March 2001–June 2004. Of those invited to participate but were unable to come, home visits were conducted. Subjects who were wheelchair bound (n = 707) and moderate to intense (n = 882) exercise was imputed in two steps. Firstly, a manual imputation was performed. Subjects who were wheelchair bound (n = 37), could not move indoors or outdoors (n = 101), and had severe physical problems or were incapable of walking 50 metres (n = 60) were coded as never taking part in any exercise. Secondly, we used fully conditional multiple regression imputation, which is a multivariate technique for multiply imputing missing values using a sequence of regression models. The following variables were included according to the literature: age, gender, light exercise, moderate to intense exercise, living in own home or institution, PADL, IADL, walking speed, number of chronic diseases/conditions, presence of dementia, chronic stroke, Parkinson’s disease, pain while moving, presence of emotional support, social anchorage (four questions regarding feelings of affinity with relatives, the neighbourhood, friends as well as membership in an association) and locus of control (one question regarding feeling of hopelessness and relying of help from others). The imputation was repeated five times, and the results were saved in five different data sets. The data sets were pooled into one data set with five observations for each person and used in the analyses. To avoid underestimation of the standard error owing to the five observations, the original sampling weight (described above) was divided by five and used in the analyses.

**Data collection**

The baseline data were collected through interviews, assessments and clinical examinations performed by nurses, psychologists and medical doctors at the research centre. For those who agreed to participate but were unable to come, home visits were conducted.

**Physical exercise level**

Information on physical exercises was obtained through a self-administered questionnaire concerning both intensity and frequency. Most of the participants with dementia or cognitive impairment had missing information (n = 217), while some (n = 51) had information filled in by a proxy, usually a next-of-kin.

The frequency included: every day, several times a week, once a week or every day. Following the recommendations by the WHO and ACSM, the participants were categorized into three different groups according to the intensity of the activities (from low to high): (i) inadequate: never, <2–3 times per month, 2–3 times per month in light and/or moderate/intense exercise; (ii) health-enhancing: light exercise several times per week or every day; and (iii) fitness-enhancing: moderate/intense exercise several times per week or every day.

**Demographic factors**

Information on age, gender and the highest level of formal education were recorded during the nurse interview.

**Health indicators**

Based on clinical examination, medical history, laboratory data and current drug use, the examining physician diagnosed and recorded all prevalent chronic diseases for each person. A disease/condition was classified as chronic if it was prolonged in duration, and if one or more of the following characteristics were present: (i) leaving residual disability or worsening of quality of life; and/or (ii) requiring a long period of care or treatment/rehabilitation. The number of co-occurring chronic diseases/conditions was calculated for each individual. Information on self-rated health in relation to other people in the same age (as good, better or worse) and self-reported current depression (yes/no) was obtained during the interview with the physician. Smoking habits were recorded, and body weight and height were measured by a trained nurse.

**Physical performance**

The subjects were asked whether they independently managed personal activities of daily living (PADL; e.g. dressing, hygiene, bathing/showering) and instrumental activity of daily living (IADL; e.g. cooking, cleaning and running errands). If they answered yes to all the items, they were coded as independent in PADL and IADL, respectively.

The participants were asked to walk 2.4 or 6 metres in a habitual speed with a flying start. Subjects who rated themselves as fast or normal walkers did the longer walk (6 metres) and slow or very slow self-rated walkers did the shorter walk (2.4 metres). These tests were merged and presented in metres per second in the analyses.

**Statistical analyses**

Statistical analyses were conducted using SPSS (Statistics 18.0) and Stata/SE 10.1. Chi square test was used to compare proportional differences. Because the youngest and the oldest age groups were overrepresented in the sample in comparison with the general population, a weight variable was created and used in all analyses.

Missing data for light (n = 707) and moderate to intense (n = 882) exercise was imputed in two steps. Firstly, a manual imputation was performed. Subjects who were wheelchair bound (n = 37), could not move indoors or outdoors (n = 101), and had severe physical problems or were incapable of walking 50 metres (n = 60) were coded as never taking part in any exercise. Secondly, we used fully conditional multiple regression imputation, which is a multivariate technique for multiply imputing missing values using a sequence of regression models. The following variables were included according to the literature: age, gender, light exercise, moderate to intense exercise, living in own home or institution, PADL, IADL, walking speed, number of chronic diseases/conditions, presence of dementia, chronic stroke, Parkinson’s disease, pain while moving, presence of emotional support, social anchorage (four questions regarding feelings of affinity with relatives, the neighbourhood, friends as well as membership in an association) and locus of control (one question regarding feeling of hopelessness and relying of help from others). The imputation was repeated five times, and the results were saved in five different data sets. The data sets were pooled into one data set with five observations for each person and used in the analyses. To avoid underestimation of the standard error owing to the five observations, the original sampling weight (described above) was divided by five and used in the analyses.
education (elementary, high school, university studies) as independent variables. The analyses were further adjusted for: (i) health indicators—self-rated health, current depression, number of chronic conditions (0, 1, 2, 3+ diseases), body mass index (BMI) (body weight in kilograms divided by height in metres squared: underweight <20, normal 20–24.9, overweight 25–29.9, obese ≥30) and current smoking; and (ii) physical performance—personal and instrumental ADL, and walking speed (categorized in tertiles: <0.81, 0.82–1.20, >1.20 m/s). In the final model the demographic, health indicators and physical performance were included simultaneously as covariates.

To examine whether the observed associations are identical in different age cohorts, stratified analyses were performed with age dichotomized in two categories (66–78 and 80+ years). In addition, sensitivity analysis was conducted by repeating the analyses only for participants with complete information (no imputations) and the results were similar (results not shown).

Results

Description of physical exercise

As shown in table 1, less than half of the participants (46%) fulfilled the recommendation for health-enhancing and a small proportion (16%) for fitness-enhancing exercises. There were significant differences between the categories of physical exercise with age, gender, education, health indicators and physical performance.

Relationship between recommended physical exercise levels and demographic factors

Participation in both types of exercise was negatively related to increasing age and positively related to higher levels of education in a dose–response fashion in the multinomial regression analyses when adjusting for demographic factors. Women were significantly less likely to participate in fitness-enhancing exercise (table 2). These results remained after controlling for health indicators. However, when controlling for physical performance, the association of age and education with both types of exercise was attenuated (table 2). The same patterns were observed in the fully adjusted model including all covariates.

The stratified analyses by age (table 3) showed that women in the younger age groups (66–78 years) were significantly more likely to perform health-enhancing exercises compared with men, but there were no differences regarding fitness-enhancing exercises. However, in the older age groups (80+ years) women were significantly less likely to perform both type of exercises independent of health indicators and physical performance. Higher education was associated with participation in health-enhancing exercises in the older age groups but not in the younger groups after controlling for physical performance.

To understand which of the physical performance factors attenuated the relationship between exercise and age, gender and education, we repeated the analyses by adding physical performance variables one by one. The results showed that only walking speed explained the difference. Therefore, an interaction term between walking speed and age, gender and education, respectively, was included in the first model and was significant in all analyses. Stratified analyses were performed for subjects with slow (<1.0 m/s) and fast (≥1.0 m/s) walking speed (based on the median value). Among people with slow walking speed, after adjusting for demographic factors, health-enhancing exercise was significantly associated with higher education and fitness-enhancing exercise was significantly associated with age and gender. For fast walkers, these associations were not observed except for fitness-enhancing exercise, which was significantly decreased in the oldest age group (figure 1).

| Table 1 Demographic, clinical and functional characteristics of the study population and levels of participation in physical exercises according to recommendations, n (%) |
|---|---|---|---|
|   | Total | No/Inadequate | Health enhancing | Fitness enhancing |
| Age groups (years)* | 2593 | 974 (38) | 1180 (46) | 439 (16) |
| 66 | 564 | 97 (17) | 290 (51) | 177 (31) |
| 72–78 | 933 | 246 (26) | 494 (53) | 193 (21) |
| 80+ | 1096 | 631 (58) | 396 (36) | 69 (6) |
| Gender | | | | |
| Women | 1744 | 707 (41)* | 794 (46) | 243 (13)* |
| Men | 849 | 267 (31) | 386 (46) | 196 (22) |
| Education* | | | | |
| Elementary school | 545 | 295 (54) | 193 (36) | 57 (10) |
| High school | 1366 | 510 (38) | 637 (47) | 219 (15) |
| University | 682 | 169 (26) | 350 (52) | 163 (22) |
| Number of chronic conditions* | | | | |
| 0 | 419 | 84 (20) | 224 (54) | 111 (26) |
| 1 | 659 | 181 (28) | 338 (52) | 140 (20) |
| 2 | 651 | 241 (38) | 303 (46) | 107 (16) |
| 3+ | 864 | 468 (55) | 315 (37) | 81 (8) |
| Self-rated health** | | | | |
| As good | 1172 | 378 (33) | 592 (51) | 202 (16) |
| Better | 807 | 208 (26) | 405 (51) | 194 (23) |
| Worse | 256 | 153 (60) | 82 (32) | 21 (7) |
| Current depression** | | | | |
| No | 2270 | 771 (35) | 1093 (48) | 406 (17) |
| Yes | 215 | 112 (53) | 78 (37) | 25 (10) |
| BMI*** | | | | |
| <20 | 188 | 104 (55) | 69 (37) | 15 (8) |
| 20–24.9 | 932 | 266 (28) | 480 (53) | 186 (19) |
| 25–29.9 | 891 | 232 (27) | 465 (53) | 194 (20) |
| ≥30 | 285 | 113 (43) | 130 (43) | 42 (14) |
| Current smoking* | | | | |
| No | 2212 | 787 (36) | 1040 (47) | 385 (16) |
| Yes | 309 | 125 (43) | 130 (41) | 54 (16) |
| Personal ADL* | | | | |
| Independent | 2287 | 693 (31) | 1161 (51) | 433 (18) |
| Dependent | 304 | 279 (92) | 19 (6) | 6 (2) |
| Instrumental ADL* | | | | |
| Independent | 1709 | 339 (20) | 971 (58) | 399 (22) |
| Dependent | 890 | 631 (72) | 209 (24) | 40 (4) |
| Walking speed** | | | | |
| <0.81 | 1155 | 752 (65) | 359 (31) | 44 (4) |
| 0.82–1.2 | 1012 | 158 (15) | 607 (62) | 247 (23) |
| >1.2 | 396 | 46 (11) | 203 (51) | 147 (38) |

n, number of subjects
ADL, activities in daily living; BMI, body mass index
a: There were missing data for the following variables: self-rated health (n = 358), depression (n = 108), walking speed (n = 30), BMI (n = 297) and smoking (n = 72)
All proportions are weighted and the weighted variables are included in the chi square analyses
* P < 0.001

Discussion

To our knowledge, this is the first study that has described participation in both health- and fitness-enhancing exercises in accordance with recommendations from health organizations, among people aged 65+ and living in the community as well as in institutions.

Although in the current study 46% of people aged >65 met the recommendations for participating in health-enhancing exercises, previous studies have reported lower participation rates: ranging from 2.5% of community-dwellers aged 65+ and living in the community as well as in institutions. The corresponding figures based on self-reported information were 20% of men and 18% of women aged 64–74 and 10% of men and 7% of women aged 75+.24 The discrepancy may be caused by the
Figure 1 Odds ratios (OR) and 95% confidence interval (CI) of exercise adjusted for demographic factors stratified by walking speed, with no/inadequate exercise as reference
participants’ age, educational levels, living situation (e.g., community-dwellers or institutionalized) and the methods of measurement used in different studies. This explanation is also supported by our finding that the majority of the participants aged <80 years and people with a higher education met the recommended level.

Fitness-enhancing exercise is of utmost importance to preserve or improve physical function such as muscle strength, endurance and balance in older people and to maintain independence in daily living.2,23 Previously, one study investigated participation in sport activities, showing that 42% of the men and 31% of the women reached a level of ≥2.5 h/wk.26 This is the first study concerning whether older people meet the fitness-enhancing recommendations.

Our observation that advanced age was related to less participation in both health- and fitness-enhancing exercise independent of health indicators is in agreement with a study showing an age-related decline in physical exercise.27 This may be explained by the fact that the barriers to exercising, such as decreased physical capacity and social network, feelings of vulnerability and fear of falling, increase with age.27–29

Our finding that there was no significant gender difference in health-enhancing exercises is in line with previous studies that reported similar walking habits in women and men,17,18 but contrary to a Mediterranean study showing that almost half of the men, but only 20% of women, aged 65+ years achieved the recommendations.30 Women participated significantly less in fitness-enhancing exercises, which is in line with the study investigating participation in sports activities.26 However, this was only true for the older age groups, indicating a change in behavior along with aging. Another explanation can be that people born in 1940 or later have a different behavior compared with those born earlier, owing to the increasing knowledge of the health benefits of physical exercise.

Low education was related to less participation in both health- and fitness-enhancing exercise independent of health indicators but not when controlling for physical performance. This is partly in line with a study showing that higher education was associated with participation in sports and exercise when controlling for health indicators,31 but in contrast to two other studies when physical performance was controlled for.14,31 The possible explanation is that we follow the recommendations to categorize physical activity, and the previous studies used different measures of physical activity.

This is the first study that examined the associations of exercise with age, gender and education stratified by functional status. Our findings that the associations were only present among slow walkers but not among fast walkers suggest that functional status plays a more important role than gender and education in determining levels of exercise. In other words, the effects of gender and education on levels of exercise were mediated by functional status. This is reasonable because functional status is associated with levels of exercise,32 and the previously reported associations of exercise level with gender and education usually had not been taken into account the influence of functional status. These findings highlight the importance of encouraging older adults to participate in physical exercise, especially when facing initial functional decline.

A limitation of the study is that the measurements of physical activity in this study are related only to physical exercise,6 therefore we cannot state that we have captured the total amount of physical activity. Lack of information regarding duration of the exercise activities is another limitation. Further, self-reported levels of physical activity may be higher compared with objectively measured levels in terms of frequency, duration and intensity.33 A consensus regarding measures of physical activity is warranted to be able to compare results across studies. Another limitation is that our study population has a higher level of education compared with the average educational level of Swedish older people. In addition, selection bias might be present, as non-participants were significantly older and more of them lived in nursing homes, which may weaken the observed association between age and participation in physical exercise. An advantage is that the current study investigated to what extent older people, amongst people living both at home and in institutions, and in different age groups, participate in health- as well as fitness-enhancing exercises according to recommendations from health organizations. Further, several health and physical factors such as chronic morbidity, BMI and walking speed were objectively measured and controlled for in the analyses.

In conclusion, the majority of the participants aged <80 years and people educated at or above the high school level met the recommended level of health-enhancing exercise. However, only a small proportion of the subjects met the recommended level of fitness-enhancing exercise. Promoting physical exercise and encouraging participation among older persons and those with lower educations, especially among people with initial functional decline (as indicated by slow walking speed), may help to reduce adverse health outcomes. Increasing the physical activity level of sedentary older people is of great importance in reducing the risk of functional decline and dependency in daily living and in cutting health care costs.34,35

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Conflicts of interest: None declared.

Key points

- The majority of the participants aged <80 years and people with higher education met the recommended level of health-enhancing exercise.
- Only a small proportion of the subjects met the recommended level of fitness-enhancing exercise.
- Women in the younger age groups participated more in health-enhancing exercise compared with men; the opposite was shown for women in the older age groups. There were no significant differences in participation in fitness-enhancing exercises in the younger age groups; however, women participated less in the older age groups.
- Advanced age and low education were negatively related to participation independent of health indicators, but not among people with fast walking speed, highlighting the importance of functional status.
- The knowledge of differences in adherence to recommendations in different age groups and functional status is important to tailor interventions to increase or maintain exercise levels.

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