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Self-reported health, physical activity and socio-economic status of middle-aged and elderly participants in a popular road running race in Switzerland: better off than the general population?

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Summary

INTRODUCTION: In affluent countries habitual physical activity (PA) levels are low while participation of middle-aged people in road running events is increasing. We compared PA determinants of runners aged 50+ to those of a general population sample of similar age in Switzerland.

METHOD: Cross-sectional study comparing 580 road running event participants to 1,067 general population subjects. Binary logistic regression was used to predict group membership and multinomial logistic regression to describe relationships between regular PA levels, health and socio-economic status, adjusted for age, marital status and sex.

RESULTS: There was better health status, higher socio-economic position, less obesity and less depression in the runners than in the general population. People in self-reported "poor / very poor" and "good" health categories were less likely than the "excellent/very good" category to engage in vigorous regular PA compared to moderate regular PA.

CONCLUSIONS: Our findings confirm the association of PA with better health and higher socio-economic status in people aged 50+ but do not allow conclusions on causality. Further research and managerial effort should be expanded to develop programmes for the inactive population. New and existing prevention programmes should be undertaken to increase the awareness of target audiences. Popular road running events should be seen as having important public health potential and should be fostered.

Key words: *physical activity; health; SHARE; road running; binary logistic regression; multinomial logistic regression*

Background

The benefits of regular physical activity (PA) on the health of all age groups in general, and on the health of middle-aged and elderly subjects in particular, are well documented and it is generally accepted that PA is an important element of healthy living [1–4]. PA consists of any force exerted by skeletal muscles that results in energy expenditure above resting level [5]. According to the WHO [1], this broad definition means that virtually all types of PA are of interest, including walking or cycling for transport, dance, traditional games and pastimes, gardening and housework, as well as sport or deliberate exercise, with a curved dose-response relationship [2, 3]. Sufficient regular PA over a lifetime thus comes with many benefits. For instance, PA has a preventable role against older adults' risk of falls and hip fractures [6, 7] and helps to maintain strength and flexibility, allowing elderly subjects to continue to perform daily activities and remain autonomous [8, 9]. Regular PA such as walking for half an hour a day, 5 days a week, increases life expectancy by 1.5 years while regular vigorous exercise may more than double these gains [2, 10]. Furthermore, there is evidence for the compression of morbidity towards the end of life in those who remain physically active [11]. Yet, similarly to what is observed in other affluent societies, physical activity levels decrease with age and more than one-third of the Swiss population aged 50+ is insufficiently physically active [12], a finding which comes with an important burden of inactivity induced morbidity and mortality [13]. There is paucity of Swiss studies comparing determinants of health in physically active people with those of the general population aged 50+. Several studies suggest the existence of a relationship between regular practice of PA and socio-economic status [12, 14], also in Switzerland [15–17].

Regular running / jogging for leisure is accompanied by better health status [18]. Participation rates of older citizens in popular road running events has increased and may play a role in fostering PA in an aging population [19–24]. Therefore we set out to compare characteristics of participants aged 50+ in the biggest road running event in Switzerland with those of the general population of the

same age. We hypothesised 1) that physically active people are healthier and of a higher socio-economic status than the general population and 2) that the practice of regular PA is associated with socio-economic status and perceived health.

Methods

Design and study population

Study design was cross-sectional. Two groups were compared: a representative sample of the general Swiss population and a group of participants in a popular road running event, both groups were aged 50+ years. Data for the general population were retrieved from the 2006–2007 Survey of Health, Ageing and Retirement in Europe (SHARE) with sample size 1,067 (inclusion criteria: Swiss resident and aged 50+). The physically active group was recruited by e-mail to participate in an on-line survey among the participants of the 33rd Course de l'Escalade (CdE) of Geneva in 2010 (inclusion criteria: Swiss resident and aged 50+). CdE is the biggest annual Swiss road running event. It has developed from its first 1978 edition with just 700 adult participants (10% women), to >25,000 participants in 2010 (45% women), in various age categories starting at 6 years and no upper age limit. Running distances vary between 2 and 8 km, depending on age and sex, and lead the runners through the old city centre of Geneva. Out of a total of 1,613 persons surveyed, 873 (54%) filled out the questionnaire. After exclusion of non-eligible persons (non Swiss resident and younger than 50), a sample size of 580 was available for analysis.

Information to participants and consent

Anonymous SHARE data are freely available to the research community upon registration with the Mannheim Research Institute for the Economics of Aging (MEA) and no consent is required. CdE runners aged 50+ years were invited by email by the organiser of the event. They were duly informed of the aims of the study, of the strict anonymisation of their responses and of their right not to participate. The survey was performed on-line. A first invitation was sent one week after the event and a single reminder was sent 4 weeks later. Formal approval was waived by the local institutional research ethics board because of the questionnaire-based nature of the study.

Instrument

The questionnaire submitted to the CdE group used the same questions as put to the Swiss residents at the time of the SHARE investigation to minimise response bias. The questions addressed health, PA in terms of nature and frequency, and socio-economic and demographic characteristics.

Main variables and data reduction

1. Physical activity: Participants were asked to rate whether their PA levels were moderate or vigorous. Moderate levels of PA imply activities such as gardening, cleaning the car or going for a brisk walk, while sports, heavy housework or a job that involves physical labour are examples of vigorous activity. Hence, PA was classified as "vigorous regular PA", "moderate regular PA", "not regularly vigorous or moderate PA", being understood that the term "regular" implied a frequency of "more than once a week". Conversely, all participants reporting a frequency of "one to three times a month" or "hardly ever/never" were classified in the "not regularly vigorous or moderate PA". The questionnaire did not differentiate between professional and leisure time PA.
2. Body mass index (BMI) was used as a proxy of body composition and calculated as self-reported body weight (kg) divided by the square of height (m). We used the WHO categories: <18.5 underweight, 18.5–24.9 normal, 25–29.9 overweight and ≥30 obese.
3. Household income. The question used was: "What is approximately the net monthly income of the household after deduction of compulsory social insurance and pension plans, and taking alimony into account ". We found some excessive amounts in the CdE group (between 200,000 and 600,000 Swiss francs) suggesting the reporting of annual instead of monthly income and we therefore divided these by twelve. Some small amounts (5–1,000 Swiss francs) were also reported. Although logistic regression does not rely on distributional assumptions, the solution may be more stable if the predictor has a multivariate normal distribution. Income was therefore log-transformed to correct for skewness of the distribution.
4. Age was used as a scale, non-transformed variable.
5. Education. The highest level of education obtained was categorised as follows: (a) no degree/other, (b) apprenticeship, (c) advanced vocational college/ professional school, (d) university.
6. Marital status. The six original categories of marital status were collapsed into three new categories to ensure an optimal number in each category. These were: (a) living together with a spouse or a partner, (b) married but living separated from spouse or divorced, (c) never married or widowed.
7. Health status. Self-reported health status categories were: (a) excellent/very good, (b) good, (c) poor/very poor.
8. Other variables considered were nationality (Swiss national vs non-Swiss), sex (male vs female), feeling depressed (yes vs no) and group membership (CdE vs SHARE).

Sample size considerations

A common rule of thumb states that 10 events per predictor would suffice for adequate power. For a proper estimate of sample size, one generally relies on data from previous studies on the same topic or from pilot studies. As none of these pre-requisites were met, a rough approximation of the sample size needed to detect an odds ratio of 1.2 for an individual with an income of one standard deviation above the mean, using a one-tailed test with a significance level of 5%, a power of 80%, a correlation coefficient between income and education of 0.3 and an overall proportion of event rates $p = 0.2$, yielded 1,441 individuals. We used the Hsieh formula as reported by [25].

Statistical analysis

Data were analysed using SPSS (version 20.0, IBM, Chicago, USA). Proportions, mean values and standard deviations were used to describe general characteristics for each study group. Between-group differences were investigated by t-tests (or Mann-Whitney, where appropriate) for quantitative measures and by Chi-square (χ^2) tests for categorical measures. Significance was set at $p < 0.05$.

Both SHARE and CdE databases included cases with one or more missing datum. Instead of excluding these cases, we used the multiple imputation technique (MI) [26, 27]. MI replaces each missing value with a set of plausible values that represent the uncertainty about the right value to impute. These multiple imputed data sets are then analysed by using standard procedures for complete data after which the results from these analyses are combined. This procedure yields statistically valid inferences that properly reflect the uncertainty due to missing values.

We used logistic regression to predict group membership (SHARE vs CdE) as the dependent variable and the transformed income variable, education level, health status, BMI, feeling depressed and intensity of PA as the covariates. Age, gender and marital status were also considered in the regression as potential confounders. Goodness of fit was assessed by the Hosmer-Lemeshow test, which allows for verification of whether or not the observed event rates match expected event rates in sub-groups of the model population. A large p-value indicates a good match. As another indication of the predictive power of the model the classification table is provided.

The hypothesis that the practice of regular PA is associated with socio-economic level and health was studied by a multinomial logistic regression. Intensity of PA (regular vigorous PA, regular moderate PA, and no regular vigorous or moderate PA) was used as the dependent variable while the transformed income variable, education level and health status formed the set of the independent variables. Age, gender, marital status, nationality and group membership were also considered in the regression as potential confounders. Goodness of fit was assessed through the deviance and the Pearson χ^2 statistics, where values >0.05 mean that the model adequately fits the data. As another indication of the predictive power of the model the classification table is also provided.

Results

Sample characteristics

Specific group characteristics are described in table 1. Except for the number of years smoking, the two groups significantly differed on all variables.

Binary logistic regression

The retained dependent variable was "group membership", i.e. SHARE or CdE. The model fitted the data well as indicated by the large p-value of the Hosmer-Lemeshow test ($p = 0.4$). The classification table 2 shows that, overall, >80% of the cases were correctly classified.

Details of the logistic regression results are given in table 3 and the interpretation of the parameter estimates is straightforward (taking into account the difference of interpretation when the variable is expressed in its original values or when it is log-transformed):

- For a 1% increase in income, the odds of being a member of CdE group increased from 1 to 1.45 (= $e^{0.368}$; β value = 0.368 not given in the table). For an increase of 5%, the odds would increase from 1 to 6.3 (=$e^{5*0.368}$). In other words, the wealthier more often belonged to the CdE group.
- Compared to a "poor/very poor" health status, people with "good" health status were significantly more likely to be found in the CdE group than in the general population.
- Compared to underweight people, obese people were significantly less likely to be found in the CdE group than in the general population.
- Compared to depressed people, non-depressed people were significantly more likely to be found in the CdE group than in the general population.
- Compared to people with no regular exercise habits, people with regular vigorous PA were significantly more likely to be found in the CdE group than in the general population.
- For a 1-year increase in age, the odds of being a member of CdE group decreased from 1 to 0.889 (=$e^{-0.118}$; β value = –0.118 not given in the table). For an increase of 10 years, the odds would decrease from 1 to 0.31 (=$e^{10*0.118}$). In other words, older people were significantly less likely to be found in the CdE group than in the general population.
- Compared to widowed / never married persons, those living together with a spouse or a registered partner were more likely to be found in the CdE group than in the general population.

Gender and education were not significant predictors of group membership.

To assess the effect of age, gender and marital status, we fitted a new model without them. The results showed significant changes in the estimated coefficients of normal BMI (18.5–24.9) and all categories of health status, which became statistically significant compared to the reference categories. The other coefficients remained unchanged. These changes suggested that the aforementioned variables are confounders and were thus kept in the final model.

Multinomial logistic regression

The retained dependent variable was "intensity of PA". The goodness of fit statistics, namely the deviance and the Pearson chi-square, had respectable values ($p = 0.4$ and $p = 0.9$ respectively) and the classification table (table 4) shows that, overall, 61% of the cases were correctly classified.

In this multinomial logistic regression the dependent variable (intensity of PA) had 3 categories: neither moderate nor vigorous regular PA, moderate PA, vigorous PA. Hence there are two logit functions modelled as a linear combination of the predictor variables. We chose the moderate PA group as the baseline comparison group. The interpretation of the parameter estimates as shown in table 5 is as follows:

In the first logit, "no PA" is compared to "moderate PA":

- For a 1% increase in income, the odds of being inactive decreased from 1 to 0.895 (=$e^{-0.111}$: β value = –0.111

not given in the table). If income increased by 5%, the odds would decrease from 1 to 0.574 ($=e^{5*(-0.111}$). In other words, the wealthier were less physically inactive.

– Concerning education, people in the "no degree/other" category were less likely to be inactive.

Age, health status, nationality, gender, group membership and marital status were not significant predictors of PA when inactivity was compared to moderate PA.

In the second logit, "vigorous PA" is compared to "moderate PA":

– For 1 unit increase in age, the odds of engaging in vigorous PA decreased from 1 to 0.985 ($=e^{-0.015}$) where –0.015 is the value of β (not given in the table). For an increase of 10 units, the odds would decrease from 1 to 0.861 ($=e^{10*(-0.015)}$). In other words, the more one gets older the less one engages in vigorous PA.
– People in poor/very poor and in good health condition were significantly less likely to engage in vigorous PA compared to people in excellent/very good health condition.
– Being a female significantly decreased the odds to engage in vigorous PA compared to a male.
– Similarly being a member of the general population significantly decreases the odds to engage in vigorous PA compared to a CdE member.

Income, education, nationality and gender were not significant predictors of PA when vigorous PA was compared to moderate PA.

Again, to assess the effect of age, gender, marital status, nationality and group membership on the estimated coefficients of the predictors of interest, a new multinomial logistic regression was fitted excluding these variables. The coefficient estimates for the health and education categories significantly changed leading us to reintegrate these variables in the final model.

Discussion

This study compared a group of participants aged 50+ years in the biggest popular road running event in Switzerland with a similarly aged representative sample of the general Swiss population. The results confirm previous findings concerning the relationships between PA and socioeconomic and demographic characteristics: among physically active people there is higher income, better health status, less depression and less obesity [17, 28–30]. For the CdE group, our bivariate analyses (table 1) and multivariate analysis by logistic regression (table 3) showed, after adjustment for potential confounders (age, gender and marital status) that its members were healthier, less depressed and less obese than the general population.

This finding raises the question whether becoming a CdE group member, by regularly participating in a popular running event, would causally confer a health advantage. Because of the transverse study design this question necessarily remains unanswered but plausible arguments in favour of such an effect can nevertheless be formulated. Marti et al. studied 4,385 Swiss runners participating in a popular 16 km run and reported that the entire difference in mean fitness levels between joggers and the general population could be explained by training and life-style characteristics. Marti et al. concluded that, on average, the joggers appeared not to be selected concerning biological predisposition, but selected concerning behaviour [31]. The fact that taking up or continuing a habit of regularly running or jogging (also in middle age) confers important health advantages is beyond doubt. The decline of fitness with aging has a multifactorial origin and involves the effects of biological aging, lifestyle habits, and the development of subclinical and clinically apparent disease. Lifestyle and disease are related, and can be influenced by behavioural change. Former athletes who continue to engage in health enhancing PA levels maintain high fitness levels, age better and live longer [32–34]. Also in non-athletes such relationships have been described [35, 36]. A longitudinal study on 538 regular runners and 423 healthy controls >50 years at inclusion showed that at 19 years, 15% of runners had died compared with 34% of controls. Runners benefited from a survival benefit and disability and survival curves continued to diverge between groups after the 21-year follow-up as participants approached their ninth decade of life. Life-time continuation of regular running thus illustrates the marked association of regular vigorous exercise with both reduced disability and postponed death, with the effect on morbidity marginally greater than the effect on mortality, arguing for modest compression of morbidity [37]. The latter principle predicts that seniors with healthier lifestyles will live longer yet have less cumulative lifetime disability than those with less healthy lifestyles [11].

It follows from these observations that the regular organisation of popular running events like the CdE may have worthwhile health enhancing effects seen from a public health perspective. Nowadays many cities organise yearly marathons. Successfully running a marathon requires adequate, regular endurance training and an appropriate lifestyle [38]. Jokl et al. analysed running time, age, and sex of all 415,000 runners in the New York City Marathon from 1983 to 1999 and found that not only the number of mature participants increased at a greater rate than their younger counterparts, but that running times for the top 50 male and female finishers over the past two decades showed significantly greater improvement in the mature groups than in the younger age groups, suggesting improved training practices, results also corroborated by recent observations in ultra-endurance events [22–24]. Even though shorter distances like the ones in the CdE can be run without much preparation, a majority of participants trains in preparation for such events [19, 31, 39]. The increase in participation rate to the CdE, from a mere 700 participants in 1978 to >25,000 in 2010, is orders of magnitude greater than the population growth in the Geneva area. This suggests that such events effectively recruit citizens into health enhancing PA behaviour. However, based on general population and CdE demographics it can be estimated that only about 1% of men aged 50+ in the Geneva canton participated in the event in 2010, compared to 10% of the cantons' children aged 6 to 12 years old and thus there remains important recruitment potential. Contrary to public belief, fuelled by overly publicised inevitable, occasional sudden deaths in runners from underlying cardiovascular disease, the overall effect of organising running events, is

Table 1: Comparison of CdE and SHARE groups for some unadjusted measures. Interval variables are presented by their mean and standard deviation (SD), whereas categorical variables are presented by their percentage (%).

Selected characteristics	**CdE (n = 580)**	**SHARE (n = 1,067)**	**t or Z*, χ2 (*p*-value)**
Age, M (SD)	56.5 (6.0)	65.7 (10.6)	19.4 (p <0.0005)
Marital status, %			154.8 (p <0.0005)
Married and living together with spouse / registered partnership	78.7	48.3	
Married, living separated from spouse / divorced	15.1	27.0	
Never married / widowed	6.2	24.7	
Nationality, %			10.5 (p = 0.001)
Swiss	85.2	90.9	
Other	14.8	8.1	
Gender, %			21.7 (p <0.0005)
Female	39.6	51.5	
Male	60.4	48.5	
Highest educational degree obtained, %			76.2 (p <0.0005)
No degree / other	4.6	16.8	
Apprenticeship	24.1	32.4	
Advanced vocational college / professional school	26.0	12.8	
University	45.3	38.0	
Household monthly income, M (SD)	16'135 (20'121)	9'162 (15'058)	–7.8 (p<0.0005)
BMI, %			109.1 (p <0.0005)
Below 18.5: underweight	2.6	5.0	
18.5–24.9: normal	71.1	45.4	
25.0–29.9: overweight	24.2	35.5	
30.0 and above: obese	2.1	14.0	
Smoke at the present time, %			101.8 (p <0.0005)
No	94.4	73.0	
Yes	5.6	27.0	
If yes, number of cigarettes, cigarillos and pipes smoked daily, M (SD) **If yes,** number of years smoking, M (SD)	6.9 (6.7) 32.4 (12.8)	13.1 (10.3) 31.7 (24.7)	–4.8 (p <0.0005) 0.1 (p = 0.9)
Number of drinks in a day last 3 months, M (SD)	2.9 (2.5)	2.6 (4.2)	2.2 (0.02)
How often 4 or more drinks in same occasion last 3 months, %			134.2 (p <0.0005)
Never	35.0	58.7	
1 day	17.3	12.0	
Between 2 and 3 days	26.2	10.9	
More than 4 days	21.5	18.4	
How many days a week consumed alcohol last 6 months, %			111.4 (p <0.0005)
Every day or almost	18.4	24.4	
5 to 6 days per week	9.2	4.2	
3 to 4 days per week	22.8	9.9	
1 to 2 times per week	31.6	24.6	
1 to 2 times per month	11.0	15.2	
Less than once a month	5.4	7.7	
Not at all	1.6	14.0	
Reported physical activity, %			101.8 (p <0.0005)
Vigorous	74.1	48.6	
Moderate	19.1	34.5	
Neither vigorous nor moderate	6.8	16.9	
Reported health status, %			82.1 (p <0.0005)
Poor / very poor	3.3	17.2	
Good	52.9	37.1	
Excellent/very good	43.9	45.7	
Feeling sad or depressed last month, %			49.7 (p <0.0005)
No	80.3	63.7	
Yes	19.7	36.3	
Trouble sleeping, %			8.9 (p = 0.003)
No	78.2	70.7	
Yes	21.8	29.3	
Number of reported physical problems as diagnosed by doctor, M (SD)	0.7 (0.2)	1.2 (0.2)	–8.8 (p <0.0005)
Most reported types of cancer as diagnosed by doctor, %			**
Breast cancer	0.7	1.5	
Colorectal cancer	1.4	0	

Skin cancer	0.5	0.2	
Number of reported medicines consumed, M (SD)	0.6 (0.9)	1.2 (1.3)	–10 (p <0.0005)
*Used in non-parametric Mann-Whitney test where relevant; **insufficient data to allow comparison.			

Table 2: Classification table of the observed and predicted cases by logistic regression.

		Predicted		
Observed		**Group membership**		**Percentage correct**
		0: SHARE	**1: CdE**	
Group membership	0: SHARE	918	149	86.0%
	1: CdE	177	403	69.5%
Overall percentage		66.5%	33.5%	80.2%

Table 3: Logistic parameter estimates with group membership (SHARE vs. CdE) as the dependent variable.

Variable	**Adjusted OR**	**95% C.I. for OR**	
		Lower	**Upper**
Income	1.446	1.252	1.669
Education level			
No degree/other	0.294	0.026	3.383
Apprenticeship	0.484	0.012	19.127
Advanced vocational college/professional school	0.890	0.078	10.117
University	1	1	1
Health status			
Poor/very poor	1	1	1
Good	3.552	1.836	6.874
Excellent/very good	1.258	0.668	2.371
BMI			
Underweight	1	1	1
Normal weight	2.032	0.642	6.438
Overweight	0.772	0.253	2.353
Obese	0.225	0.075	0.673
Feeling depressed			
No	2.231	1.495	3.331
Yes	1	1	1
Intensity of PA			
Neither moderate nor vigorous	1	1	1
Moderate	1.305	0.758	2.246
Vigorous	2.519	1.480	4.288
Age	0.889	0.869	0.909
Gender			
Female	0.708	0.495	1.014
Male	1	1	1
Marital status			
Married and living together with spouse/registered partnership	2.550	1.439	4.517
Married, living separated from spouse / divorced	1.179	0.103	13.506
Never married / widow	1	1	1
Constant	4.865	0.664	35.630

Table 4: Classification table of the observed and predicted cases by multinomial logistic regression.

Observed	**Predicted**			
	Neither vigorous nor moderate	**Moderate**	**Vigorous**	**Percent correct**
Neither vigorous nor moderate	12	68	141	5.4%
Moderate	6	125	347	26.2%
Vigorous	4	77	867	91.5%
Overall percentage	1.3%	16.4%	82.3%	61.0%

a reduction in cardio-vascular morbidity and mortality on a population level [40]. Local governments should therefore actively foster the organisation of such popular running events. On the other hand, even if the health benefits of regular exercise are very substantial, runners get injured regularly, especially suffering lower limb injury, and proper training advice is therefore mandatory [21, 41].

The relationships between work time PA, leisure time PA, health, socio-economic status and other ecological factors like local culture are complex. From an ecological perspective there are many factors from multiple contexts of daily life that influence PA behaviour and development [28]. Determinants of regular habitual health enhancing PA can be found at personal, family, work and community level. To further complicate matters, these relationships are

Table 5: Multinomial logistic parameter estimates with group membership (neither moderate nor vigorous AP vs moderate AP vs vigorous AP) as the dependent variable.

	Adjusted OR	95% C.I. for OR	
		Lower	Upper
Neither moderate nor vigorous AP vs moderate AP			
Intercept	–	–	–
Age	0.996	0.975	1.018
Income	0.895	0.815	0.984
Health status			
Poor / very poor	1.483	0.934	2.353
Good	1.160	0.793	1.698
Excellent / very good	1	1	1
Education			
No degree / other	0.489	0.261	0.917
Apprenticeship	0.724	0.422	1.242
Advanced vocational college/professional school	0.755	0.435	1.308
University	1	1	1
Nationality			
Foreigner	1.135	0.357	3.608
Swiss national	1	1	1
Gender			
Female	0.781	0.550	1.107
Male	1	1	1
Group membership			
SHARE	1.298	0.797	2.115
CdE	1	1	1
Marital status			
Married and living together with spouse / registered partnership	0.700	0.434	1.129
Married, living separated from spouse / divorced	0.640	0.309	1.329
Never married / widow	1	1	1
Vigorous AP vs moderate PA			
Age	0.985	0.971	0.999
Income	0.980	0.912	1.053
Health status			
Poor / very poor	0.353	0.239	0.521
Good	0.607	0.471	0.782
Excellent / very good	1	1	1
Education			
No degree/other	0.932	0.494	1.761
Apprenticeship	1.114	0.756	1.641
Advanced vocational college/professional school	1.020	0.675	1.541
University	1	1	1
Nationality			
Foreigner	0.960	0.617	1.494
Swiss national	1	1	1
Gender			
Female	0.666	0.521	0.852
Male	1	1	1
Group membership			
SHARE	0.449	0.320	0.629
CdE	1	1	1
Marital status			
Married and living together with spouse / registered partnership	1.007	0.685	1.481
Married, living separated from spouse/divorced	0.818	0.537	1.249
Never married / widow	1	1	1

not necessarily fixed. There are also important differences that relate to overall socio-economic status and local culture. In a country like Switzerland, with a prosperous economy, socio-economic status relates positively with fitness and health status, and negatively with morbidity and mortality [42]. Meyer et al. reported in 8,405 Swiss citizens aged 50–80+ years that higher socio-economic status was associated with involvement in moderate sports/exercise, vigorous sports/exercise, or optimal physical activity (combining recommended habitual physical activity levels with sports/exercise habits) whereas lower socio- economic

status was associated with habitual physical activity levels only [12].

Study limitations

Even if the questions asked of the CdE group were exactly identical to the ones used for SHARE, a potential response bias may exist due to the fact that the SHARE survey was conducted by face-to-face interviews. In SHARE any issues misunderstood, or inconsistent answers, could be rephrased by the interviewer, respectively corrected by the interviewee, while this was not possible in the on-line version used for the CdE participants.

Unexpectedly, the multinomial logistic regression highlighted the association between education level and PA intensity through the "no degree / other" category which tended to be less inactive when compared to moderate PA. Possible explanations for this finding are the assessment of PA by questionnaire. For our specific hypothesis, we defined the intensity of PA as vigorous, moderate, neither vigorous nor moderate, associated only with the highest level of frequency (more than once a week) but had to rely on the subjective appreciation of the participants for PA intensity, duration and frequency. Objective measurement of PA with e.g., accelerometers would possibly yield different results.

Participation in the surveys was voluntary and selection bias is therefore possible. Differences in response may have affected the strength of association between regular PA and socio-economic status because the response rate was higher in the CdE group (54%) than in the SHARE group (38%). Twenty-three (23)% of the respondents lived abroad (mostly in nearby France) and had to be excluded since they did not fulfil the inclusion criteria. Nonetheless, a sensitivity analysis conducted with all the respondents including these non-residents did not change the coefficients of the previous regression with the Swiss residents except for the obese.

Finally, although this study has proved useful to test our hypothesis, its cross-sectional design precludes any strong assertion of causal relationships.

Conclusions

We report self-rated PA, health, socio-economic status and demographic characteristics in physically active Swiss residents aged 50+ (CdE) compared to a representative sample of the general population (SHARE). As hypothesised, the CdE group was more active and in better shape.

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