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Socioeconomic inequalities in sport participation: pattern per sport and time trends – a repeated cross-sectional study

Viviane Richard[1], Giovanni Piumatti[2], Nick Pullen[1], Elsa Lorthe[1], Idris Guessous[3,4], Nicola Cantoreggi[5] and Silvia Stringhini[1,6*]

Abstract

Background Sport participation is an important component of a healthy lifestyle and is known to be more common among privileged individuals. However, few studies examined socio-demographic patterns of participation by type of activity. This study aims at quantifying socio-economic inequalities in sport participation by sport type, and to analyse their trend over 15 years.

Methods We used 2005–2019 data from the Bus Santé study, a yearly population-based cross-sectional survey of Geneva adults. Sport participation was defined as reporting at least one sporting activity over the previous week; educational level, household income and occupational position were used as indicators of socio-economic position. Socio-economic inequalities in sport participation, and their trend over time, were examined using the relative and slope indexes of inequality (RII/SII).

Results Out of 7769 participants (50.8% women, mean age 46 years old), 60% participated in a sporting activity. Results showed that the higher the socioeconomic circumstances, the higher the sport participation (RII = 1.78; 95% Confidence Interval (CI): 1.64–1.92; SII = 0.33; 95%CI: 0.29–0.37 for education). Relative inequalities varied per sport e.g., 0.68 (95%CI: 0.44–1.07) for football and 4.25 (95%CI: 2.68–6.75) for tennis/badminton for education. Yearly absolute inequalities in sport participation tended to increase between 2005 and 2019 for household income, especially among women and older adults.

Conclusions We observed strong socio-economic inequalities in sport participation in Geneva, with different magnitude depending on the sport type. These inequalities seemed to increase over the 2005–2019 period. Our results call for tailored measures to promote the participation of socially disadvantaged populations in sporting activities.

Keywords Social inequalities, Sports, Lifestyle

*Correspondence:
Silvia Stringhini
Silvia.Stringhini@hcuge.ch
[1]Unit of Population Epidemiology, Division of Primary Care Medicine, Geneva University Hospitals, Rue Jean-Violette 29, Geneva 1205, Switzerland
[2]Fondazione Agnelli, Via Giuseppe Giacosa, 38, Turin 10125, Italy
[3]Department of Health and Community Medicine, Faculty of Medicine, University of Geneva, Rue Michel-Servet 1, Geneva 1211, Switzerland
[4]Division and Department of Primary Care Medicine, Geneva University Hospitals, Rue Gabrielle- Perret-Gentil 4, Geneva 1205, Switzerland
[5]Institute of Global Health, University of Geneva, Chemin des Mines 9, Geneva 1202, Switzerland
[6]University Center for General Medicine and Public Health, University of Lausanne, Rue du Bugnon 44, Lausanne 1011, Switzerland

Background

Physical activity has important health benefits [1–4] and the World Health Organization recommends that adults engage in at least 150 min of moderate-intensity physical activity per week, 75 min of vigorous physical activity, or a combination of both [5]. However, in high-income countries, a meaningful share of the population does not participate in sufficient physical activity to meet these guidelines [6]. This is thought to contribute to the burden of non-communicable diseases [7].

As a specific type of physical activity, sport can represent an interesting way of balancing the lack of movement of many daily occupations, with additional benefits such as a positive impact on mental health and social cohesion [3, 8]. The determinants of sport participation have been widely studied and favourable socio-economic conditions are consistently associated with higher sport participation [9–11]. Indeed, privileged individuals may have more psychosocial, financial and neighbourhood resources, as well as a higher health literacy to establish healthy behaviours [9–11].

In most studies examining the social patterning of physical activity, sport participation is analysed globally, whereas different patterns could exist as per sport type [12]. For example, United-States and Australian studies found that privileged socio-economic conditions are associated with higher general sport participation, but that this relationship is reversed for team sports participation [12, 13]. A French study obtained similar results, with higher education and income being associated with individual sport participation, but not with team sport participation [14]. These differences are usually explained by socio-cultural factors or by the fact that group activities are more affordable compared to other sports. Very few epidemiological studies stratified the association between socio-economic conditions and sport participation by type of sport, while a more detailed understanding of this relationship would help in designing appropriate and effective promotion strategies, especially for disadvantaged populations. This is supported by a study that analysed motivations and barriers for attendance in a physical activity program in a disadvantaged community, and reported that tailoring activities to the needs and interests of the target group was a key factor for both recruitment and retention [15].

The evolution of the association between socio-economic conditions and sport participation also remains unclear, as some studies report increasing inequalities over time [16, 17], while others do not find significant trends [18–21]. In sum, the evolution of social inequalities in sport participation seems context- and time-dependent. Furthermore, gender-specific analyses are rare and inconsistent [16, 18, 20], and recent data is lacking, with very few estimates after 2012 [17, 21].

The goal of the present study is to evaluate the association between socio-economic conditions and participation in different sports; and to analyse its evolution over a 15 years study period in the canton of Geneva, Switzerland.

Methods

Study population

Data was drawn from the Bus Santé study, an ongoing yearly population-based cross-sectional survey conducted since 1993 in Geneva [22]. This small urban Swiss canton is characterized by a good transportation network, a high population density and an important immigration. Every year, an age- and sex-stratified random sample of about 1000 non-institutionalized residents aged 20–75 years (35–75 years before 2012) provided by the local authorities was recruited through an initial invitation letter. Non-respondents were contacted with up to seven phone calls and two additional letters. Participants completed socio-demographic, lifestyle and health questionnaires, and attended a medical check-up, during which questionnaires were verified by a trained research nurse [22]. Overall, study participants were representative of the non-institutionalized adult population of Geneva in terms of age and sex. The Bus Santé study was approved by the Institute of Ethics Committee of the University of Geneva. All participants signed a written informed consent.

In the present study, we included participants of the Bus Santé surveys from 2005 to 2019, the most recent year with available data. Average annual participation rate (number of participants/number of eligible invited persons) was 36.8% [range: 29.0–47.0%]. These estimates are conservative since it was not possible to identify if participants unreachable by phone [annual range: 18.1–54.9%] did not want to participate or did not receive the invitation letters.

We further selected participants who were physically capable of engaging in a sporting activity; physical incapacity being defined as an affirmative answer to either of the questions: "*Over the 4 last weeks, did you have difficulties showering or bathing, getting dressed, getting in/up from your bed or a chair, using the toilets or eating?*" and "*Over the 4 last weeks, did you have difficulties shopping or doing routine household chores?*". Since individuals aged 20–34 years old were only recruited from 2012 onwards in the Bus Santé study, participants were divided into two subgroups for the following analyses: (1) participants aged 20–75 years old recruited between 2012 and 2019 for the analyses by sport category, and (2) participants aged 35–75 years old recruited between 2005 and 2019 for the time trend analyses (Supplementary 1).

Measures

Outcome

The main outcome was sport participation, overall, by sport category and by sport type, reported in a dedicated subsection of a validated physical activity frequency questionnaire (PAFQ) [23], and defined as the participation in at least one sporting activity in the week preceding the Bus Santé appointment. The 17 different sport types proposed in the PAFQ were grouped into four categories based on practice modalities: (1) Individual sports (running, brisk walking, racing bicycle, strength training/weight lifting, swimming, and ice-/roller-skating); (2) Racket sports that require one or few partners (tennis/badminton, squash); (3) Group sports that are usually practiced in group or team sessions (dance, European football, handball, gymnastics, judo/karate), and (4) Special sports requiring longer trips to reach specific places or facilities (golf, downhill/water skiing, cross-country skiing, diving). Participants could report participation in more than one sport type or category.

Explanatory variables

Socio-economic conditions were separately measured with education, household income and occupational position. Based on the main milestones of the Swiss education system, the educational level was divided into lower secondary (ISCED 2011 levels 0–2), upper secondary (ISCED 2011 levels 3–4) and tertiary (ISCED 2011 levels 5–8) [24]. Categories of gross monthly household income were adjusted by the number of people living in the household using the OECD-modified scale [25]. The result was split into four categories: <3000 CHF, 3000–4999 CHF, 5000–6999 CHF and $\geq$ 7000 CHF. Finally, participants reported their current occupational position in one of the following four categories: manual worker, manual self-employed worker, non-manual worker, and non-manual manager.

Covariates

The following demographic and health characteristics were considered as covariates: age at the moment of the interview, sex, and country of birth (Switzerland, Southern Europe, Western Europe, Eastern and South-Eastern Europe, Other), as well as health indicators such as self-reported health (very good, good, medium, poor, very poor), body mass index (BMI), active smoking and presence of a chronic disease (diabetes, hypertension, or cardiovascular disease).

Statistical analyses

Socio-economic inequalities in sport participation were estimated using the relative and slope indexes of inequality (RII and SII). These regression-based measures summarise the outcome difference between the socio-economic extremes, while taking intermediate categories into account [26, 27]. The RII evaluates the relative difference: a RII of 1.1 is interpreted as a 10% higher outcome prevalence in the most privileged socio-economic group compared with the least privileged one. The SII measures the absolute difference: a SII of 0.1 means that the prevalence of the outcome is 10% points higher in the most privileged socio-economic group than in the least privileged one.

To compute these indexes, each category of the ordinal socio-economic variables was translated into a numerical rank equal to the proportion of participants with lower socio-economic conditions, and added as the independent variable in the models. The SII was based on linear regressions, while the RII was computed with generalized linear models following a quasi-Poisson distribution; robust standard errors were calculated. A first minimal model was adjusted for potential demographic confounders such as age, sex, an interaction between age and sex, and country of birth; a second full model further included the above-defined health factors to disentangle the effect of the health status in the association between socio-economic conditions and sport participation. The season and year of survey participation were included as covariate in a sensitivity analysis to correct for seasonality and medium-term variations in sport participation.

To evaluate the evolution of inequalities over time between 2005 and 2019, the participants' visit year was added in the above-described models, both as a main effect and as an interaction term with all other covariates. The coefficient of the interaction between the socio-economic rank and the year (β) was used to give an estimation of the time trend in inequalities [16]. A sensitivity analysis was performed by removing years that may overly influence the regression.

Complete case analyses were performed by excluding observations with missing data on the examined variables. Analyses per sport category and of trends over time were performed on the entire resulting sample, as well as with a sex stratification. Time trend analyses were additionally stratified by age. All analyses were performed with R-4.0.3 and significance level was set to 5%; p-values of descriptive analyses were adjusted for multiple comparisons with the Bonferroni method.

Results

Of the 8425 individuals taking part in the survey between 2012 and 2019, we excluded 656 who were physically unable to engage in sporting activities (Supplementary 1). Therefore, the study population for the main analyses consisted of 7769 participants, with a mean age of 46 years old (SD: 14.2 years), 50.8% being women (Table 1).

A total of 4660 (60.0%) participants reported engaging in at least one sporting activity over the last week.

Individual sports were the most practised, reported by 3424 (44.1%) participants, while racket sports were only practised by 407 (5.2%) participants. Sport participation was more common among younger participants, born in Switzerland or in Western Europe, with a good self-reported health, a normal BMI, no chronic disease, no smoking, and higher socio-economic conditions ($P<0.001$; Table 1).

In line with the descriptive analysis, the RII and SII estimations showed that the higher the socio-economic conditions, the higher the sport participation, whichever the sport category ($P<0.05$; Fig. 1, Supplementary 2–4). For overall sport participation, results of the minimally adjusted model indicated that sport participation was 1.78 times (RII=1.78; 95% Confidence Interval: 1.64–1.92) and 33% points (SII=0.33; 95% CI: 0.29–0.37), higher among participants with the highest educational level compared to those with the lowest one. These inequalities were lower when adjusted for health-related factors (RII=1.56; 95% CI: 1.45–1.69 and SII=0.26; 95% CI: 0.21–0.30). The same magnitude of results was observed when using household income or occupational position as indicators of socioeconomic circumstances. Relative inequalities were more important for racket (RII=3.69; 95% CI: 2.41–5.64) and special sports (RII=4.47; 95% CI: 3.20–6.25) than for group sports (RII=1.79; 95% CI: 1.53–2.09), while the highest absolute inequalities could be observed in the overall sport participation. In analyses stratified by sex, inequalities were higher in racket and special sports among men than women, while the opposite was observed for group sports (Supplementary 2–3). Results did not vary after additionally adjusting for the season and year of survey participation.

When stratifying by specific type of activity, for most sports, a higher educational level was associated with higher sport participation. With the minimally adjusted model, sports such as tennis/badminton (RII=4.25; 95% CI: 2.68–6.75) showed high inequalities compared to football (RII=0.68; 95% CI: 0.44–1.07), the only sport where the direction of inequalities seemed reversed, although not significantly (Fig. 2). Apart from substantially higher inequalities in golf participation, the same magnitude of results was observed when using the household income and the occupational position as indicators of socioeconomic conditions, as well as when adjusting for season and year of survey participation (Supplementary 5).

Over the 2005–2019 period, for which data was available only for participants aged 35 to 75 years old, the RII and SII showed persistent inequalities. An increasing but non-significant trend could be observed (Fig. 3), for both the yearly change of the RII ($\exp(\beta)=1.01$; $P=0.184$) and of the SII ($\beta=0.01$; $P=0.099$) for education (Supplementary 6). Absolute income inequalities significantly increased over time ($\beta=0.01$; $P=0.024$), especially among women ($\beta=0.02$; $P=0.012$) and participants aged between 55 and 75 years old ($\beta=0.02$; $P=0.003$; Supplementary 6). Since the comparatively small inequalities observed between 2005 and 2007 (Fig. 3, Supplementary 7) could overly influence these results, a sensitivity analysis was performed by removing these years. When analysing the 2008–2019 period, increasing income inequalities in sport participation were only significant among women (RII: $\exp(\beta)=1.03$; $P=0.033$ and SII: $\beta=0.02$; $P=0.021$) and older adults (RII: $\exp(\beta)=1.04$; $P=0.029$ and SII: $\beta=0.02$; $P=0.027$; Supplementary 6). Results did not change when adjusting for the season of survey participation.

Discussion

This study conducted on a randomly selected sample of the Geneva population showed strong socio-economic inequalities in sport participation among adults, with privileged socio-economic conditions being associated with higher sport participation. These inequalities were consistently observed with different socio-economic indicators, as well as after sex and sport stratification. Relative inequalities were higher for racket and special sports than for group sports, while the highest absolute inequalities were observed in the overall sport participation. Income inequalities in sport participation tended to increase over the 2005 to 2019 period, particularly among women and older adults.

These results are in line with the existing literature [9–11], and more specifically with other populational studies, that quantified educational inequalities in sporting inactivity in Germany in 2012 (RII=3.4; SII=0.4) [16] and in Sweden in 2014 (RII=2.0; SII=0.1) [29]. The high relative inequalities found in the racket, and special sports reflect findings from studies showing that participation in these sports is more common among privileged groups [30, 31]. On the other hand, group sport participation seemed to present lower socio-economic inequalities, as previously observed [12, 13]. Our results further showed that inequalities in group sport participation were lower among men than women. In fact, sports included in the group sport category (football, handball, judo/karate, gymnastics, and dance) were unequally practised according to gender. Stratifying this category by sex highlighted the higher socio-economic inequalities in gymnastics and dance, which were more practised by women, compared to football and handball, which were popular among men. It shows that analyses by specific sport are relevant to study socio-economic inequalities in sport participation in detail.

Part of the association between socio-economic position and sport participation might be explained by health

Table 1 Demographic and health characteristics according to participation in sport categories, among adults aged 20 to 75 years, 2012–2019, Geneva

	Total	Sport participation									
		All		Individual[a]		Racket[a]		Group[a]		Special[a]	
	n (%[b])	n (%)	P-value[c]	n (%)	P-value[c]	n (%)	P-value[c]	n (%)	P-value[c]	n (%)	P-value[c]
Total	7769 (100.00)	4660 (60.0)		3424 (44.1)		407 (5.2)		2034 (26.2)		662 (8.5)	
Sex (n = 7769)											
Men	3823 (49.2)	2333 (61.0)	0.068	1802 (47.1)	< 0.001	287 (7.5)	< 0.001	790 (20.7)	< 0.001	399 (10.4)	< 0.001
Women	3946 (50.8)	2327 (59.0)		1622 (41.1)		120 (3.0)		1244 (31.5)		263 (6.7)	
Age (n = 7769)											
20–34	1885 (24.3)	1244 (66.0)	< 0.001	984 (52.2)	< 0.001	119 (6.3)	0.009	528 (28.0)	0.001	138 (7.3)	0.006
35–49	2735 (35.2)	1707 (62.4)		1316 (48.1)		153 (5.6)		657 (24.0)		273 (10.0)	
50–64	2125 (27.4)	1187 (55.9)		823 (38.7)		96 (4.5)		543 (25.6)		173 (8.1)	
65–75	1024 (13.2)	522 (51.0)		301 (29.4)		39 (3.8)		306 (29.9)		78 (7.6)	
Country of birth (n = 7757)											
Switzerland	3815 (49.1)	2430 (63.7)	< 0.001	1749 (45.8)	< 0.001	227 (6.0)	< 0.001	1069 (28.0)	< 0.001	376 (9.9)	< 0.001
Southern Europe	1123 (14.5)	556 (49.5)		418 (37.2)		27 (2.4)		255 (22.7)		44 (3.9)	
Western Europe	1097 (14.1)	699 (63.7)		531 (48.4)		66 (6.0)		289 (26.3)		140 (12.8)	
Eastern / South-Eastern Europe	394 (5.1)	240 (60.9)		181 (45.9)		24 (6.1)		116 (29.4)		28 (7.1)	
Other	1338 (17.2)	735 (54.9)		545 (40.7)		63 (4.7)		305 (22.8)		74 (5.5)	
Self-perceived health (n = 7762)											
Very good	2235 (28.8)	1574 (70.4)	< 0.001	1225 (54.8)	< 0.001	152 (6.8)	< 0.001	670 (30.0)	< 0.001	250 (11.2)	< 0.001
Good	4376 (56.3)	2572 (58.8)		1828 (41.8)		223 (5.1)		1139 (26.0)		362 (8.3)	
Medium	1078 (13.9)	482 (44.7)		344 (31.9)		30 (2.8)		217 (20.1)		45 (4.2)	
Poor	62 (0.8)	23 (37.1)		19 (30.6)		0 (0.0)		7 (11.3)		4 (6.5)	
Very poor	11 (0.1)	6 (54.5)		5 (45.5)		1 (9.1)		1 (9.1)		1 (9.1)	
Body mass index[d] (n = 7654)											
Under/normal weight (< 25 kg/m^2)	4638 (59.7)	3033 (65.4)	< 0.001	2270 (48.9)	< 0.001	251 (5.4)	0.064	1356 (29.2)	< 0.001	438 (9.4)	< 0.001
Overweight (25-29.9 kg/m^2)	2274 (29.3)	1254 (55.1)		896 (39.4)		129 (5.7)		518 (22.8)		182 (8.0)	
Obesity (≥ 30 kg/m^2)	742 (9.6)	329 (44.3)		225 (30.3)		26 (3.5)		145 (19.5)		38 (5.1)	
Chronic disease (n = 7769)											
No	6088 (78.4)	3849 (63.2)	< 0.001	2888 (47.4)	< 0.001	345 (5.7)	0.002	1681 (27.6)	< 0.001	542 (8.9)	0.025
Yes	1681 (21.6)	811 (48.2)		536 (31.9)		62 (3.7)		353 (21.0)		120 (7.1)	
Smoking (n = 7761)											
No	6105 (78.6)	3785 (62.0)	< 0.001	2799 (45.8)	< 0.001	327 (5.4)	0.43	1657 (27.1)	< 0.001	543 (8.9)	0.031
Yes	1656 (21.3)	871 (52.6)		623 (37.6)		80 (4.8)		375 (22.6)		119 (7.2)	
Educational level (n = 7691)											

Table 1 (continued)

	Total	Sport participation									
		All		Individual[a]		Racket[a]		Group[a]		Special[a]	
	n (%[b])	n (%)	P-value[c]	n (%)	P-value[c]	n (%)	P-value[c]	n (%)	P-value[c]	n (%)	P-value[c]
Tertiary	4003 (51.5)	2721 (68.0)	< 0.001	2027 (50.6)	< 0.001	280 (7.0)	< 0.001	1158 (28.9)	< 0.001	459 (11.5)	< 0.001
Upper secondary	3088 (39.7)	1661 (53.8)		1196 (38.7)		116 (3.8)		751 (24.3)		185 (6.0)	
Lower secondary	600 (7.7)	229 (38.2)		163 (27.2)		9 (1.5)		100 (16.7)		11 (1.8)	
Household income[e] (n = 6927)											
≥7000 CHF	1962 (25.3)	1367 (69.7)	< 0.001	1032 (52.6)	< 0.001	152 (7.7)	< 0.001	549 (28.0)	0.001	266 (13.6)	< 0.001
5000–6999 CHF	1806 (23.2)	1157 (64.1)		824 (45.6)		104 (5.8)		494 (27.4)		193 (10.7)	
3000–4999 CHF	1953 (25.1)	1065 (54.5)		763 (39.1)		79 (4.0)		485 (24.8)		114 (5.8)	
<3000 CHF	1206 (15.5)	563 (46.7)		407 (33.7)		36 (3.0)		269 (22.3)		38 (3.2)	
Occupational position (n = 5429)											
Non-manual manager	1584 (20.4)	1097 (69.3)	< 0.001	859 (54.2)	< 0.001	128 (8.1)	< 0.001	377 (23.8)	< 0.001	229 (14.5)	< 0.001
Non-manual worker	2606 (33.5)	1664 (63.9)		1217 (46.7)		146 (5.6)		736 (28.2)		220 (8.4)	
Manual self-employed worker	249 (3.2)	135 (54.2)		84 (33.7)		10 (4.0)		64 (25.7)		14 (5.6)	
Manual worker	990 (12.7)	441 (44.5)		343 (34.6)		22 (2.2)		160 (16.2)		33 (3.3)	

[a] Sport categories: Individual (running, brisk walking, racing bicycle, strength training/weightlifting, swimming, ice-/roller-skating); Racket (tennis/badminton, squash); Group (dance, football, handball, gymnastics, judo/karate); Special (golf, downhill/water skiing, cross-country skiing, diving). Participants could engage in several sports

[b] Percentages calculated on the total number of participants (7769). Missing categories are not shown, therefore percentages may not add up to 100%. The numbers of observations without missing values are provided in the headline of each variable

[c] P-values from Chi-Square tests of sport participation adjusted for multiple comparisons with the Bonferroni method

[d] Body mass index categories according to the World Health Organization classification [28]

[e] Gross monthly household income adjusted for the number of people living in the household according to the OECD-modified scale [25]

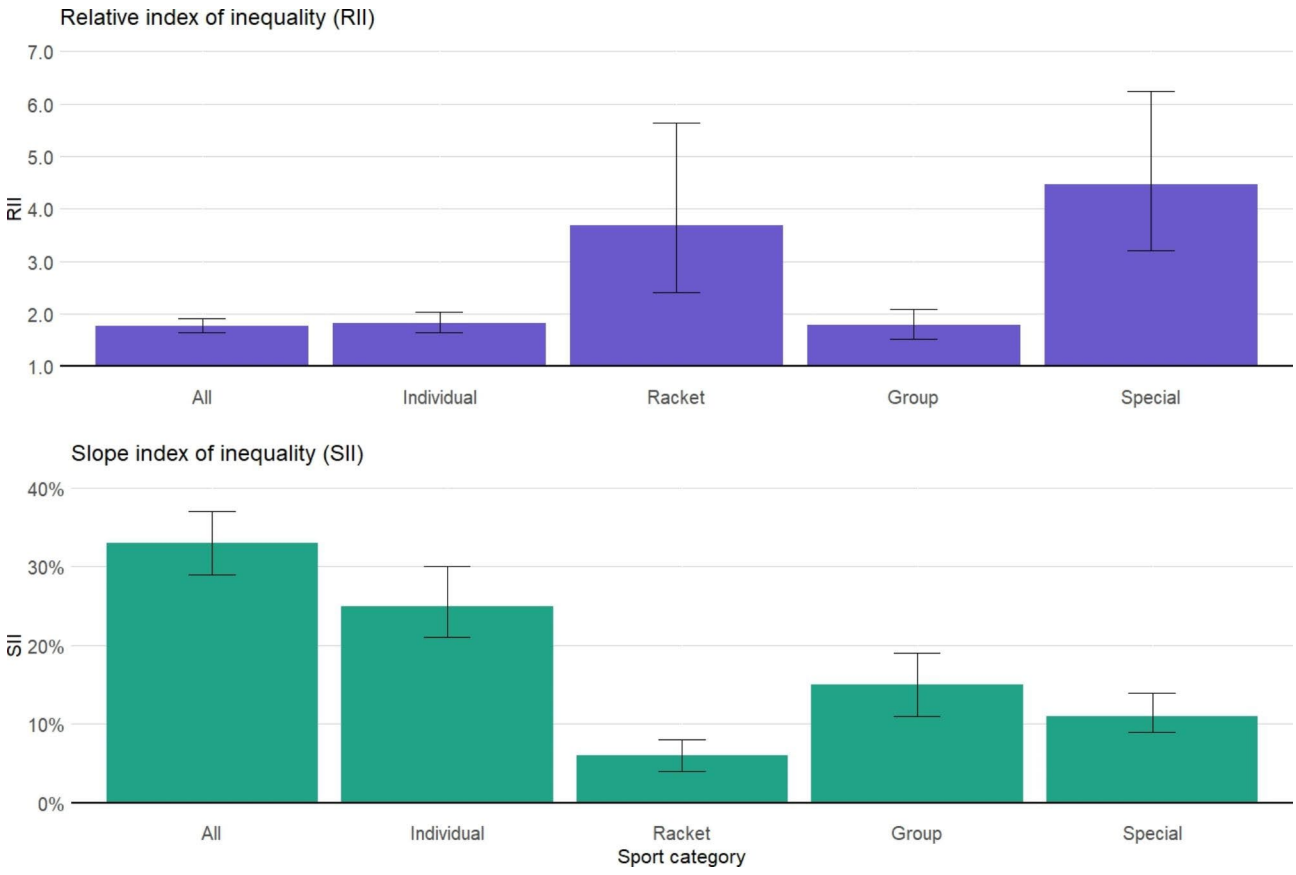

Fig. 1 Relative and slope indexes of inequality (RII/SII) and 95% confidence intervals of sport participation among Geneva adults aged 20 to 75 years old, according to the educational level, stratified by sport category. Generalized linear model following a quasi-Poisson distribution for the RII and linear model for the SII. Minimal model, adjusted for age, sex, an interaction between age and sex, and country of birth. Sport categories: Individual (running, brisk walking, racing bicycle, strength training/weightlifting, swimming, ice-/roller-skating, n = 3386); Racket (tennis/badminton, squash, n = 405); Group (dance, football, handball, gymnastics, judo/karate, n = 2009); Special (golf, downhill/water skiing, cross-country skiing, diving, n = 655). N = 7689

conditions, as previously observed [32]. Indeed, socio-economic inequalities in sport participation were slightly attenuated when taking health indicators into account. Socio-economic disadvantage is related to poorer health, which may in turn decrease the likelihood of engaging in a sporting activity [32].

Income inequalities in sport participation seemed to increase between 2005 and 2019, especially among women and older adults. This is in line with studies finding an increase in socio-economic inequalities in sporting inactivity between 2003 and 2012 in Germany [16] and in health between 1990 and 2010 in Switzerland [33]. Contrary to our results, Galobardes et al. [18] did not observe any trend in socio-economic inequalities in physical inactivity over the 1994–1999 period in Geneva, which suggests that the increasing trend noticed in our study could be recent. In a context of widening inequalities in income following the 2008 Great Recession [34], it might be that sport activities became relatively less affordable for disadvantaged people. In the wake of the COVID-19 pandemic, it highlights the need for further research to disentangle, and if appropriate to mitigate, the impact of crises on health behaviours.

Because of the positive health impact of leisure-time physical activity, such as sport [2, 3, 35], our findings are of concern in terms of health inequalities in the population. Our results call for measures encouraging sport participation specifically targeting underprivileged groups, both because they need it the most and because they may not fully benefit from population-level interventions. In Geneva, affordable and quality sport facilities and programs are available to all within less than 20 min of travel [36]. Although necessary, such structural measures, especially when relying on wilful behaviours, may not be adapted to limit social inequalities. Indeed, disadvantaged groups may be less aware of the availability of such possibilities, and less likely to make sense of associated recommendations and follow them [37]. Additionally, individuals with lower socioeconomic conditions have been shown to face specific barriers to physical activity such as fatigue, health-related restrictions or financial limitations, their main motivations being enjoyment,

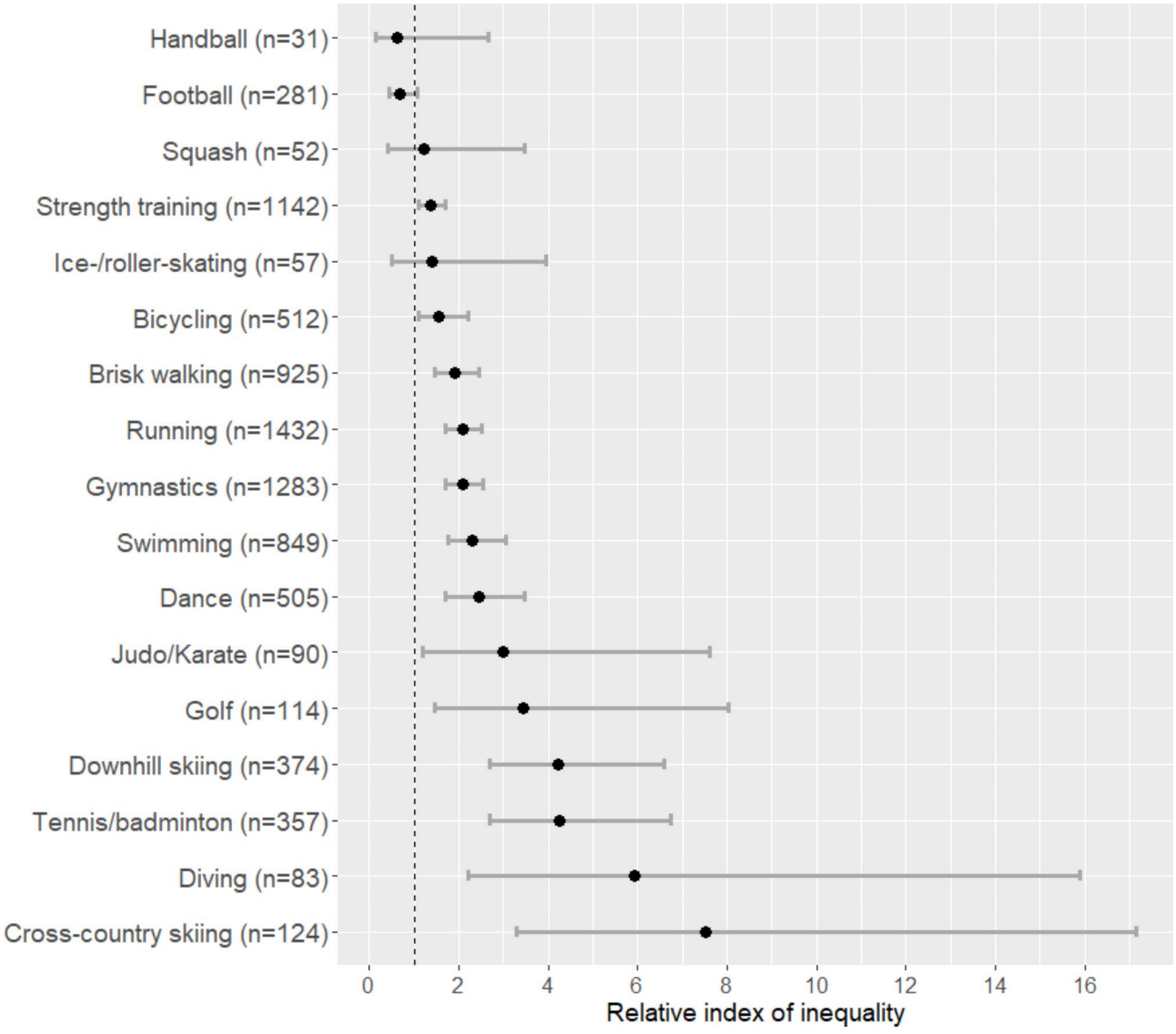

Fig. 2 Relative index of inequality (RII) for educational level, stratified by specific sport among Geneva adults aged 20 to 75 years old. Generalized linear model following a quasi-Poisson distribution adjusted for age, sex, an interaction between age and sex, and country of birth. N = 7689

health benefits and social interaction or support [38]. To ensure an equitable uptake, targeted interventions should hence aim at reducing these barriers while capitalizing on positive aspects of sport participation. A possibility could be to involve members of underprivileged groups in the delivery of or referral for financially accessible sport sessions [39]. Promoting sporting activities that are already practised in socially disadvantaged communities, while drawing on group interactions and highlighting health benefits could also improve the acceptance of such measures. Finally, it seems important to propose achievable and enjoyable activities that are adapted to the participants needs and abilities beyond their socioeconomic conditions, for instance by also taking their age, gender and health condition into account [38].

This study presents some limitations. Despite the random selection process, individuals with a lower secondary educational level were underrepresented in the sample (7.7% vs. 25.4% in the Geneva population) [40]. As health consciousness may be related to a greater interest in epidemiological research, we cannot exclude that underprivileged participants in our study engaged in more sporting activities, than non-participants from similar socio-economic backgrounds. This could lead our results to underestimate socio-economic inequalities in sport participation. On the other hand, social desirability bias related to healthy behaviour was found to be particularly pronounced among privileged individuals [41]. Consequently, they may be more prone than disadvantaged people to over-report sport participation,

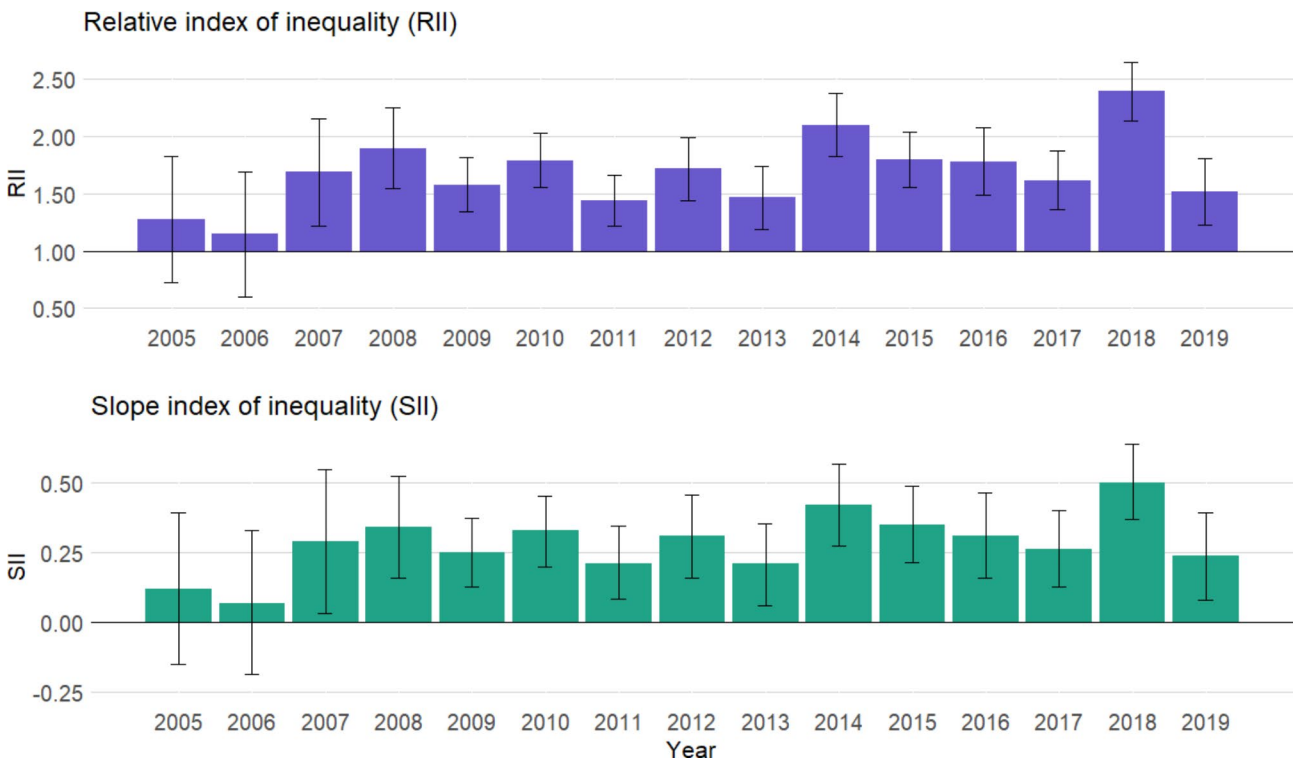

Fig. 3 Relative and slope indexes of inequality (RII/SII) and 95% confidence intervals of sport participation according to the educational level, per year, among Geneva adults aged 35 to 75 years old. Generalized linear model following a quasi-Poisson distribution for the RII and linear model for the SII. Minimal model adjusted for sex, age, an interaction between age and sex, and country of birth. N = 9711

which in turn could lead to an overestimation of inequalities. The overall prevalence of sport participation may be overestimated, both because of the underrepresentation of disadvantaged individuals who are less likely to engage in a sporting activity, and because of the potential social desirability bias related to the use of self-reported data. Finally, the sample size was too small to analyse the trends in socio-economic inequalities per sport type or category.

This study also has major strengths. It relied on a population-based design with a random selection, targeting a large age range. The sizeable sample enabled stratification by sport and sex. Inequalities in sport participation were estimated using three different socio-economic indicators and their evolution over time was measured over 15 years. Finally, we were able to exclude people with reduced mobility to restrict our analyses to individuals able to engage in sporting activities.

Conclusion

This study showed that sport participation is consistently higher among socio-economically advantaged individuals, although the size of inequalities differs according to the type of sport. Group sports showed the lowest relative inequalities, while sizeable inequalities were observed in racket and special sports. These results call for tailored strategies to promote sport participation among socially disadvantaged populations.

Abbreviations

BMI	body mass index
CI	confidence interval
PAFQ	physical activity frequency questionnaire
RII	relative index of inequality
SII	slope index of inequality

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-023-15650-7.

Supplementary Material 1

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Author contributions

All authors contributed to the study conception and design. Material preparation and data collection were performed by GP. Additional material preparation and analysis were performed by VR who also wrote the first draft of the manuscript. All authors critically revised the first draft of the manuscript and approved the final one.

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Data Availability
The datasets analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The Bus Santé study was approved by the Institute of Ethics Committee of the University of Geneva (ID 10-030R). All participants signed a written informed consent. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors have no relevant financial or non-financial interests to disclose.

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