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Associations of multiple socio-economic circumstances with physical functioning among Finnish and British employees

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Background: To further increase our understanding of socio-economic health inequalities, we need studies considering multiple socio-economic circumstances and comparing different cultural contexts. This study compared the associations of past and present socio-economic circumstances with physical functioning between employees from Finland and Britain.
Methods: Cross-sectional survey data from the Helsinki Health Study ($n = 5866$) and the Whitehall II Study ($n = 3052$) were used. Participants were white-collar public sector employees aged 45–60 years. Physical functioning was measured with the SF-36 physical component summary. The socio-economic indicators were parental and own education, childhood and current economic difficulties, occupational class, income, housing tenure.
Results: Childhood and current economic difficulties were independently associated with physical functioning in both cohorts, although in London women childhood difficulties did not reach statistical significance. Own education was independently associated with physical functioning in Helsinki. Occupational class showed associations with physical functioning in both cohorts. These were mainly attenuated by education and income, but in London women there was a strong independent association. The association of income with physical functioning was attenuated by education (Helsinki) and occupational class (London). Parental education and housing tenure showed no consistent associations.
Conclusions: Past and present economic difficulties were independently associated with physical functioning. The conventional socio-economic indicators showed less consistent associations which were partly mediated through other indicators and modified by the national context. The associations that varied according to the indicators and between the cohorts highlight the importance of considering the multiplicity of socio-economic circumstances and comparing different cultural contexts in further studies.

Keywords: comparisons, employees, physical functioning, socio-economic position.

Introduction

A lower socio-economic position is associated with poorer physical and general health and higher mortality.[1–4] In the multitude of studies conducted on socio-economic inequalities in health, a wide variety of socio-economic indicators have been used. However, individual studies have mostly concentrated on only one or a few socio-economic indicators at a time, or tried to find the most important one.[5–7] Furthermore, studies that have included a variety of indicators simultaneously have mainly been limited to one national context only.

To increase our understanding of the production of socio-economic inequalities in health, and of the exact ways in which socio-economic circumstances together influence health, multiple socio-economic circumstances need to be analysed simultaneously. Different indicators reflect different dimensions of a person's socio-economic circumstances and differ in their associations with health outcomes and in the related causal processes.[5,8–13] Among the conventional socio-economic indicators, i.e. education, occupational class and income, education primarily indicates non-material resources such as knowledge and skills, and is likely to influence health through health behaviours. Occupational class reflects work-related status and working conditions. Education contributes to occupational class and through this to income.[11,12,14] Income, wealth and other dimensions of financial situation such as economic difficulties measure material resources and may influence health through health behaviours and living conditions.[15,16] Childhood socio-economic circumstances may affect adult health either directly or indirectly through other factors and later circumstances, or by leading to accumulation of disadvantage across the lifecourse.[17,18]

In addition to studying multiple socio-economic circumstances, comparing different populations and societal and cultural contexts can further add to our understanding of socio-economic inequalities in health. International comparisons enable us to identify the determinants of these inequalities in different countries and to assess the generalizability of findings from one national setting to another. Nevertheless, we lack studies comparing associations of multiple socio-economic circumstances with health across affluent western societies. We seek to compare associations of socio-economic circumstances with physical functioning between employees from Finland and Britain. Previous studies using single socio-economic indicators have found only small differences in socio-economic inequalities in physical and general health between these countries.[3,19–22] It is, however, possible that inequalities vary between Finland and Britain when considering multiple socio-economic circumstances, as these two western European countries have also dissimilarities between them. They differ e.g. in their patterns of welfare provision

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and allocation, labour markets, social and family structures, and income distributions which may all contribute to the socio-economic inequalities in health.[23,24] Differences exist also in their social and economic history. Rapid social and economic transformation took place in Finland only after the WWII, when the UK had already a long history as an affluent industrial society. In Finland, the expanding public sector recruited employees from rural settings, which may cause the Finnish cohort to have a more rural background. Thus, the origins of the white-collar employees within the cohorts may vary, and could also influence the class composition to some degree.[25] However, the cohorts share many similarities, consisting of public sector employees in white-collar occupations from western European capital cities and from the same age-groups, which increases the comparability.

We aim to examine key indicators of past and present socio-economic circumstances. Our research questions are:

(i) What kind of associations and pathways can be found between the conventional indicators of adult socio-economic position and physical functioning?
(ii) Are childhood and current economic difficulties associated with physical functioning and other socio-economic circumstances?
(iii) What kind of similarities and dissimilarities can be found between the two cohorts?

Our previous study examined the associations of the same set of socio-economic indicators with common mental disorders (CMD) and found childhood and current economic difficulties to be associated with the outcome.[26] By examining physical health using a similar framework, we aim to deepen the understanding of similarities and dissimilarities in the socio-economic patterning of the physical and the mental domain of health among Finnish and British employees.

Methods

Data

The data derived from surveys conducted among public sector employees in Finland and Britain. The Helsinki Health Study is a cohort study of employees of the City of Helsinki, aged 40–60 years at the baseline in 2000–2002 (67% responded, $n = 8960$).[4] The Whitehall II Study is a longitudinal prospective cohort study of civil servants aged 35–55 years at baseline (1985, 73% responded, $n = 10\,308$), working in the London offices of 20 National Government Civil Service departments.[27,28] We used data from the postal survey at phase 5 (1997) ($n = 7830$, 76% responded).

The Helsinki Health Study data collection largely followed the Whitehall II Study protocol. To make the cohorts maximally comparable, we included 45–60 year olds from both cohorts. We excluded manual workers from the Helsinki cohort and respondents who had left civil service from the London cohort. The number of participants who met the inclusion criteria and had information on the outcome measure was 5866 (82% women) in Helsinki and 3052 (28% women) in London.

Measurements

Physical functioning was measured with the physical component summary (PCS) of the Short Form 36 (SF-36) questionnaire.[29,30] The scoring varies from 0 to 100, lower scores implying poorer functioning. We used the lowest quartile to indicate poor physical functioning. The cut-off was 47.3 (men) and 44.2 (women) in Helsinki, and 50.1 (men) and 46.4 (women) in London.

More details of the socio-economic measures can be found in our previous publication[26] Parental education was classified into higher, intermediate and basic. Childhood economic difficulties were measured by asking whether the respondent's childhood family had faced serious (Helsinki) or continuing (London) financial problems before the respondent's age 16. Own education was divided into higher, intermediate, and basic. Occupational class was divided into three hierarchical categories: administrative and managerial, professional and semi-professional, and clerical employees. Household income was divided by household size and weighted using the modified OECD equivalence scale[31] Housing tenure was dichotomized into owner-occupiers and renters. Current economic difficulties were summed from two questions concerning difficulties in paying bills and buying food or clothing to oneself and one's family.[32] Three categories were formed: no, occasional and frequent difficulties.

Statistical methods

Age-adjusted prevalence of poor physical functioning and 95% confidence intervals (CI) were calculated by each socio-economic indicator. Logistic regression analysis was used to examine associations between the socio-economic indicators and poor physical functioning. Firstly, we calculated age-adjusted bivariate models for each socio-economic indicator. In the following multivariate models the indicators were added in an assumed temporal order: first childhood circumstances, next the conventional indicators of adult socio-economic position, and finally all indicators simultaneously. The results are presented as odds ratios (OR) and their 95% CI.

Item missing was treated with multiple imputation using ICE (Imputation by Chained Equations) method in STATA.[33] Five copies of the data were formed in the process, each with missing values imputed. These copies were independently analysed and estimates of parameters were averaged across the copies to obtain a mean estimate and 95% CI. The results were practically identical with those obtained with a complete case analysis, but the precision of the estimations was improved.

Results

In Helsinki, the age-adjusted prevalence of poor physical functioning was higher in lower status groups by all socio-economic indicators (table 1), although among men not all variations were statistically significant. In London, the prevalence of poor physical functioning was higher in lower status groups by all other socio-economic indicators, except parental and own education by which the variations were more inconsistent (table 1). Not all variations were statistically significant.

Among Helsinki women, the bivariate models confirmed the prevalence percentages (table 2). After further adjustments, childhood and current economic difficulties and own education remained associated with physical functioning. Differences by parental education, occupational class and household income attenuated particularly after adjusting for own education (results not shown). Among Helsinki men, all other socio-economic indicators, except parental education, showed some associations with physical functioning in the bivariate models (table 2), although not all associations reached statistical significance. After further adjustments, all associations weakened and most lost their statistical significance. Only childhood economic difficulties and own education showed statistically significant associations with physical functioning. Similarly to women, adjusting for own education

Table 1 Number of participants (*N*) and age-adjusted prevalence of poor physical functioning, Helsinki and London

	Helsinki women		Helsinki men		London women		London men	
	N	%	*N*	%	*N*	%	*N*	%
Parental education								
Higher	844	19	254	23	176	23	444	24
Intermediate	1345	24	331	25	209	21	644	26
Basic	2618	27	474	26	462	27	1117	25
Childhood economic difficulties								
No difficulties	3878	23	892	23	595	23	1648	23
Difficulties	929	34	167	33	252	29	557	31
Own education								
Higher	1320	16	464	19	281	21	905	24
Intermediate	1592	24	329	26	176	31	688	23
Basic	1895	31	266	32	390	25	612	29
Occupational class								
Administrative/managerial	366	17	280	19	205	16	1110	23
Professional/semi-professional	2079	20	645	26	397	26	972	27
Clerical	2362	30	134	34	245	30	123	28
Household income								
Highest group	1045	20	224	21	261	19	764	22
2nd	1298	24	314	21	157	18	315	24
3rd	1232	25	284	27	193	29	561	28
Lowest group	1232	30	237	34	236	31	565	27
Housing tenure								
Owner-occupier	3375	24	826	24	777	25	2096	25
Renter	1432	28	233	30	70	28	109	32
Current economic difficulties								
No difficulties	2597	22	630	22	460	20	1258	22
Occasional difficulties	1811	27	370	28	323	29	827	28
Frequent difficulties	399	38	59	40	64	38	120	34
Total	4807	25	1059	25	847	25	2205	25

affected the differences by occupational class and household income (results not shown).

Among London women, the associations observed in bivariate models remained after the adjustments, current economic difficulties and occupational class being associated with physical functioning (table 3). Those in the lowest income classes were initially more likely to have poor functioning, but this association weakened after adjusting for occupational class (results not shown) and finally disappeared. Among London men, childhood and current economic difficulties were associated with physical functioning in the bivariate models (table 3). There were also statistically borderline significant associations for own education, occupational class and income. After the adjustments, only childhood economic difficulties remained statistically significantly associated with physical functioning. For current economic difficulties weak associations remained.

Discussion

Main findings

We aimed to examine the associations of key socio-economic indicators with physical functioning among Finnish and British white-collar employees. We found that childhood and current economic difficulties were most consistently associated with poor physical functioning. This was generally observed in both cohorts and genders, and the associations mostly remained after adjustments. Own education was associated with physical functioning in Helsinki, poor functioning being more common in the lower groups. For occupational class, there were variations in both cohorts and genders, but these remained only in London women. For income, some variations were observed in both cohorts but these did not remain after adjustments. Parental education and housing tenure showed generally only small variations.

Firstly, the consistent importance of current economic difficulties to physical functioning was somewhat unexpected as the conventional socio-economic indicators showed inconsistent associations with physical functioning. However, this result was remarkably similar to what we have previously observed for CMD.[26] In previous studies, current economic difficulties have also been independently associated with self-rated health[15] and even incidence of coronary events.[34] Particularly the finding on coronary events suggests that this association is unlikely to be due to self-report bias in the exposure or the outcome. It is also noteworthy that in our study the association of current economic difficulties with physical functioning remained even after adjusting for income. As we studied employee cohorts, actual poverty is unlikely among the participants, and serious material deprivation and physical hardship are implausible explanations for the result. However, people can face financial problems regardless of income levels. Such problems might occur due to strenuous life situations such as divorce or partner's unemployment. Also excess consumption and accumulation of debt might lead to financial problems even when income level is not particularly low.[35,36] We further adjusted for net financial assets in the London cohort but this had little effect on the association of economic difficulties with physical functioning (results not shown). Thus, it is unlikely that debt-related deprivation or actual low incomes are major explanations for our finding, and the possible explanations remain open.

Secondly, also childhood economic difficulties were independently associated with physical functioning. This finding

Table 2 Associations between socioeconomic circumstances and poor physical functioning in Helsinki

	Helsinki Women				Helsinki Men			
	Model 0 Age-adjusted	**Model 1 0+PE+ChED**	**Model 2 1+OE+OC+HI**	**Model 3 2+HT+CuED**	**Model 0 Age-adjusted**	**Model 1 0+PE+ChED**	**Model 2 1+OE+OC+HI**	**Model 3 2+HT+CuED**
Parental education PE								
Higher	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.38 (1.11–1.72)	1.32 (1.06–1.64)	1.06 (0.84–1.33)	1.06 (0.85–1.33)	1.08 (0.72–1.60)	1.07 (0.72–1.59)	0.87 (0.58–1.32)	0.88 (0.58–1.34)
Basic	1.62 (1.33–1.97)	1.49 (1.22–1.82)	1.06 (0.85–1.31)	1.06 (0.86–1.32)	1.15 (0.80–1.65)	1.10 (0.76–1.58)	0.81 (0.55–1.21)	0.83 (0.56–1.24)
Childhood economic difficulties ChED								
No difficulties	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Difficulties	1.79 (1.52–2.11)	1.71 (1.46–2.02)	1.67 (1.41–1.96)	1.59 (1.35–1.88)	1.61 (1.11–2.32)	1.59 (1.10–2.30)	1.57 (1.08–2.28)	1.48 (1.01–2.17)
Own education OE								
Higher	1.00		1.00	1.00	1.00		1.00	1.00
Intermediate	1.65 (1.37–2.00)		1.52 (1.24–1.86)	1.53 (1.25–1.88)	1.57 (1.11–2.21)		1.54 (1.07–2.21)	1.51 (1.04–2.18)
Basic	2.37 (1.99–2.83)		1.89 (1.47–2.45)	1.90 (1.47–2.45)	2.10 (1.48–2.97)		1.89 (1.24–2.87)	1.84 (1.21–2.80)
Occupational class OC								
Administrative/managerial	1.00		1.00	1.00	1.00		1.00	1.00
Professional/semi–professional	1.21 (0.91–1.62)		1.17 (0.87–1.57)	1.16 (0.86–1.55)	1.46 (1.03–2.07)		1.27 (0.88–1.82)	1.26 (0.88–1.80)
Clerical	2.06 (1.55–2.74)		1.29 (0.93–1.78)	1.25 (0.90–1.73)	2.04 (1.24–3.34)		1.25 (0.72–2.20)	1.20 (0.67–2.12)
Household income HI								
Highest group	1.00		1.00	1.00	1.00		1.00	1.00
2nd	1.25 (1.01–1.54)		1.09 (0.88–1.35)	1.08 (0.87–1.34)	1.10 (0.72–1.68)		0.97 (0.63–1.49)	0.94 (0.61–1.45)
3rd	1.37 (1.11–1.69)		1.09 (0.88–1.36)	1.06 (0.85–1.32)	1.52 (0.99–2.33)		1.25 (0.80–1.94)	1.23 (0.79–1.91)
Lowest group	1.79 (1.47–2.19)		1.27 (1.03–1.58)	1.17 (0.94–1.46)	2.04 (1.31–3.17)		1.47 (0.91–2.38)	1.36 (0.83–2.23)
Housing tenure HT								
Owner-occupier	1.00			1.00	1.00			1.00
Renter	1.28 (1.11–1.48)			0.94 (0.81–1.11)	1.37 (0.98–1.92)			1.09 (0.76–1.57)
Current economic difficulties CuED								
No difficulties	1.00			1.00	1.00			1.00
Occasional difficulties	1.34 (1.16–1.55)			1.18 (1.01–1.37)	1.34 (0.98–1.81)			1.11 (0.80–1.54)
Frequent difficulties	2.26 (1.79–2.84)			1.72 (1.34–2.21)	2.28 (1.29–4.04)			1.61 (0.88–2.97)

OR with 95% CI from logistic regression analysis, Woman ($N = 4807$) and men ($N = 1059$).

Table 3 Associations between socioeconomic indicators and poor physical functioning in London

	London women				London men			
	Model 0 Age-adjusted	**Model 1 0+PE+ChED**	**Model 2 1+OE+OC+HI**	**Model 3 2+HT+CuED**	**Model 0 Age-adjusted**	**Model 1 0+PE+ChED**	**Model 2 1+OE+OC+HI**	**Model 3 2+HT+CuED**
Parental education PE								
Higher	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	0.84 (0.46–1.54)	0.83 (0.45–1.52)	0.77 (0.41–1.45)	0.73 (0.39–1.37)	1.10 (0.80–1.50)	1.08 (0.79–1.48)	1.05 (0.76–1.43)	1.05 (0.76–1.44)
Basic	1.20 (0.72–1.99)	1.15 (0.69–1.91)	1.03 (0.59–1.82)	1.04 (0.59–1.83)	1.06 (0.78–1.44)	1.02 (0.75–1.39)	0.95 (0.70–1.30)	0.96 (0.70–1.31)
Childhood economic difficulties ChED								
No difficulties	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Difficulties	1.32 (0.94–1.86)	1.28 (0.91–1.80)	1.28 (0.90–1.82)	1.23 (0.86–1.76)	1.48 (1.19–1.84)	1.48 (1.19–1.84)	1.49 (1.20–1.86)	1.46 (1.17–1.82)
Own education OE								
Higher	1.00		1.00	1.00	1.00		1.00	1.00
Intermediate	1.67 (1.03–2.69)		1.24 (0.75–2.06)	1.32 (0.80–2.19)	0.99 (0.78–1.26)		0.89 (0.70–1.15)	0.90 (0.70–1.15)
Basic	1.22 (0.83–1.79)		0.61 (0.37–1.01)	0.62 (0.37–1.03)	1.32 (1.04–1.67)		1.15 (0.87–1.51)	1.16 (0.88–1.53)
Occupational class OC								
Administrative/managerial	1.00		1.00	1.00	1.00		1.00	1.00
Professional/semi–professional	1.90 (1.21–2.98)		1.91 (1.11–3.29)	1.81 (1.05–3.10)	1.28 (1.05–1.57)		1.20 (0.94–1.52)	1.13 (0.89–1.45)
Clerical	2.48 (1.53–4.02)		2.56 (1.30–5.04)	2.38 (1.21–4.70)	1.35 (0.89–2.05)		1.16 (0.71–1.88)	0.94 (0.56–1.59)
Household income HI								
Highest group	1.00		1.00	1.00	1.00		1.00	1.00
2nd	0.86 (0.50–1.49)		0.70 (0.39–1.26)	0.67 (0.37–1.21)	1.13 (0.83–1.55)		1.06 (0.76–1.47)	1.04 (0.75–1.44)
3rd	1.63 (1.01–2.63)		1.32 (0.74–2.34)	1.19 (0.66–2.15)	1.38 (1.06–1.78)		1.30 (0.99–1.70)	1.28 (0.97–1.68)
Lowest group	1.80 (1.15–2.81)		1.37 (0.77–2.44)	1.14 (0.63–2.07)	1.31 (1.01–1.69)		1.15 (0.85–1.57)	1.08 (0.79–1.47)
Housing tenure HT								
Owner-occupier	1.00			1.00	1.00			1.00
Renter	1.27 (0.71–2.26)			1.03 (0.55–1.91)	1.56 (1.03–2.37)			1.45 (0.92–2.28)
Current economic difficulties CuED								
No difficulties	1.00			1.00	1.00			1.00
Occasional difficulties	1.66 (1.18–2.33)			1.48 (1.03–2.12)	1.34 (1.09–1.64)			1.26 (1.02–1.56)
Frequent difficulties	2.43 (1.38–4.27)			2.14 (1.16–3.95)	1.71 (1.14–2.57)			1.45 (0.95–2.24)

OR with 95% CI from logistic regression analysis, women (*N*=847) and men (*N*=2205).

was also similar to that observed for CMD.[26] Previous studies have suggested that childhood adversities may influence adult health either directly or indirectly through other factors and later circumstances, or by leading to accumulation of disadvantages across the lifecourse.[17,18] However, the association between childhood economic difficulties and physical functioning was unaffected by adjustments for current circumstances in this study. Also correlations between childhood economic difficulties and current socio-economic circumstances were low in both cohorts ($r = 0.01$–0.15). Thus, no pathways between these were found. However, among Helsinki women an educational pathway between past and present circumstances was identified, as the effect of parental education on physical functioning was mediated through own education.

Thirdly, the associations of education, occupational class and household income with physical functioning were affected by adjustments for each other, but in different ways in the two cohorts. In Helsinki, own education was independently associated with physical functioning and partly explained the initial associations of occupational class and household income with physical functioning (results not shown). It has previously been observed in the Helsinki cohort, that education partly explains the associations of occupational class with limiting long-standing illness and self-rated health.[6] In London, however, education did not have such effects, whereas occupational class showed a clear association with physical functioning in women and partly explained the effect of household income in both genders (results not shown). The weaker association of occupational class with physical functioning among London men than women may partly be related to attrition, which is discussed below.

The differences between the cohorts might be partly related to education being possibly a more important socio-economic determinant in Finland than in Britain. Due to the rapid social structural transformation from an agrarian society of post WWII to urban industrial and service economy in Finland from the 1950s–70s, there has been strong upward social mobility to fill in jobs in the expanding service and public sectors.[25] Simultaneously, the educational opportunities of Finns strongly expanded and the previously relatively poorly educated population was by year 2000 one of the best educated nations in Europe.[37]

Other factors that may cause conventional socio-economic indicators to be somewhat differently associated with physical functioning in Finland than in Britain might be for example a higher employment rate among women, a more universal welfare coverage and smaller income differences in Finland than in Britain.[24]

One of our aims was to find out whether there are differences by the national context. Previous studies on general and physical health have documented only small differences between Finland and Britain when examining only one socio-economic indicator, usually occupational class or education.[3,19–22] Also in our previous study on multiple socio-economic circumstances and CMD the cohorts showed few differences.[26] In this study, however, we found both similarities and dissimilarities between the cohorts. The overall importance of economic difficulties and the less pronounced role of the conventional indicators were similar in the two cohorts. Dissimilarities were found in the associations of the conventional indicators with physical functioning and in the related pathways. The divergent results concerning education, occupational class and income may be due to differences between the cohorts in their class composition related to the social and economic historical background, as well as to differences in the occupation types represented. The ways these indicators discriminate people may also differ between the two countries on a more general level. Dissimilarities between the two national contexts, their working life, social policies and welfare state regimes in general may further contribute to the socio-economic patterning and the mechanisms behind.[23,25,38]

Methodological considerations

Our aim was to compare health inequalities between cohorts from two countries in a multiple socio-economic framework. The data were highly comparable with regard to data collection, measurements and participants, and thus suitable for the study. However, some limitations need to be considered.

Firstly, as our sample included white-collar employees only, the generalizability might be limited. Also, in employee cohorts, some of the socio-economic variations in health might be smaller than in general populations.[39] Despite the overall homogeneity, differences exist between the cohorts in job types represented. The employees of the City of Helsinki work in general local government administration, healthcare, social welfare, education, culture, public transport, technical and construction services. However, we included only white-collar employees to increase comparability with the civil servants ranging from clerical and office support to executive officers and administration in the Whitehall II cohort. Furthermore, both cohorts consist of public sector employees from the capitals of the countries, which increases their comparability with each other, but we acknowledge that they do not represent general populations.

Secondly, due to the cross-sectional design, causal interpretations should be made with caution. There is a possibility of health-related selection, i.e. low socio-economic position being influenced by poor health, although the causal direction is likely to be mainly from socio-economic status to health.[40,41] In the Whitehall II Study health has been shown to affect the social position much less than vice versa.[42]

Thirdly, self-reported data has a possibility for reporting bias. The respondents' poor health might influence their responses, although this is likely to apply more to mental than physical health. Particularly the retrospective questions about childhood conditions might be affected. However, retrospective information on childhood adversities has been widely used and their measurement has shown good reliability.[43,44] Furthermore, phrasing of the questions or the respondents' tendency for underreporting may have affected the responses.

Fourthly, non-response bias may affect the results in surveys. In the Helsinki cohort, women and those in higher social classes had a higher response rate. However, the bias does not seriously affect the results concerning relative differences by socio-economic status.[45,46]

Fifthly, in the Whitehall follow-up data, there has been more attrition in the lowest occupational class. This may have affected particularly the occupational class gradient among men, attenuating the class differences observed. Also, attrition may have been more common among those with poorer health and thus attenuated the socio-economic differences. However, we used data from phase 5 as earlier phases do not include all the socio-economic measures. We also checked the associations of the socio-economic indicators available in phases 1 and 3 and physical functioning, and they were practically similar to those in phase 5.

Sixthly, there is a possibility of multicollinearity of the socio-economic indicators. Various socio-economic indicators are of necessity correlated as they reflect a broad abstract construct which can not be directly measured. Our indicators show mutual correlations varying from $r = 0.003$ to $r = 0.61$. Thus the indicators share both common and specific characteristics of socio-economic position in general and are not interchangeable. Furthermore, earlier analysis of multicollinearity of the indicators used in this study showed acceptable values.[47]

Conclusions

Past and present economic difficulties were independently associated with physical functioning among Finnish and British public sector employees. In contrast, the conventional socio-economic indicators showed less consistent associations, which varied between the cohorts being partly explained by and mediated through other socio-economic circumstances. These findings suggest that economic difficulties should be taken into account alongside the conventional socio-economic indicators in further studies and in efforts to reduce socio-economic inequalities in physical functioning. As the explanations for the association between economic difficulties and physical functioning still remain unresolved, further studies analysing the possible factors contributing to this association are warranted.

Overall, the findings that varied between the socio-economic indicators, as well as the pathways among them, provide evidence that different indicators measure partly different dimensions of socio-economic circumstances being interrelated at the same time. Thus, our results highlight the importance of including multiple measures of socio-economic circumstances in studies to obtain a more comprehensive picture of the socio-economic production of health. Furthermore, we found both similarities and dissimilarities between the two cohorts, which suggests that the pathways and causal processes involved in the socio-economic production of health may differ between societal and cultural contexts, even among affluent western European societies. Therefore, we underline the importance of international comparisons to further disentangle the mechanisms of and explanations for the large and persisting socio-economic inequalities in health.

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Key points

- This study compared the associations of multiple socio-economic circumstances with physical functioning between employees from Finland and Britain.
- Past and present economic difficulties were independently and consistently associated with physical functioning, whereas own education, occupational class and income showed inconsistent associations which were partly mediated through other indicators and modified by national context.
- Economic difficulties should be considered alongside with other socio-economic circumstances in further studies and efforts to reduce socio-economic inequalities in health.
- The associations that varied by socio-economic indicator and by cohort highlight the importance of including multiple socio-economic measures and comparing national contexts when examining socio-economic inequalities in health.

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