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Early-Life Socioeconomic Circumstances and Physical Activity in Older Age: Women Pay the Price

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Abstract

Health in older age is shaped by early-life socioeconomic circumstances (SECs) and sex. However, whether and why these factors interact is unclear. We examined a cultural explanation of this interaction by distinguishing cultural and material aspects of SECs in the context of physical activity—a major determinant of health. We used data from 56,331 adults between 50 and 96 years old from the Survey of Health, Ageing and Retirement in Europe (SHARE), a 13-year, large-scale, population-based cohort. Confounder-adjusted logistic linear mixed-effects models showed an association between the cultural aspects of early-life SEC disadvantage and physical activity among women, but it was not consistently observed in men. Furthermore, these associations were compensated for only partially by adult-life socioeconomic trajectories. The material aspects of early-life SECs were not associated with adult-life physical activity. These findings highlight the need to distinguish different aspects of SECs because they may relate to health behaviors in diverse ways.

Keywords

sex, early-life socioeconomic circumstances, health, physical activity, aging, open data

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Health and health behaviors are shaped by socioeconomic circumstances (SECs; Cutler et al., 2008) and sex (Macintyre et al., 1996): People from disadvantaged SECs and women have poorer health than people from advantaged SECs and men. However, how SECs and sex interact has been underresearched (Eagly et al., 2012; Parker et al., 2020), although many aspects of daily life are structured by sex, suggesting that men and women respond differently to adverse SECs (Macintyre & Hunt, 1997). For example, living in disadvantaged SECs is associated with smoking and excessive alcohol consumption in men and unhealthy eating and physical inactivity in women (Mackenbach et al., 1999). This suggests that the social patterning of health behaviors differs for men and women. In this study, we pursued this line of research by further investigating the impact of the SEC-by-sex interaction on one major health factor: physical activity.

A few studies conducted on children have confirmed the social patterning of physical activity by sex (Cairney et al., 2015; Gorely et al., 2009; Seabra et al., 2013). Compared with girls from high-socioeconomic-status

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backgrounds, those from low-socioeconomic-status backgrounds reported lower preference for physical activity, whereas no such effect was observed in boys (Anokye et al., 2013; Seabra et al., 2013). In addition, participation in active free play decreases in girls from low-income neighborhoods at a faster rate from ages 9 to 13 years relative to girls from high-income neighborhoods (Cairney et al., 2015). In contrast, boys' participation rates are similar across neighborhood income levels.

However, why and how SECs interact with sex remains largely unknown. The cultural hypothesis proposes that sex roles and social norms might operate through at least two mechanisms (Bourdieu, 1978; Macintyre & Hunt, 1997; Mackenbach et al., 1999). First, sex roles may create differences in the access to coping mechanisms against the stress associated with disadvantaged SECs. For example, smoking and alcohol consumption are more socially acceptable in men, whereas unhealthy eating and physical inactivity are more socially acceptable in women (Macintyre & Hunt, 1997). Second, the social norms associated with physical activity could also play a role. According to Bourdieu (1978), whereas aesthetics, absence of physical contact, and education are promoted in an advantaged socioeconomic environment, strength, physical contact, and competition are instead valued in disadvantaged socioeconomic environments. Of particular relevance here, activities that are valued in an advantaged milieu are often perceived as appropriate for both men and women (e.g., horseback riding, tennis). In contrast, activities valued in a disadvantaged milieu are more often typically masculine (e.g., boxing, soccer; for a review, see Chalabaev et al., 2013). Consequently, access to physical activities is restricted to "masculine" sports (e.g., rugby, cycling) for women living in disadvantaged SECs, whereas women living in advantaged ones have access to "feminine" (e.g., dance, synchronized swimming) or "sex-neutral" (e.g., volleyball, table tennis) activities. In contrast, men have access to activities that are congruent with a masculine sex role in both advantaged (e.g., fencing, golf) and disadvantaged (e.g., weightlifting, cycling) SECs. This could explain why the social patterning of physical activity is gendered.

Although cultural explanations of the SEC-by-sex interaction have been put forward by several authors, empirical support is lacking. We proposed to test this hypothesis by distinguishing the cultural and material dimensions of SECs. This may allow the disentangling of whether disadvantaged early-life SECs are a risk factor for physical inactivity because families lack the economic resources necessary to facilitate their children's participation in physical activity or because their cultural background does not encourage involvement in physical activities, especially for girls (Johnston et al., 2007; Stalsberg & Pedersen, 2010). Until now, this cultural hypothesis has been overlooked because most research explained SEC differences in physical activities using mechanisms related to material or economic resources, such as lack of access to transportation to facilities for physical activity, lack of money to pay for leisure-time activities and sports, and lack of time (Chinn et al., 1999; Sherwood & Jeffery, 2000), or in terms of the increased biopsychosocial stress linked with low material SECs (McNeill et al., 2006).

In addition, although SECs and sex seem to interact during childhood, whether this interaction persists through the life span remains an open question because their effects have usually been examined separately (Anokye et al., 2013). A recent study showed that women who grew up in disadvantaged SECs were less physically active later in life, compared with women who grew up in advantaged SECs (Cheval, Sieber, et al., 2018). Crucially, from a statistical standpoint, the association between early-life SECs and physical inactivity was fully mediated by adulthood SECs, especially by the level of education. This suggests that the influence of the socioeconomic milieu in which women grew up can fully compensate for their adult-life socioeconomic

Statement of Relevance

Scientists have long known that the socioeconomic conditions in which children grow up impact their health behaviors in adulthood—particularly physical activity. But are economic or cultural resources the key? Does this impact depend on sex? This longitudinal study of 56,000 Europeans tested whether cultural (number of books at home at age 10 years and parents' occupation) and material (overcrowding at home and housing quality) disadvantages predicted physical activity and whether these associations differed by sex. Cultural, but not material, disadvantage played a key role in physical activity in adulthood. Crucially, this effect was more pronounced for women than for men. Specifically, 28% of culturally advantaged men and 31% of disadvantaged men were physically inactive, compared with 30% and 38%, respectively, in women. The cultural environment during childhood plays a determining role in physical activity in adulthood, particularly in women, who seem more vulnerable to disadvantaged cultural conditions than men.

trajectories. Moreover, past research suggests that the cultural dimension of SECs may have stronger effects through the life span than the material one because of its impact on health behaviors (Cutler et al., 2008). However, no study to our knowledge has investigated whether the early-life SEC-by-sex interaction persists in later life.

To fill these gaps, we investigated whether the early-life SEC-by-sex interaction on physical activity in later life depends on the SEC dimension (material or cultural). This question was examined in a 13-year, large-scale cohort of adults ages 50 years and older. Indicators of material early-life disadvantages included overcrowding and low housing quality at age 10 years, and indicators of cultural ones included low occupational position of the household's main breadwinner and low number of books at home at age 10 years. Finally, to further understand the potential long-lasting effect of early-life SECs, we assessed whether the associations between early-life disadvantage and physical activity in later life were mediated by adulthood SECs, as in the study by Cheval, Sieber, et al. (2018).

First, we predicted that, compared with men, women would be less physically active (Hypothesis 1). Second, we expected that people would be less physically active when they grew up in disadvantaged early-life SECs than in advantaged ones. On the basis of previous studies showing the importance of the cultural dimension in explaining physical activity, we hypothesized that the cultural aspect of disadvantage would be more strongly associated with lower physical activity than the material one (Hypothesis 2). Third, we hypothesized that the associations between early-life SECs and physical activity would be particularly pronounced in women (Hypothesis 3). Fourth, we hypothesized that the associations of sex and early-life SECs with physical activity could be, at least partly, explained by adulthood SECs (Hypothesis 4). Finally, we explored these effects on the evolution of physical activity over time.

Method

Study population and design

We used the Survey of Health, Ageing and Retirement in Europe (SHARE; Börsch-Supan et al., 2013), a 13-year, large-scale, population-based European cohort of adults ages 50 years and older, in which repeated measurements were obtained in seven waves every 2 years between 2004 and 2017.

Physical activity was assessed at Waves 1, 2, 4, 5, 6, and 7. Early-life SECs were assessed once, at Wave 3 or Wave 7. Participants were eligible for the study if they participated in either the third wave or seventh wave and had at least one measure of physical activity. The relevant local research ethics committees in the participating countries approved SHARE. All participants provided written informed consent.

Measures

Physical activity. Physical activity was derived from the following two questions: "How often do you engage in activities that require a low or moderate level of energy such as gardening, cleaning the car, or going for a walk?" and "How often do you engage in vigorous physical activity, such as sports, heavy housework, or a job that involves physical labor?" (Cheval et al., 2020; Cheval, Rebar, et al., 2019; de Souto Barreto et al., 2017). Participants answered using a 4-point scale: 1 = *more than once a week*, 2 = *once a week*, 3 = *one to three times a month*, and 4 = *hardly ever or never*. Participants who did not answer "more than once a week" to either item were classified as physically inactive. As described in previous research (Cheval, Sieber, et al., 2018), this strategy reduces the potential misclassification bias that would lead to physically inactive participants being incorrectly classified as physically active. Yet a robustness analysis was conducted to test the models with a different cutoff point (for more details, see the Robustness Analysis section) and showed results consistent with the main analyses.

Early-life SECs. Early-life SECs were indexed by four binary indicators reflecting cultural and material dimensions of participants' SECs at the age of 10 years (Wahrendorf & Blane, 2015). The cultural dimension of early-life SECs was indexed by the number of books at home and the occupational position of the household's main breadwinner (first and second levels vs. higher skill levels of the International Standard Classification of Occupations). The number of books was used as a proxy for a focus on education (Evans et al., 2010; van Bergen et al., 2017) and was dichotomized into 0 to 10 books versus more than 10 books at home. Occupational position was built according to a reclassification of the main occupational groups of the International Standard Classification of Occupations based on skill levels (Wahrendorf et al., 2013). The first and second skill levels were grouped as "disadvantaged" occupational position, whereas the third and fourth levels were grouped as "advantaged" occupational position.

The material dimension of SECs were a measure of overcrowding (more vs. less than one person per room in the household) and housing quality (absence vs. presence of either fixed bath, cold running-water supply, hot running-water supply, inside toilet, or central heating; Cheval, Boisgontier, et al., 2018; van der Linden et al., 2020). Overcrowding (Marsh, 1999) and housing

quality (Dedman et al., 2001; Stafford & McCarthy, 2006) are independent social characteristics related to the household that have been described as a determinant of health. Previous studies have supported the validity of the operationalization of the aforementioned SEC indicators in distinguishing advantaged and disadvantaged individuals (Pinto Pereira et al., 2014, 2015). However, whether this categorization can be generalized across countries still needs to be examined (see the Limitations section).

Sex. Participants were asked "What is your sex?" and could answer either "male" or "female." To be consistent with the terminology used by SHARE, we used "sex" rather than "gender." However, the present study focused on socially constructed roles and behaviors associated with a person's biological sex, which reflect gender according to the American Psychological Association (2012) guidelines.

Adult-life SEC mediators. The following variables were included as potential adult-life SEC mediators: participants' highest educational attainment (primary, secondary, or tertiary) during the follow-up, main occupational position based on the skill classification of the main job over the life course (low skill, high skill, or no paid work), and satisfaction with current household income. The latter was assessed using the question, "Is the household able to make ends meet?" and participants responded on a scale from 1 (*with great difficulty*) to 4 (*easily*). Regarding education, primary, secondary, and tertiary categories corresponded respectively to the codes 0 (less than primary education) and 1 (primary education); 2 (lower secondary education), 3 (upper secondary education), and 4 (postsecondary nontertiary education); and 5 (short-cycle tertiary education) and 6 (bachelor's or equivalent degree) of the International Standard Classification of Education 97 classification. We computed the mode of this variable over the follow-up to retain as many observations as possible (Aartsen et al., 2019; Cheval, Chabert, Orsholits, et al., 2019; Sieber et al., 2019).

Covariates and potential confounders. All analyses were adjusted for age, body mass index, attrition (no dropout, dropout [participants who responded to neither Wave 6 nor Wave 7], death), birth cohort (war [between 1914 and 1918 and between 1939 and 1945], Great Depression [between 1929 and 1938], no war and no economic crisis [before 1913, between 1919 and 1928, and after 1945]), and country of residence (Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland). All of these variables have been found to be related to later-life health (Cheval, Chabert, Sieber, et al., 2019; Sieber et al., 2020).

Statistical analysis

Logistic mixed-effects models were used to account for the nested structure of the data (i.e., multiple observations within a single participant; Boisgontier & Cheval, 2016). The final random structure included random intercepts for participants and random linear slopes for age at the participant's level. These random effects estimated each participant's probability of engagement in physical activity and the rate of change of this probability of engagement over the years. Age was centered on the midpoint of the sample's age range (73 years) and was then divided by 10. This approach allowed a simpler interpretation of the parameters and reduced the risk of model-convergence issues. The coefficients yielded the effects of the physical-activity rate of change over a 10-year period. For time-varying covariates, we used the mode to reduce observation loss. Odds ratios (*OR*s) are reported as a measure of effect size and were calculated by exponentiating the values of the estimates obtained in the logistic mixed-effects model; 1.5, 2.5, and 4.3 were used as cutoffs for small, medium, and large effect sizes, respectively (Cohen, 1988).

Model 1 tested the association between sex and the probability of physical activity. In addition, this model included interaction terms between sex and age (both linear and quadratic) to examine whether sex was associated with (both linear and nonlinear) change in the probability of physical activity over the years. A statistically significant interaction would indicate that the evolution of the probability of physical activity over the years depended on the participant's sex. In Model 2, we tested the association between early-life SEC indicators and the probability of physical activity and change over the years. All early-life SEC indicators were included in Model 2 as well as in the subsequent models. In Model 3, we added interaction terms between sex and the early-life SEC indicators, as well as a three-way interaction between sex, early-life SEC indicators, and age (linear and quadratic) to examine whether the effects of early-life SECs on the probability of physical activity and of its change over the years were moderated by the participant's sex. In Model 4, we tested whether the effects of early-life SECs and sex on the probability of physical activity and of its change over the years were explained by adult-life SECs. Statistical assumptions associated with mixed-effects models (i.e., normality of the residuals, linearity, multicollinearity, and undue influence) were checked and met for all models.

Sensitivity analyses

We performed a series of sensitivity analyses excluding (a) participants with dementia, (b) participants who died during the survey, and (c) participants who dropped out during the survey. For more details on all covariates used in the sensitivity analyses, see Table S3 in the Supplemental Material available online.

Robustness analysis

A robustness analysis was conducted to test the models with a different cutoff point for the measure of physical activity. Specifically, participants who answered "hardly ever or never" to at least one of the physical-activity items were classified as physically inactive, whereas participants who answered "more than once a week" or "once a week" to at least one of the physical-activity items were classified as physically active. The objective of this classification was to reduce the potential misclassification bias, which could lead to physically active participants being erroneously classified as physically inactive.

Results

After the descriptive statistics, the results are reported in four sections: The first section describes analyses of the association between sex and physical activity, the second section describes analyses of the association between early-life SECs and physical activity, the third section describes results concerning the moderation of the association between early-life SECs and physical activity by sex, and the fourth section describes the mediating role of adulthood SECs in the associations between early-life SECs, sex, and physical activity. For the full results of the mixed-effects models, see Table S2 in the Supplemental Material.

Descriptive statistics

Table 1 shows the characteristics of the participants by sex at baseline. Briefly, our study sample consisted of 56,331 people (56.3% women) between the ages of 50 and 96 years old. During the course of the study, 3,013 (5.3%) participants died, and 7,234 (12.8%) dropped out for other reasons. The average number of observations per participant was 2.91 (total number of observations was 164,022). For additional descriptive statistics stratified by physical-activity levels and early-life SECs, see Table S1 in the Supplemental Material.

Main analyses

Sex and physical activity. As hypothesized (Hypothesis 1), results showed that at 73 years (because age was centered at 73 years, the midpoint of the sample's age range), women were less likely than men to be physically active (adjusted *OR* = 0.69, 95% confidence interval [CI] = [0.66, 0.72], $p < .001$). In addition, compared with men, women demonstrated a steeper decrease in the probability of being physically active over the years (*OR* = 0.75, 95% CI = [0.72, 0.79], $p < .001$, for linear effect of age; *OR* = 0.95, 95% CI = [0.92, 0.98], $p < .001$, for quadratic effect of age; Table 2, Model 1).

Early-life SECs and physical activity. As hypothesized (Hypothesis 2), results showed that at 73 years of age, cultural aspects of disadvantaged early-life SECs were associated with a lower probability of physical activity (*OR* = 0.76, 95% CI = [0.72, 0.80], $p < .001$, for low number of books; *OR* = 0.87, 95% CI = [0.81, 0.93], $p < .001$, for occupational position of the main breadwinner associated with low skill). By contrast, material aspects of disadvantaged early-life SECs were not associated with the probability of physical activity (*OR* = 0.96, 95% CI = [0.90, 1.02], $p = .188$, for overcrowding; *OR* = 1.04, 95% CI = [0.98, 1.10], $p = .173$, for housing quality). In addition, low occupational skill of the main breadwinner (*OR* = 0.88, 95% CI = [0.82, 0.94], $p < .001$) and poor housing quality (*OR* = 0.94, 95% CI = [0.90, 0.99], $p = .033$) were associated with a steeper linear decrease in the probability of physical activity over the years. Number of books and overcrowding were, however, not associated with the probability of physical-activity change over aging (Table 2, Model 2).

The moderating role of sex in the associations between early-life SECs and physical activity. As predicted (Hypothesis 3), interactions between the cultural aspects of early-life SEC disadvantage and sex on the probability of physical activity were significant (*OR* = 0.88, 95% CI = [0.79, 0.98], $p = .019$, for number of books; *OR* = 0.84, 95% CI = [0.73, 0.97], $p = .014$, for occupational position of the main breadwinner). When these interactions were further analyzed, results revealed that the occupational position of the main breadwinner was not significantly associated with the probability of physical activity in men (*OR* = 0.95, 95% CI = [0.86, 1.06], $p = .383$), whereas this variable was associated with lower probability of physical activity in women (*OR* = 0.81, 95% CI = [0.74, 0.88], $p < .001$). Moreover, the association between the number of books and physical activity was significantly stronger in women (*OR* = 0.72, 95% CI = [0.67, 0.78], $p < .001$) than in men (*OR* = 0.82, 95% CI = [0.76, 0.89], $p < .001$). By contrast, no significant interactions were found between the material aspects of disadvantaged early-life SECs and sex (*OR* = 0.97, 95% CI = [0.86, 1.09], $p = .633$, for overcrowding; *OR* = 0.99, 95% CI = [0.89, 1.11], $p = .891$, for housing quality). Finally, no

Table 1. Characteristics of Women and Men in the Sample at Baseline

	Women		Men		
Variable	*n*	%	*n*	%	*p*
	Focal variables				
Physical-activity outcomes					
Physically inactive	8,415	26.6	5,772	23.4	
Physically active	23,202	73.4	18,942	76.6	< .001
Early-life SECs					
Number of books					
10 or less	12,230	38.7	9,977	40.4	
More than 10	19,387	61.3	14,737	59.6	< .001
Occupational position of the main breadwinner					
Low skills	25,727	81.4	20,063	81.2	
High skills	5,890	18.6	4,651	18.8	.573
Overcrowding					
Yes	23,726	75.0	18,183	73.6	
No	7,891	25.0	6,531	26.4	< .001
Housing quality					
Low	8,618	27.3	6,582	26.6	
High	22,999	72.7	18,132	73.4	.10
Adult-life SECs					
Education					
Primary	8,186	25.9	5,156	20.9	
Secondary	17,232	54.5	13,588	55.0	
Tertiary	6,199	19.6	5,970	24.1	< .001
Main occupational position					
Low skills	19,403	61.4	15,980	64.7	
High skills	8,477	26.8	8,428	34.1	
Never worked	3,737	11.8	306	1.2	< .001
Ability to make ends meet					
With great difficulty	3,853	12.2	2,464	10.0	
With some difficulty	6,968	22.0	4,954	20.0	
Fairly easily	9,477	30.0	7,431	30.1	
Easily	11,319	35.8	9,865	39.9	< .001
	Covariates				
Country of residence					
Belgium	2,655	8.4	2,197	8.9	
Austria	1,714	5.4	1,231	5.0	
Denmark	1,592	5.0	1,364	5.5	
France	2,009	6.4	1,446	5.9	
Germany	2,087	6.6	1,830	7.4	
Greece	1,968	6.2	1,497	6.1	
Israel	786	2.5	601	2.4	
Italy	2,601	8.2	2,238	9.1	
The Netherlands	1,039	3.3	870	3.5	
Spain	2,618	8.3	2,099	8.5	
Sweden	1,889	6.0	1,627	6.6	
Switzerland	1,304	4.1	1,085	4.4	
Czech Republic	2,509	7.9	1,697	6.9	
Ireland	338	1.1	264	1.1	
Poland	1,111	3.5	874	3.5	

(continued)

Table 1. *(continued)*

	Women		Men		
Variable	*n*	%	*n*	%	*p*
Estonia	2,068	6.5	1,258	5.1	
Hungary	244	0.8	175	0.7	
Portugal	191	0.6	145	0.6	
Slovenia	1,504	4.8	1,075	4.3	
Luxembourg	448	1.4	394	1.6	
Croatia	942	3.0	747	3.0	< .001
Birth cohort					
After 1945	17,703	56.0	13,426	54.3	
Between 1939 and 1945	6,352	20.0	5,354	21.7	
Between 1929 and 1938	5,709	18.1	4,662	18.9	
Between 1919 and 1928	1,853	5.9	1,272	5.1	< .001
Attrition					
No dropout	26,162	82.7	19,922	80.6	
Dropout	4,027	12.7	3,207	13.0	
Death	1,428	4.6	1,585	6.4	< .001

Note: The mean age at baseline was 62.7 years (*SD* = 9.3) for women and 63.1 years (*SD* = 8.9) for men ($p < .001$). For each variable, the *p* value was obtained by testing for the difference between all levels of the variable and sex. Continuous variables were tested using analyses of variance, and categorical variables were tested using χ^2 tests. SECs = socioeconomic circumstances.

significant three-way interactions between early-life SECs, sex, and age (linear and quadratic) were found (*p*s > .167), thereby suggesting that sex did not significantly moderate the effect of early-life SECs on the evolution of the probability of physical activity over the years (Table 2, Model 3; Fig. 1).

Mediating role of adulthood SECs in the associations between early-life SECs, sex, and physical activity. The associations of sex and early-life SECs with the probability of physical activity were only partially attenuated by the life-course SECs. Specifically, sex and number of books, but not the occupational skill of the main breadwinner, remained associated with the probability of physical activity, and the occupational skill of the main breadwinner remained associated with a steeper linear decrease in the probability of physical activity over the years (Table 2, Model 4a). Moreover, housing quality turned out to be associated with the probability of physical activity (*OR* = 1.12, 95% CI = [1.05, 1.18], $p < .001$), whereas its association with the linear decrease in the probability of physical activity over the years became marginal ($p = .075$). The associations between cultural aspects of disadvantaged early-life SECs and the probability of physical activity remained more pronounced in women than in men (although the effect of the number of books became marginal, $p = .091$; Table 2, Model 4b). In this fully adjusted model, number of books was associated with lower probability of physical activity in both men and women, whereas the association between the main breadwinner and the probability of physical activity was observed only in women.

Sensitivity and robustness analyses. Results of the sensitivity and robustness analyses were consistent with those of the main analyses (see Table S3).

Discussion

Main findings

The effects of sex and early-life SECs on health in older age have largely been examined separately (Eagly et al., 2012). Here, we examined their interaction on physical activity and tested a cultural explanation of this interaction. Results showed that the cultural dimension of early-life disadvantaged SECs was more strongly associated with physical activity in women than in men. This suggests that these barriers act in a multiplicative manner, rather than in an additive way, calling into question the widespread assertion that SECs are a well-established risk factor for physical inactivity. In fact, SECs may be an important risk factor in women, but less so in men.

In addition, the association between early-life SECs and physical activity was only partially attenuated by life-course SECs, suggesting that early-life SECs have a long-lasting impact on health behaviors, which cannot

Table 2. Coefficients From the Mixed-Effects Models Predicting Physical-Activity Level From Sex, Early-Life SECs, and the Interaction Between Sex and Early-Life SECs

	Model 1		Model 2		Model 3		Model 4a		Model 4b	
Variable	*OR* [95% CI]	*p*	*OR* [95% CI]	*p*	*OR* [95% CI]	*p*	*OR* [95% CI]	*p*	*OR* [95% CI]	*p*
Sex (reference = men)	0.69 [0.66, 0.72]	< .001			0.87 [0.76, 1.01]	.061	0.78 [0.74, 0.82]	< .001		
Early-life SEC										
Number of books (reference = more than 10)			0.76 [0.72, 0.80]	< .001	0.82 [0.76, 0.89]	< .001	0.87 [0.82, 0.92]	< .001		
Occupational position of the main breadwinner (reference = high skills)			0.87 [0.81, 0.93]	< .001	0.95 [0.86, 1.06]	.383	0.97 [0.90, 1.04]	.332		
Overcrowding (reference = no)			0.96 [0.90, 1.02]	.188	0.99 [0.90, 1.08]	.805	1.02 [0.96, 1.08]	.608		
Housing quality (reference = high)			1.04 [0.98, 1.10]	.173	1.05 [0.96, 1.14]	.289	1.12 [1.05, 1.18]	< .001		
Early-Life SEC × Sex										
Sex (reference = men) × Number of Books (reference = more than 10)					0.88 [0.79, 0.98]	.019			0.91 [0.82, 1.01]	.091
Sex (reference = men) × Occupational Position of the Main Breadwinner (reference = high skills)					0.84 [0.73, 0.97]	.014			0.83 [0.73, 0.95]	.009
Sex (reference = men) × Overcrowding (reference = no)					0.97 [0.86, 1.09]	.633			0.96 [0.86, 1.08]	.544
Sex (reference = men) × Housing Quality (reference = high)					0.99 [0.89, 1.11]	.891			1.00 [0.89, 1.12]	.996

Note: All models were adjusted for age, body max index, attrition, birth cohort, and country of residence. Models 4a and 4b were also adjusted for adult-life socioeconomic circumstance (SEC) mediators (i.e., participants' highest educational attainment during the follow-up, main occupational position, and satisfaction with current household income). Model 4b included interaction terms between sex and early-life SECs. For the full results, see Table S2 in the Supplemental Material available online. *OR* = odds ratio; CI = confidence interval.

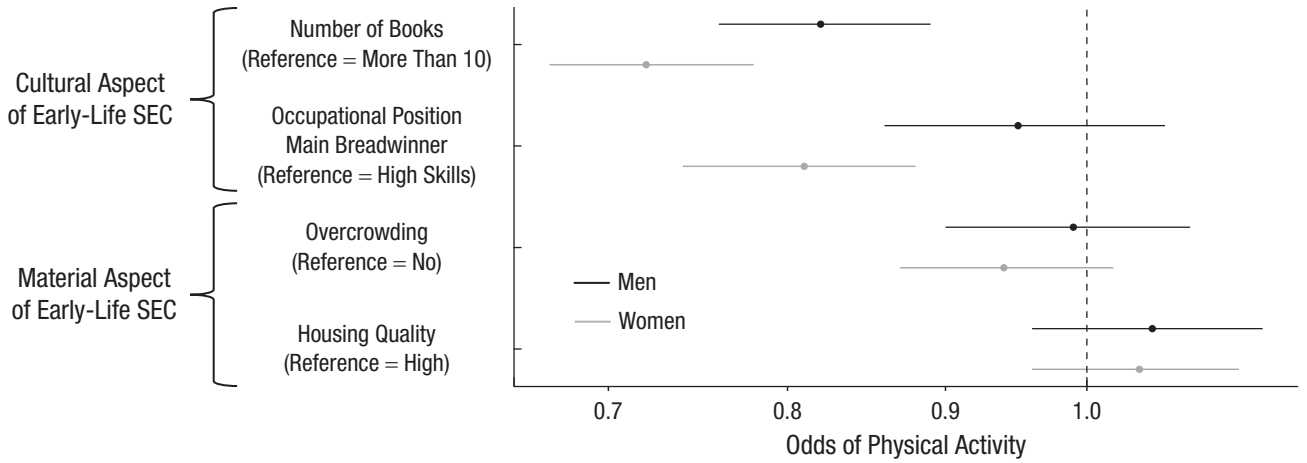

Fig. 1. Association of physical activity with cultural and material aspects of early-life disadvantage in socioeconomic circumstances (SECs), separately for men and women. Points are odds ratios, and error bars are 95% confidence intervals (data from Model 3 are reported). The dashed line indicates the null effect. Effects are not significant if their confidence interval crosses this line.

be fully compensated for by socioeconomic mobility during adulthood. Taken together, these results further support the need for adopting an intersectional perspective (Eagly et al., 2012) when examining health inequalities. However, the size of the association was small (*OR*s < 1.50). This suggests that other variables (e.g., motivation) could affect physical activity.

Comparison with other studies

Observing SEC-by-sex interactions only for the cultural aspects of SECs provides support for the cultural hypothesis. Cultural factors, such as social norms and sex roles, may lead women and men to have differential access to health behaviors, given, for example, that physical activity is more socially acceptable in men than in women, especially in disadvantaged SECs (Bourdieu, 1978; Macintyre & Hunt, 1997; Mackenbach et al., 1999).

Moreover, the finding that the social patterning of physical activity is sex dependent is in line with past studies conducted on children (Cairney et al., 2015; Seabra et al., 2013). It adds to the existing literature by showing that cultural early-life SECs have long-lasting effects. A potential explanation is that sex roles are learned very early, during childhood, and that their effects are implicit (Boiché et al., 2014). Therefore, girls' tendency to avoid physical activities may turn into habits that may be difficult to change in adulthood. These findings stand in contrast with those of Cheval, Sieber, et al.'s (2018) study, which found that the association between early-life SECs and physical inactivity was fully mediated by adulthood SECs. This difference can be explained by the fact that our study disaggregated the material and cultural aspects of early-life disadvantage, whereas the previous one did not. Therefore, consistent with recent suggestions (Cheval, Orsholits, et al., 2019), results confirm the need to differentiate various aspects of early-life disadvantage to better gauge their specific links with health in later life.

Strengths and limiting conditions

This study has several strengths. First, the repeated measurement of physical activity allowed us to investigate its evolution over 46 years (from ages 50 to 96 years). Second, our study was based on large-scale data ($N = 56{,}331$). Third, we measured four different indicators of SECs (two cultural and two material), allowing a more fine-grained measure of this early-life disadvantage. Fourth, we applied an analytical approach well-suited to examine not only level differences but also change as a person ages.

However, this study also has limitations. First, we used self-reported measures of physical activity, which may generate a misclassification bias (Prince et al., 2008), be subject to lack of granularity, and include examples that may prime individuals' response toward activities related to household chores and recreational activities. Nevertheless, we believe that the potential measurement errors associated with self-reports are unlikely to explain the observed associations between SECs, sex, and physical activity. Moreover, the observed associations remained consistent across the multiple ways of modeling the dependent variable (i.e., two different cutoff points) and across the different population samples (i.e., three sensitivity analyses using different samples). Finally, applying a cutoff to both the

moderate and vigorous-intensity items addressed some limits of our measure (e.g., difficulty for participants to categorize their physical activities according to the intensity). Second, early and adult-life SECs were assessed using self-reported retrospective data, which are subject to memory bias or social desirability. However, previous studies suggest sufficient validity of this self-reported socioeconomic information to discriminate between advantaged and disadvantaged individuals on the basis of the specific cutoff points (Pinto Pereira et al., 2014, 2015; Solís et al., 2015). In addition, and unlike previous literature relying on crude assessments of early-life SECs (e.g., using a limited number of early-life indicators; Stringhini et al., 2013; Wannamethee et al., 1996), we used a comprehensive and rich measure of early-life SECs. However, these indicators were not exhaustive and may still have been insufficient to accurately distinguish between the different SEC groups. Consequently, we cannot fully exclude potential misclassification bias. Third, the SHARE design has two selection biases, related to the recruitment procedure that occurs at age 50 years and older (respondents may be more likely to be in better health than nonrespondents) and to the loss of participants during the follow-up. This latter bias was limited by adjusting for attrition in the analyses and by excluding participants who died or dropped out during the follow-up in the sensitivity analyses. Fourth, the cultural interpretation of the SEC-by-sex interaction remains speculative because individual motivations for physical activity were not measured. Fifth, the cutoff scores used in SHARE to operationalize early-life SECs are the same across countries, which may limit their validity in distinguishing advantaged and disadvantaged SECs. Likewise, although a discussion of how the findings observed can be moderated by the country is outside the scope of the current article, we believe that future studies need to investigate this question. This will allow researchers to determine whether and how the influence of sex and SECs can be increased or decreased depending on the type of country or welfare regime (Sieber et al., 2019, 2020).

Conclusion

This is one of the first studies to provide empirical support for a cultural explanation of the SEC-by-sex interaction on health behaviors. In women, but not in men, the number of books in the household remained significantly associated with a lower probability of physical activity after adjustments for life-course socioeconomic trajectories, suggesting that habits developed within the social milieu during childhood may partly determine behavior on a lifelong basis.

Transparency

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Author Contributions

M. P. Boisgontier and B. Cheval are joint senior authors. B. Cheval and A. Chalabaev developed the study concept and designed the analyses. B. Cheval analyzed the data. B. Cheval, M. P. Boisgontier, and A. Chalabaev drafted the manuscript. All the authors critically appraised the manuscript, worked on its content, and approved the final version for submission.

Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

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Open Practices

Data for the present study were obtained from the Survey of Health, Ageing and Retirement in Europe (SHARE) Waves 1, 2, 3 (SHARELIFE), 4, 5 and 6 (https://doi.org/10.6103/SHARE.w1.600, https://doi.org/10.6103/SHARE.w2.600, https://doi.org/10.6103/SHARE.w3.600, https://doi.org/10.6103/SHARE.w4.600, https://doi.org/10.6103/SHARE.w5.600, https://doi.org/10.6103/SHARE.w6.600). The design and analysis plans for the present study were not preregistered. This article has received the badge for Open Data. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/09567976211036061

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