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Understanding educational inequalities in sports participation through structurally based resources and individual agency – a sequential mediation analysis

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Abstract

Educational inequalities in sports participation remain a public health issue in the Netherlands. Combining structurally based resources from Pierre Bourdieu's theory of capital with Amartya Sen's conceptualization of individual agency may offer new insights into the complex mechanisms that drive these inequalities. Specifically, we posited that the way individuals are able to exercise their agency within the structurally based economic, social, and cultural resources they have access to may help explain educational inequalities in sports participation.

Data from two waves of the GLOBE study (2014, 2021) were used to test whether two sequential mediators, structurally based resources followed by individual agency, help explain the relationship between educational level and sports participation. Adults aged 25 and older residing in Eindhoven, the Netherlands self-reported highest attained educational level, structurally based resources (economic, social, and embodied cultural capital), individual agency (self-control, perceived choice, and reflexivity), and sports participation. A sequential mediation analysis using structural equation modelling was used to test the direct effect of education on sports participation, the sequential indirect effect through both mediators, and partial indirect effects through each mediator individually.

Educational level was positively associated with sports participation. The hypothesized sequential mediation pathway was not supported; educational level was positively associated with structurally based resources and structurally based resources were positively associated with individual agency, but individual agency was not related to sports participation. Though not through individual agency, structurally based resources helped explain educational inequalities in sports participation.

Having access to more economic, social, and cultural resources may empower individuals by increasing their agency. This increased agency was not associated with sports participation, which could be because sports participation is not universally valued as a goal. The conceptualization and operationalization of individual agency in the context of sports participation warrants more research. We found that structurally based resources helped explain a substantial portion of educational inequalities in sport, so we propose that policies alleviating more than just economic barriers to sports participation, but also social and cultural barriers, may help reduce educational inequalities in sports participation in the Netherlands.

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Background

Sports participation is beneficial for general health and well-being, as it helps prevent chronic illnesses and lowers mortality risk [1, 2]. Educational inequalities in sports participation have been well-documented in the Netherlands, where adults with less education are less likely to participate in sports than those with more education [3–6]. These inequalities persist despite research on the roots of these inequalities and policy efforts to reduce these unfair, avoidable differences in sports participation.

In research aimed at reducing inequalities in health-related behavior, there has been a shift in attention from individual-level mechanisms towards structural mechanisms [7, 8], which are the broader contexts and resources in society in which behavior takes place [9]. In particular, the built environment (e.g., presence and quality of parks, walkability of streets, land-use mix) has been found to have a strong link with physical activity [10, 11], though evidence about its influence on socioeconomic inequalities in physical activity, including sports participation, is conflicting (e.g., [4, 10, 12–14]). Recognizing that individuals must actively make choices within the structures they find themselves in – the built environment along with other structures and resources – is necessary for a holistic and realistic analysis of how individuals interact with their environments [15–17], including when it comes to participating in sports. Put otherwise, individuals have agency, broadly defined as the capacity to take action [18, 19], which they can exercise within the constraints of the resources they have access to.

While most empirical studies have focused on structure-related or agency-related mechanisms separately, there is a strong theoretical case for considering the interplay between agency and structure in research on socioeconomic inequalities in health-related behavior [20–22]. An empirical investigation into how structure-*and* agency-related mechanisms influence educational inequalities in sports participation, grounded in theory, may provide new insights and lead to a fuller understanding of why these inequalities persist.

In a recent theoretical analysis, Frohlich and Abel argued for the interplay between structure and agency in the context of inequalities in health practices, combining the importance of structurally based resources from Pierre Bourdieu's theory of capital with the emphasis on individual agency from Amartya Sen's capability approach [15]. Bourdieu viewed one's position in society as granting access to different types of resources, which serve as facilitators or constraints to how individuals perceive and navigate the social world [23]. As such, the resources individuals have access to are considered socially structured and as arising from broader social structures. More specifically, following Bourdieu, structurally based resources are defined as the economic, social, and cultural resources one has access to [15, 24]. In their analysis, Frohlich and Abel reason that while Bourdieu's theory offers an explanation for how socioeconomic inequalities are maintained, individuals must actively use economic, social, and cultural capital for them to become beneficial for health [15]. In other words, individuals have critical, reflexive agency over decisions related to their health [25], meaning that they have individual agency, defined as the capacity of individuals to take actions and to make active change [26–28]. More concretely, Sen's conceptualization of agency includes two components: agency freedom, what a person is free to do and achieve in pursuit of the goals they value, and agency achievement, a person's realization of these goals [28, 29]. As Sen places importance on the goals that an individual values, regardless of what the goals may be (e.g., wealth, health, happiness), individual agency is referred to as having open conditionality [26, 28]. The ways individuals put their resources to use, in line with their goals, can transform their health and health-related behavior. Individual agency may be especially important for sports participation, which requires an active choice and a conscious dedication of time and effort [3, 30].

The way we seek to understand health inequalities should therefore consider how the resources at people's disposal (structurally based resources) shape the real range of options they have to act (individual agency) along with how people act (health-related behavior) [20, 31]. Individual agency can be regarded as largely positioned within a network of power relations or structures [32–34], such that the structures individuals find themselves in dictate, to a large extent, their individual agency. That said, in following Sen's conceptualization closely, individual agency is worth considering as a distinct concept [35] that plays a part in the mechanism through which structurally based resources enable or hinder sports participation. The authors of two existing interview studies about socioeconomic inequalities in health-related behavior also argued for a specific pathway through agency shaped by structure [36, 37], which, to our knowledge, has not yet been tested quantitatively. A quantitative investigation of whether, and how, individual agency exercised within structurally based resources can help explain educational inequalities in sports participation is warranted to test how these theory-based mechanisms play out in a large sample of adults residing in the Netherlands.

The aim of this study is to investigate how individual agency within structurally based resources may help explain educational inequalities in sports participation for adults residing in the Netherlands. As a starting point, we hypothesize that having more education

is associated with more sports participation, which is in line with existing research [3–6]. Our main hypothesis, based on the theoretical and empirical qualitative literature presented above, is that individual agency exercised within structurally based resources helps explain educational inequalities in sports participation. Specifically, we posit that more education enables individuals to accrue more structurally based resources, through, for example, higher earnings, stronger social networks, and the development of health-relevant knowledge and skills. These resources may increase individuals' agency and, in turn, their ability to deliberately and actively participate in sports.

Methods

Data

The GLOBE (Dutch acronym for "Health and Living Conditions of the Population of Eindhoven and surroundings") study is a prospective cohort study focused on socioeconomic inequalities in health. Between 1991 and 2021, several waves of the GLOBE study were conducted in Eindhoven and surrounding municipalities in the Netherlands [38]. A sample consisting of participants who partook in the two most recent waves of the study, in 2014 and 2021, were used in the analyses described in this paper. Data from respondents who reported implausible age differences between 2014 and 2021 ($N=12$) were removed to increase the likelihood that the same person filled in the survey in both years, leading to a final sample of 1332 respondents. The age difference was considered implausible if it was more than two standard deviations away from the mean. The use of personal data in the GLOBE study is in compliance with the Dutch Personal Data Protection Act and the Municipal Database Act; the study is registered with the Dutch Data Protection Authority (number 1248943). The 2021 wave of the GLOBE study was approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of Utrecht University (number 21–0355).

Measures used in the analysis

The measures used in the analysis are described below, and an overview of the survey questions composing the measures can be found in Additional file 1.

Sports participation

Sports participation was measured using the validated Short QUestionnaire to ASsess Health-enhancing physical activity (SQUASH) [39]. Respondents were asked to list up to four specific sports they participated in in recent months along with the frequency, duration, and self-reported intensity (light, moderate, or intense) of their weekly participation in each sport. Each reported sport was assigned a sport-specific intensity weight called a MET score (ranging from 1.5 for bridge, chess, and other board games to 12 for squash) based on Ainsworth's categorization [40]. Reported sports included both organized (e.g., playing on a volleyball team) and unorganized sports (e.g., going for a jog), but did not include active travel to and from work or walking and cycling in leisure time. Following the guidelines for using the SQUASH questionnaire by Wendel-Vos, an overall intensity score ranging from 1 (lowest intensity) to 9 (highest intensity) for each sport respondents participated in was derived by combining the MET score for that sport, the respondent's self-reported intensity (light, moderate, or intense), and their age (e.g., for respondents 55 and older, a MET score of 5 and above was considered intense, whereas for younger respondents, a MET score of 6.5 and above was considered intense). An overall intensity score of 3 and above was considered moderate. Taking this overall intensity score into account for each of up to four sports allowed us to derive each respondent's weekly time and intensity spent participating in sports. Due to heavy skewness towards zero, sports participation in 2021 was operationalized as a dichotomous variables, with 1 = engaging in sports for at least 30 min once per week at moderate intensity and 0 = engaging in sports for less than 30 min once per week. This cutoff, in line with existing research [6, 41], represents an amount of time and intensity that requires making a real effort. Participants who met this criterion were considered to have meaningfully engaged in sports.

Educational level

Respondents' reported highest attained educational levels in 2014 were categorized according to the International Standard Classification of Education (ISCED): high (higher professional education and university; ISCED 5–7), middle (intermediate professional and higher general education; ISCED 3–4), low (lower professional and intermediate general education; ISCED 2), and lowest (no or primary education; ISCED 0–1). In our sample of adults aged 25 and above, respondents were assumed to have completed their education in 2014.

Structurally based resources

Economic capital Household equivalent income, financial strain, and housing tenure in 2014 were included as measures of economic capital, reflecting assets convertible into money or property rights [24]. Monthly household equivalent income was calculated by dividing respondents' reported monthly household income by the square root of the number of people living off this income. Financial strain was measured by asking respondents whether they

had difficulties paying for essentials like food, rent, mortgage, and electricity in the past year (answer options were "no difficulty at all", "some difficulty", and "great difficulty"). Housing tenure was measured by asking respondents whether they own their home, rent through the private sector, or rent through the public sector.

Social capital Three physical activity-specific qualities of respondents' support networks, representing the activation of social capital towards physical activity, were used to measure social capital in 2014. Respondents were presented with statements about the behavior of, beliefs of, and stimulation from their support network related to physical activity (e.g., "Most people who are important to me stimulate me to exercise regularly"), which were adapted from measures of descriptive and injunctive norms [42]. Agreement with each of the three statements was assessed on a 5-point Likert scale, with answer options ranging from "totally agree" to "totally disagree". The associations of more general measures of social capital (i.e., size of one's network) with sports participation were expected to be inconsistent and highly dependent on the behavior of, beliefs of, and stimulation from the members of one's network [41], which is why we used these physical activity-specific measures of social capital.

Embodied cultural capital Bourdieu distinguished between objectified, institutionalized, and embodied cultural capital. Embodied cultural capital represents the internalized knowledge, values, and skills developed throughout the process of socialization [43, 44]. It is the type of cultural capital that can be directly activated towards health-related behavior [45], making embodied cultural capital particularly relevant for understanding how cultural resources may influence individual agency and sports participation [41, 45]. Two commonly used measures of embodied cultural capital, cultural participation and reading frequency [46, 47], were measured in 2014. Respondents reported how frequently they visited museums, music, dance, or theatre performances, and cultural monuments; answer options were "never", "around once per year", and "multiple times per year". Respondents indicated how frequently they read books on a 5-level scale ranging from "at least one book per week" to "never". These measures reflect highbrow cultural behaviors and signals, which, according to Bourdieu and others [48–50], are manifestations of embodied cultural capital that can be used for cultural distinction. We acknowledge that, in reality, embodied cultural capital is evolving and context-specific, transcending highbrow cultural expression [51].

Because Bourdieu considered people's social position to depend on the relative, rather than absolute, amount of capital they possess relative to others [52], relative measures of each form of capital were calculated. The individual measures of each form of capital (e.g., for embodied cultural capital, cultural participation and reading frequency) were standardized to be on the same scale (if needed), then averaged to calculate a mean score of each form of capital. In line with existing research [41], these mean overall scores were then divided into quartiles to obtain relative measures of each form of capital. Finally, an overall measure of structurally based resources was calculated as the mean of the relative measures of economic, social, and embodied cultural capital.

Individual agency

Conceptualizing agency is not straightforward and should be appropriate to the study population and context [20, 53]. No standard instrument for measuring individual agency exists. We used existing measures that represent individual agency, broadly (not regarding specific goals), according to Sen's conceptualization [54]. One distinction that can be made in agency measures is between those that measure direct control, including the ability to make choices and control procedures, and effective power, specifically, the effective power to achieve chosen results [26]. Direct control is related to Sen's agency freedom, and effective power relates to agency achievement. In the 2021 wave of the GLOBE study, we measured facets of individual agency relevant for health-related decision making that represent direct control (perceived choice and self-control) and effective power (reflexivity). An overview of how our measures of individual agency relate to Sen's conceptualization is summarized in Table 1.

Table 1 Agency conceptualization and measures

Facet of agency [31]	*Type of measure* [26]	*Measure*
Agency freedom: the beings and doings a person is free to achieve in pursuit of the goals they value	The ability to make choices	Perceived choice
	The ability to control procedures	Self-control
Agency achievement: a person's realization of goals and values that they choose and have reason to pursue	The effective power to achieve chosen results	Reflexivity

Perceived choice: the ability to make choices Perceived choice reflects feeling a sense of choice about one's own behavior, which was measured using the perceived choice subscale of the Perceived Choice and Awareness of Self Scale [55, 56]. For each of five pairs of statements, respondents indicated the extent to which they agreed with the statements related to perceived choice, with a value of 1 corresponding to fully agreeing with the first statement in the pair and a value of 5 corresponding to fully agreeing with the second. For example, one pair of statements was "I always feel like I choose the things I do" and "I sometimes feel that it is not really me choosing the things I do".

Self-control: the ability to control procedures Self-control is regarded as the capacity to pursue longer-term goals over instant gratification, choosing to and being able to forego immediate pleasure for goals that deliver larger rewards in the future [57]. Self-control was measured in the 2021 GLOBE survey using five items of the Brief Self-Control Scale developed by Tangney and colleagues [58]. This scale was built around the ability to override and interrupt undesired behavioral responses, such as breaking habits and resisting temptation. Respondents assessed each of the five statements on a 5-point Likert scale, with answer options ranging from "totally agree" to "totally disagree". Examples of the statements are"I do certain things that are bad for me because I enjoy them", which was reverse coded, and "People would say that I have iron self-discipline".

Reflexivity: the effective power to achieve chosen results Reflexivity is the extent to which a person deliberates and engages in an internal dialogue about their actions, circumstances, and experiences [59]. This facet of agency captures that individuals may have agency but may be unable to exercise it in a reflexive way [60]. In the 2021 GLOBE survey, we measured reflexivity using a scale developed by Oude Groeniger and colleagues [59]. For each of 10 pairs of statements, respondents indicated the extent to which they agreed with the statements, with a value of 1 corresponding to fully agreeing with the first statement in the pair and a value of 10 corresponding to fully agreeing with the second. For example, one pair of statements was "Before I make a decision, I consider and weigh all the options" and "I prefer making decisions spontaneously".

A score for each measure of agency was calculated by taking the mean of the responses to each of the statements (for self-control) or pairs of statements (for perceived choice and reflexivity). When needed, responses to individual items were reversed prior to taking the mean of all items. The three scores were standardized to be on the same scale, then an overall individual agency score was calculated by taking the mean of the scores for perceived choice, self-control, and reflexivity.

Control variables

Age in years, gender, and country of birth, all measured in 2014, were included as demographic covariates. Gender was operationalized as a binary variable indicating whether a respondent was female or not. For country of birth, a binary variable indicating whether a respondent was born in the Netherlands or not was used in the analyses.

Prior sports participation, measured in 2014, was included in the analysis to control for potential confounding between structurally based resources, individual agency, and sports participation in 2021; it was operationalized in the same way as sports participation in 2021. Similarly, prior levels of self-control were included to control for potential confounding between structurally based resources and individual agency. Prior levels of perceived choice and reflexivity were not included because these were only collected in 2021.

The 2021 GLOBE survey was conducted during the COVID-19 pandemic, which may have influenced the estimated relationships. In a sensitivity analysis described in the discussion, we controlled for whether respondents felt their financial situation worsened, stayed the same, or improved during the COVID-19 crisis.

Sequential mediation model

The pathways through which we hypothesized structurally based resources and individual agency to help explain educational inequalities in sports participation were tested using sequential mediation analysis. A sequential mediation analysis enables the estimation of whether and the extent to which the mediators (here, structurally based resources and individual agency) explain the relationship between the exposure (educational level) and outcome (sports participation) in a specific order. In line with our hypotheses, we expected structurally based resources to precede individual agency in the causal chain.

The sequential mediation model was estimated using a structural equation model (SEM), which is a system of linked regression-style equations. A SEM approach using a weighted least squares estimator was chosen because of its ability to test complex hypotheses and generate model fit statistics. The SEM consisted of the simultaneously fitted Eq. 1, Eq. 2, and Eq. 3. Constant terms and coefficients for the included baseline covariates (demographic measures and other potential confounders, described in more detail below) are not shown.

$$\begin{aligned} \textit{Structurally based resources} \sim a1 \times \textit{Educational level} \\ + \textit{Baseline covariates} + \varepsilon 1 \end{aligned} \quad (1)$$

$$\begin{aligned} \textit{Individual agency} \sim a2 \times \textit{Educational level} + d \\ \times \textit{Structurally based resources} \\ + \textit{Baseline covariates} + \varepsilon 2 \end{aligned} \quad (2)$$

$$\begin{aligned} \textit{Sports participation} \sim c\prime \times \textit{Educational level} + b1 \\ \times \textit{Structurally based resources} + b2 \\ \times \textit{Individual agency} + \textit{Baseline covariates} + \varepsilon 3 \end{aligned} \quad (3)$$

The direct effect of educational level on sports participation, controlling for the mediators, is *c'*. The total indirect effect of educational level on sports participation through structurally based resources and individual agency is the sum of *a1*b1*, *a2*b2*, and *a1*d*b2* [61]. This total indirect effect consists of partial indirect effects through structurally based resources only (*a1*b1*), through individual agency only (*a2*b2*), and through structurally based resources followed by individual agency (*a1*d*b2*).

Educational level and structurally based resources were measured in 2014 and individual agency and sports participation were measured in 2021. This established a temporal sequence between educational level (which was assumed to be completed in 2014, as the minimum age in the sample was 25), structurally based resources, and individual agency.

Several potential confounders were added to the sequential mediation model as baseline covariates in a stepwise manner. These potential confounders were included to increase the likelihood that the estimated changes in the outcome were due to the hypothesized causal pathways rather than driven by other variables unaccounted for in the model. In Model 1, baseline covariates included age, gender, and country of birth. In all equations, age, gender, and country of birth were posited to influence both educational level and the dependent variables (structurally based resources, individual agency, and sports participation), so we controlled for these demographic characteristics to address potential exposure-mediator and exposure-outcome confounding bias.

In Model 2, prior sports participation was added. In general, controlling for prior levels of the exposure, mediators, and outcome is recommended to render mediation model estimates much more plausible, as these prior levels may serve as the most important confounders of the relationships between the exposure, mediators, and outcome [62, 63]. Prior levels may have a direct influence on the mediators and outcome or may influence them indirectly, through unmeasured variables [64]. Controlling for prior sports participation in Eq. 3, in which sports participation is the dependent variable, was expected to adjust for the majority of potential confounding, as prior sports participation may influence structurally based resources, individual agency, and subsequent levels of sports participation. By adjusting for prior sports participation, we also accounted for variables preceding prior sports participation in the causal chain that may confound the mediator-outcome relationships. For example, prior health status likely shapes prior sports participation, which may then influence the relationship between structurally based resources and subsequent sports participation. We applied a similar approach in a previous study, where we found that prior levels of the outcomes were important confounders of the estimated relationships [65].

In Model 3, prior levels of individual agency (self-control only) were added for similar reasons. We controlled for prior levels of individual agency in Eq. 2, in which individual agency is the dependent variable, to account for potential mediator-mediator confounding. This is sufficient to account for the potential influence of prior levels of structurally based resources on subsequent levels of structurally based resources, as prior levels of individual agency are expected to be causally linked with prior levels of structurally based resources. The estimated relationships, including all baseline covariates, are visualized in Fig. 1.

Overall measures of structurally based resources and individual agency allowed us to test our main hypothesis, that individual agency exercised within structurally based resources helps explain educational inequalities in sports participation. To fully understand the relationships we modelled, we conducted follow-up analyses with separate measures; we estimated one sequential mediation SEM with the overall measure of structurally based resources and separate measures of individual agency (perceived choice, self control, reflexivity) and another with separate measures of structurally based resources (economic capital, social capital, embodied cultural capital) and the overall measure of individual agency.

Multiple imputation was used to account for the bias introduced by missing data. An informative set of predictors, including all variables used in the analysis and other variables from the 2014 and 2021 GLOBE surveys, were used to generate 20 imputed datasets. After imputation, respondents who did not fill in the sports participation questions in the 2021 survey were removed from the analyses ($N=54$). The sequential mediation SEMs were estimated on each of the 20 imputed datasets, then parameter estimates and standard errors were pooled using Rubin's rule [66, 67]. Model fit was assessed using the Chi-square test and the robust RMSEA fit statistic; an RMSEA below 0.08 was considered an acceptable fit to the data. Incremental measures of fit like the CFI and TFI are also commonly used, but these are not informative when the null model RMSEA is less than 0.158, which was the case for all models we estimated [68].

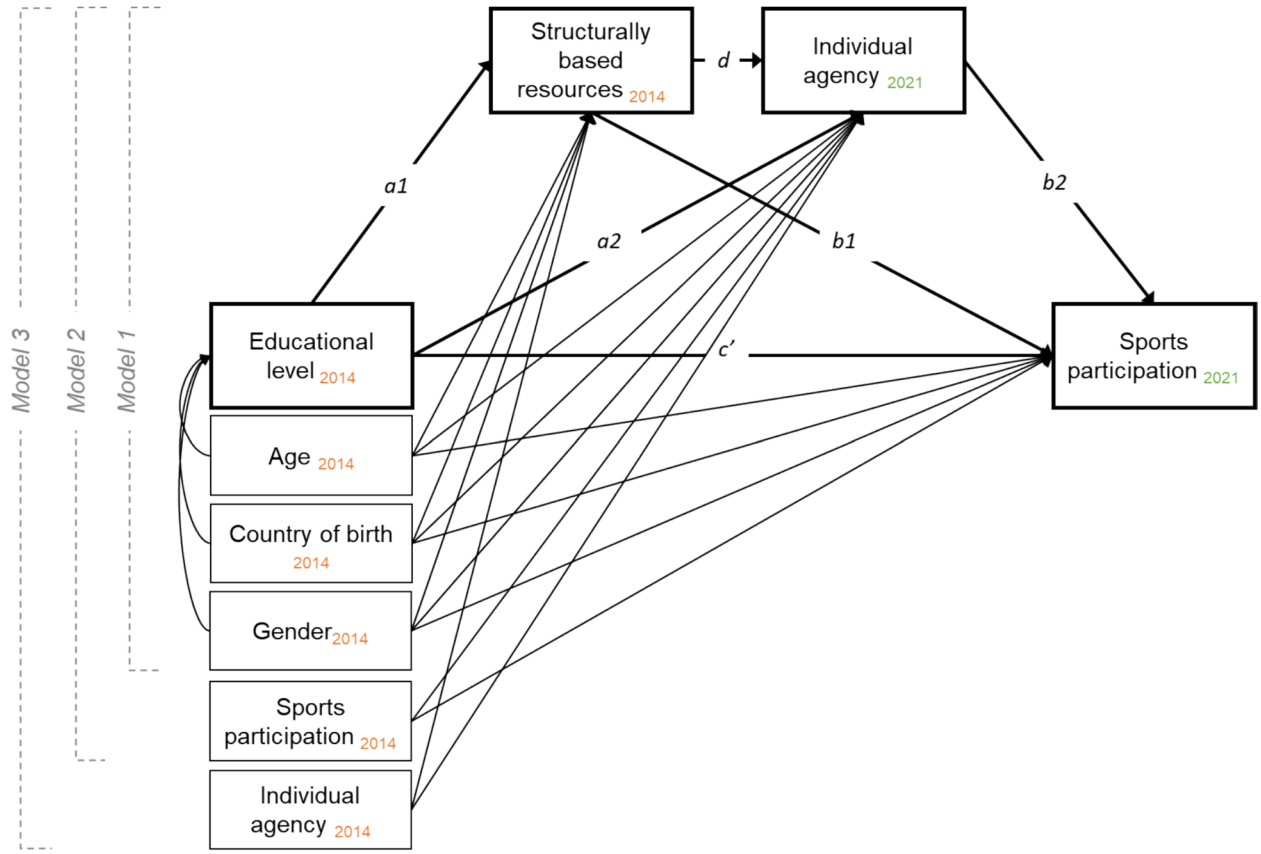

Fig. 1 Path diagrams for the stepwise sequential mediation models

All analyses were performed in R (version 4.2.1). The mice package (version 3.16.0) was used for multiple imputation and the lavaan (version 0.6–16) and semTools (version 0.5–6) packages were used for the sequential mediation analyses.

Results

Descriptive statistics of GLOBE respondents

Descriptive statistics of the study sample (from the non-imputed data) stratified by educational level are presented in Table 2. Nearly half of respondents had a high educational level. About 26% of respondents had a middle level of education, 24% had a low level of education, 4% had the lowest level of education, and the remaining participants did not report their level of education (less than 1%). The average age of respondents was 55.4 years, females made up slightly more than half of the sample, and a majority of respondents were born in the Netherlands.

Sequential mediation analysis results

Here, we present results from Model 1 of the sequential mediation analysis. While conceptually sound, models including prior sports participation (Model 2) and prior levels of individual agency (Model 3) worsened the model fit and did not change the overall patterns observed in the data. For these reasons, we focus on the results from Model 1 in this manuscript. Results from Model 2 and Model 3 are presented in Additional file 2.

In the three simultaneously estimated equations in the sequential mediation SEM, having a higher level of education was statistically significantly associated with having higher structurally based resources, having a higher level of individual agency, and sports participation (Table 3). Having higher structurally based resources was statistically significantly associated with having a higher level of individual agency and sports participation, though individual agency was not associated with sports participation.

Based on the estimates from the sequential mediation SEM, the sequential mediation analysis results (Table 4) showed that educational level had a positive direct effect on sports participation (absolute contribution = 0.058, p-value = 0.094), which explained 70.7% of the total effect of educational level on sports participation. We observed a positive indirect effect of educational level on sports participation through structurally based resources only

Table 2 Descriptive statistics of the study sample (from the non-imputed data)

	Educational level				
	Total	**Lowest**	**Low**	**Middle**	**High**
	N **= 1332**[a]	***N*** **= 49**	***N*** **= 320**	***N*** **= 342**	***N*** **= 616**
Age					
Mean (SD)	55.35 (15.49)	64.69 (13.74)	64.93 (11.64)	54.46 (14.7)	50.06 (15.12)
NA, %	0.0	0.0	0.0	0.0	0.0
Gender, %					
Female	53.9	61.2	60.9	58.2	47.2
Male	46.1	38.8	39.1	41.8	52.8
NA	0.0	0.0	0.0	0.0	0.0
Country of birth, %					
The Netherlands	92.7	91.8	95.9	93.0	91.7
Other	6.8	8.2	3.4	7.0	8.1
NA	0.5	0.0	0.6	0.0	0.2
Sports participation, %					
At least 30 min once per week	44.7	20.4	34.7	35.7	57.1
Less than 30 min once per week	51.2	61.2	58.4	62.3	40.4
NA	4.1	18.4	6.9	2.1	2.4
Structurally based resources (possible range: 1–4)					
Mean (SD)	2.32 (0.67)	1.79 (0.53)	2.16 (0.63)	2.14 (0.64)	2.51 (0.64)
NA, %	22.7	46.9	26.6	26.6	16.4
Economic capital, %					
Quartile 1 (lowest)	24.5	65.3	32.8	30.4	13.5
Quartile 2	23.8	6.1	23.1	25.2	25.0
Quartile 3	30.8	8.2	24.1	24.9	39.3
Quartile 4 (highest)	10.0	0.0	4.7	7.3	15.1
NA	11.0	18.4	15.3	12.3	7.1
Physical activity-related social capital, %					
Quartile 1 (lowest)	23.1	18.4	20.9	24.9	23.7
Quartile 2	29.1	18.4	23.0	31.6	32.3
Quartile 3	21.0	22.5	24.1	18.1	20.8
Quartile 4 (highest)	12.2	12.2	15.3	8.8	12.3
NA	14.6	28.6	17.5	16.7	10.9
Embodied cultural capital, %					
Quartile 1 (lowest)	24.8	69.4	35.3	29.0	13.5
Quartile 2	30.6	18.4	33.1	33.9	28.1
Quartile 3	27.0	8.2	20.0	24.0	33.9
Quartile 4 (highest)	16.8	2.0	10.3	12.3	24.0
NA	0.9	2.0	1.3	0.9	0.5
Individual agency (possible range: 1–5)					
Mean (SD)	3.40 (0.46)	3.19 (0.57)	3.28 (0.48)	3.35 (0.45)	3.50 (0.42)
NA, %	8.6	20.4	11.3	7.6	6.7
Perceived choice (possible range: 1–5)					
Mean (SD)	3.85 (0.86)	3.62 (1.18)	3.74 (0.98)	3.85 (0.85)	3.94 (0.75)
NA, %	4.8	4.1	4.7	4.4	5.0
Self-control (possible range: 1–5)					
Mean (SD)	3.17 (0.64)	3.09 (0.68)	3.19 (0.64)	3.12 (0.65)	3.20 (0.63)
NA, %	3.8	6.1	4.4	3.2	3.4
Reflexivity (possible range: 1–5)					
Mean (SD)	3.16 (0.68)	2.90 (0.69)	2.88 (0.64)	3.10 (0.66)	3.35 (0.64)

Table 2 (continued)

	Educational level				
	Total	**Lowest**	**Low**	**Middle**	**High**
	N **= 1332[a]**	***N*** **= 49**	***N*** **= 320**	***N*** **= 342**	***N*** **= 616**
NA, %	5.5	20.4	6.3	4.4	4.2
Prior sports participation, %					
At least 30 min once per week	56.3	26.5	46.3	53.8	65.4
Less than 30 min once per week	35.7	63.3	45.0	37.4	27.6
NA	8.0	10.2	8.8	8.8	7.0

NA missing, *SD* Standard deviation

[a] *N* = 5 respondents did not report their educational level

Table 3 Path estimates for sequential mediation SEM: Model 1

Dependent variable	Independent variable	Estimate	*p*-value
Structurally based resources (2014)	Educational level	0.175	0.000***
	Age	0.013	0.000***
	Female	-0.179	0.000***
	Born in the Netherlands	0.055	0.420
Individual agency (2021)	Educational level	0.058	0.095*
	Structurally based resources (2014)	0.096	0.000***
	Age	0.000	0.980
	Female	0.021	0.412
	Born in the Netherlands	-0.090	0.099*
Sports participation (2021)	Educational level	0.058	0.094*
	Structurally based resources (2014)	0.115	0.000***
	Individual agency (2021)	0.051	0.103
	Age	-0.005	0.000***
	Female	0.026	0.367
	Born in the Netherlands	0.117	0.033**

Reported estimates are statistically significant at *α = 0.1, **α = 0.05, ***α = 0.01

Model fit statistics: Chi-square *p*-value = 0.010, Robust RMSEA = 0.047

(absolute contribution = 0.020, *p*-value = 0.003), which explained 24.4% of the relationship between educational level and sports participation. There was no indirect effect through individual agency only, and we did not find evidence of a sequential indirect effect of educational level on sports participation through structurally based resources followed by individual agency.

The sequential mediation SEM with separate measures of structurally based resources did not have an acceptable fit to the data. Despite having an acceptable fit to the data, the sequential mediation SEM with separate measures of individual agency did not provide new insights, as, similar to the model with a combined measure of individual agency, neither perceived choice, self-control,

Table 4 Mediation results: Educational level → structurally based resources → individual agency → sports participation

Effect	Absolute effect	*p*-value	Relative contribution to total effect
Total effect	0.082	0.012**	
Direct effect	0.058	0.094*	70.7%
Indirect effect (structurally based resources only)	0.020	0.003***	24.4%
Indirect effect (individual agency only)	0.003	0.332	3.7%
Indirect effect (structurally based resources → individual agency)	0.001	0.110	1.2%

Reported estimates are statistically significant at *α = 0.1, **α = 0.05, ***α = 0.01

or reflexivity mediated educational inequalities in sports participation, either alone or via structurally based resources. Estimates from both of these models are presented in Additional file 3.

Discussion

Summary of main findings

In our analysis of a sample of adults residing in Eindhoven, the Netherlands, educational level was positively associated with sports participation. These educational inequalities in sports participation were not explained by individual agency exercised within structurally based resources. Educational level was positively associated with structurally based resources and structurally based resources were positively associated with individual agency, but individual agency was not related to sports participation. We found that structurally based resources (on their own, not through individual agency) did help explain educational inequalities in sports participation.

Analysis of main findings

Having more structurally based resources was positively associated with having higher individual agency. This finding lends credence to the understanding of individual agency as positioned within the structurally based resources people have access to [32, 34], suggesting that improved access to structurally based resources can empower individuals and restore a sense of freedom. The notion that increased stability related to one's financial situation, housing, and support systems is crucial for feeling a sense of freedom and control over one's life was also found in a recent interview study about experiences of Dutch adults living in socioeconomic insecurity [71]. Importantly, our study shows that more combined economic, social, and embodied cultural resources may help increase individual agency. Embodied cultural capital may be more challenging to increase in the short term than social or economic capital, as it may largely be developed through longer term socialization processes [43, 44].

While having more structurally based resources was associated with higher individual agency, individual agency was not associated with sports participation. Therefore, individual agency did not help explain educational inequalities in sports participation, neither via structurally based resources nor on its own. In conceptualizing individual agency as consisting of agency freedom and agency achievement, broadly, we did not explicitly account for the open conditionality of individual agency (that agency is used towards goals that an individual values, regardless of what those goals may be) [26, 28]. Having higher levels of agency may only contribute to individuals deciding to actively participate in sports if they value healthy behavior and view participating in sports as healthy, which may not be the case for everyone. Sports participation has been framed as a cultural practice associated with social position in terms of the types of sports practiced and in terms of the propensity to participate in sports (e.g., [69, 70]). There may be educational inequalities in the extent to which sports participation is valued as a goal in the Netherlands, where educational differences in the expected outcomes of and intentions for sports participation were observed [5]. Future research could consider how agency specific to sports- or physical activity-related goals helps explain educational inequalities in sports participation by using goal-specific measures of agency, which may reveal different relationships than when conceptualizing agency as having open conditionality.

Though not through individual agency, structurally based resources helped explain educational inequalities in sports participation. These findings demonstrate the importance of a certain type of structural mechanism: structurally based resources conceptualized in line with Bourdieu. Participating in sports often requires an investment of resources, which those with more education may be better able to make because they have more resources at their disposal. This investment could take many forms, including monetary (e.g., fees to rent a tennis court), related to having stable housing in a neighborhood with clean, safe spaces to play sports in, or even related to cultivating relationships with people who encourage you to play sports and an interest in sports in general. The insights from this study add to a growing body of empirical research applying Bourdieu's theory of capital that views resources beyond economic and material resources as important drivers of educational inequalities in physical activity [52, 72–76]. Structurally based resources explained a substantial proportion of the relationship between educational level and sports participation, though a majority of this relationship remains unexplained by the mechanisms considered in this study. We focused on resources and agency at the individual level. Structural mechanisms at the area level, such as sports facilities that correspond with the cultural preferences for sport in a neighborhood [77], and mechanisms related to collective agency, which is "people's shared beliefs in their collective power to produce desired results" (27, p.75), such as the sway of a local council [78], may also influence educational inequalities in sports participation.

Methodological considerations

This study investigated complex conceptual relationships using a large longitudinal dataset and sequential mediation SEMs, a method that is useful for estimating complex mediation relationships but not yet commonly used in

public health research. Testing our main hypothesis using a sequential mediation SEM allowed us to account for a concrete temporal ordering of educational level, structurally based resources, and sports participation. That said, several methodological choices should be mentioned when interpreting the findings from this study. Ideally, there also would have been a time lag between measurements of individual agency and sports participation, since a change in individual agency may only lead to changes in behavior after some time. This time lag would have increased our ability to interpret our findings as a causal pathway. Because all three agency indicators were only measured in the most recent wave of the GLOBE survey, 2021, we could only control for baseline levels of self-control. Controlling for prior values of all measures of agency may have increased that model's fit to the data, but would be unlikely to have influenced our findings since, in the model without controlling for prior values, individual agency did not mediate educational inequalities in sports participation.

Our measure of individual agency was based on three components: the ability to make choices, the ability to control procedures, and the effective power to achieve chosen results, encompassing both agency freedom and agency achievement. While conceptualizations of agency differ and, within Sen's conceptualization, there are other possible distinctions between components of agency, our measure was based on a theory-based conceptualization and existing instruments [54]. In particular, we propose reflexivity as a useful measure that is a step closer to representing individual effective power, as it measures how individuals reflect on and exercise agency [59, 60]. Effective power, in particular, is challenging to measure and is often excluded from measures of agency [26]. Measures of proxy agency (others acting on an individual's behalf) and collective agency (only achievable by groups) have been developed as measures of effective power [27], though we are not aware of any other existing measures of individual effective power.

Though there are other approaches to measuring structurally based resources, especially social and embodied cultural capital, we chose measures that align with Bourdieu's theory and our previous study (for an in-depth discussion of how we measured the forms of capital, see [41]). Specific to the current study, it is worth considering how relevant structurally based resources measured in 2014 were for behavior in 2021, during the COVID-19 pandemic. For example, many types of cultural participation, a measure of embodied cultural capital, were heavily restricted in the Netherlands during the pandemic. Conceptually, we would expect that socioeconomic inequalities in physical activity (and sports participation) widened during the pandemic, and that differences in structurally based resources may have played an especially important role in these inequalities. This is because access to resources, such as a house with ample space to exercise in, may have been especially important for sports participation during lockdowns. There is indeed evidence that the pandemic widened socioeconomic inequalities in physical activity in the Netherlands [79]. In a sensitivity analysis to check how the pandemic may have influenced our findings, including how respondents felt the COVID-19 crisis influenced their financial situation did not modify the estimated relationships between educational level, structurally based resources, individual agency, and sports participation.

Implications for research and policy

Our application of the concept of individual agency from Sen's capability approach, and the resulting conceptual and operational uncertainties, suggests that more work may be needed to measure all facets of individual agency and explore if and how it is related to educational inequalities in sports participation. Future studies could measure whether individuals experience a sense of agency regarding specific goals related to sports participation, a measure that would account for the open conditionality of agency. In our study, we used data from two time points, though longitudinal data from more time points would allow researchers to investigate how agency and structure are related over time. Indeed, it is likely that structure not only shapes individual capacity to act, but that over the longer term, individual and collective actions can contribute to the maintenance of structure, forming a reinforcing feedback loop between behavior, structure, and agency [80].

The findings from our study also indicate that Bourdieu's theory of capital remains an important lens through which to view resources and how they shape behavior. In this study, we considered how people's economic, social, and embodied cultural capital helped explain educational inequalities in sports participation in terms of overall, combined structurally based resources and separate types of resources (in the follow-up analyses). While several studies exist on the association of the forms of capital with health and health behavior [52, 74–76], to our knowledge, only one other study has investigated how all three forms of capital help explain educational inequalities in health behavior [73]. Bourdieu emphasized that the forms of capital are interlinked in how they shape behavior [24], and, in a previous study, we found that economic and social capital were conditional on each other in their associations with sports participation [41]. Future research could build upon the findings from our previous study and this study by investigating how the forms of capital are interlinked in their influence on educational *inequalities* in sports participation.

While the aim of this study was to better understand theory-driven mechanisms, we provide a general recommendation for policy based on our findings. Structurally based resources, including economic, social, and embodied cultural resources, may play an especially important role in educational inequalities in sports participation, so removing barriers to sports participation for those with less education could be an effective way to reduce these inequalities. While more research is required, we recommend that policymakers consider going beyond addressing economic barriers and aim to alleviate social and cultural barriers to sports participation.

Conclusions

In this study, we applied the concepts of structurally based resources from Bourdieu's theory of capital and individual agency from Sen's capability approach to gain a deeper understanding of how structure- and agency-related mechanisms help explain educational inequalities in sports participation in the Netherlands. Structurally based resources played an important role in explaining why those with more education were more likely to participate in sports. Having more structurally based resources was associated with higher levels of individual agency, but individual agency was not related to sports participation. More research is needed on the conceptualization and measurement of individual agency. Specifically, measures of individual agency that capture goals specifically related to sports or physical activity may provide different insights into whether and how people exercise their agency towards well-being-related behavior. Our findings reiterate existing recommendations to remove barriers to sports participation, and we propose that social and cultural barriers should be addressed in addition to the often-addressed economic and physical barriers.

Abbreviations

GLOBE	Dutch acronym for "Health and Living Conditions of the Population of Eindhoven and surroundings"
ISCED	International Standard Classification of Education
NA	Missing values
SD	Standard deviation
SEM	Structural equation model
SQUASH	Short QUestionnaire to ASsess Health-enhancing physical activity

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12939-024-02303-3.

Additional file 1. GLOBE survey questions that compose the measures used in the analysis.

Additional file 2. Results from SEMs with control for prior sports participation or prior individual agency.

Additional file 3. Results from SEMs with separate measures of structurally based resources or individual agency.

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Authors' contributions

ALM, CBMK, MB, and FJvL developed the study conceptualization and design and curated the data used in the study. AM conducted the formal analysis of the data and wrote the first draft of the manuscript. All authors contributed to the interpretation of the findings and critically revised the manuscript. All authors read and approved the final manuscript. Each author agrees to be personally accountable for their own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Data availability

The dataset generated and/or analysed during the current study is not publicly available due privacy regulations but is available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted according to the guidelines laid down in the Declaration of Helsinki. The use of personal data in the GLOBE study is in compliance with the Dutch Personal Data Protection Act and the Municipal Database Act, and the study has been registered with the Dutch Data Protection Authority (number 1248943). The 2021 wave of the GLOBE study was approved by the Ethics Committee of the Faculty of Social and Behavioural Sciences of Utrecht University (number 21–0355), and all study participants provided active informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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