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Does sport-participation improve health? A panel analysis on the role of educational attainment, economic deprivation and work–family load

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ABSTRACT

In this study, we analyze the connection between a person's sport-participation and reported subjective health. We hypothesize that this relationship may be affected by educational attainment, economic deprivation and work–family load in two manners. First, these resources may function as common determinants of health and sports participation causing a spurious effect. Moreover, they may moderate this relationship as physical activity might be more beneficial for groups that experience a lack of resources. Our second goal is to study differences between people, and also to investigate developments within individuals' life courses. In doing so, a stronger claim on causation is feasible. The NETHERLANDS Longitudinal Lifecourse Study (NELLS) 2009/2013 on the Dutch population of 15–45 years is used to test our hypotheses with cross-sectional and fixed effects models. Our results show that men and women who have a higher sports frequency report better subjective health, but for women differences in subjective health are partially explained by education, economic deprivation and work–family load. We hardly find moderating effects of these particular resources. This underscores that sport participation is beneficial among members of all educational groups, with various work–family loads and for both people in wealth and poverty.

KEYWORDS

Self-rated health; sport participation; fixed-effect models; panel research; personal resources

1. Introduction

'There are probably few ideas which are as widely and uncritically accepted as that linking sport and exercise with good health' (Waddington, Malcolm, & Green, 1997, 165). Indeed, research often illustrates that participating in sport holds beneficial effects for both physical and mental health (e.g. Eime, Young, Harvey, Charity, & Payne, 2013; Ferron, Narring, Caudey, & Michaud, 1999; Fox, 1999; Green, Smith, & Roberts, 2005; Ransford & Palisi, 1996). It is argued that physical activity results in an improvement of the physical state, enhances confidence and self-esteem, and boosts social and cognitive

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development (Bailey, 2006; Das & Horton, 2012; WHO, 2010; Wicker & Frick, 2015). Contrarily, a lack of sport-activity is linked to higher rates of mortality and obesity, and higher risks of diseases, like diabetes and (some) cancer (Bauman, 2004; Fox, 1999). Consequently, sport-participants often report better health conditions than those who do not participate in sports (Hildebrandt, Chorus, & Stubbe, 2010).

The relationship between sports and health, however, may be understood as less straightforward than often suggested. Both sport-participation and a person's health relate to opportunities and restrictions in life, such as economic, social and cultural resources, and aspects of time-pressure (Kraaykamp, Oldenkamp, & Breedveld, 2013; Mackenbach, Bakker, Kunst, & Diderichsen, 2002). Individual differences in the availability of such resources therefore play an important role, for they are common determinants of both sport-participation and a person's health situation, possibly even leading up to the conclusion that the sport-health association is a spurious one. In addition, individual aspects may also moderate this relationship; sports participation may be more beneficial for some individuals than for others, depending on their resources. This conditional way of looking at the sport-health relation until now has been under-examined.

In this article we want to elaborate on these issues and focus on educational attainment, economic deprivation and work-family load as important determinants of both sport-participation and health. We therefore answer the following two research questions: (1) *To what extent do educational attainment, economic deprivation and work-family load explain the relationship between sport-participation and self-rated health?* and (2) *To what extent is the relationship between sport-participation and self-rated health conditioned by educational attainment, economic deprivation and work-family load?* We study self-rated health, as this measure includes both objective and subjective aspects that may be related to more frequent sports participation.

Previous population studies on the relationship between sport and health are often based on cross-sectional data (for exceptions: Vuillemin et al., 2005; Wendel-Vos, Schuit, Tjihuis, & Kromhout, 2004). One, however, needs to be cautious when inferring causality from non-longitudinal research (Bize, Johnson, & Plotnikoff, 2007). When sport-participants report better health, cause and effect are not clear-cut, as bad health is often named as a barrier for not participating in sport (Hildebrandt et al., 2010). So, often there is no way to determine whether sports leads to better health, or that people in good health more often practice sports. In our contribution we use panel data from the Netherlands Longitudinal Lifecourse Study (NELLS) to deal with causality issues more accurately. This recent panel study (wave 1, 2009; wave 2, 2013) enables us to analyse the effects of changing behaviours (e.g. in sport-participation) and changes in (experienced) health. So, selection into sports due to health conditions is more adequately dealt with. Moreover, in so-called fixed effect models, it is possible to deal with the issue of unobserved heterogeneity.

2. Theory and hypotheses

To investigate the relationship between sport-participation and self-rated health, we derive hypotheses from a sociological perspective, focussing on an individual's resources and restrictions. We specifically employ educational attainment, economic

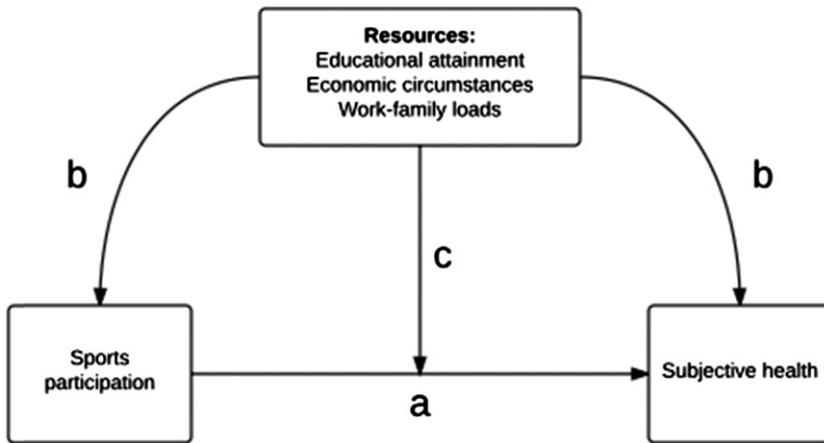


Figure 1. Heuristic model.

deprivation and work–family load as shared determinants. Additionally, resources and restrictions may function as moderators, enhancing the health benefits of sport-participation only for some. Figure 1 displays a visual representation of the relationships we will discuss and investigate in our research.

2.1. Sports participation and health

A positive association between sport-participation and health is broadly accepted (Bauman, 2004; Bize et al., 2007; Ferron et al., 1999). In their much cited review article, Warburton, Nicol, and Bredin (2006) stated that they found ‘incontrovertible evidence that regular physical activity contributes to the primary and secondary prevention of several chronic diseases and is associated with a reduced risk of premature death’ (p. 807). When assessing the sport–health relationship from a sociological perspective, the focus often is on a person’s subjective health or wellbeing. Respondents’ reporting on their health situation appear to provide strong predictors of mortality (Idler & Benyamini, 1997).

Studies investigating the influence of sport-participation on subjective health show positive effects. A recent contribution of Kantomaa, Tammelin, Ebeling, Stamatakis, and Taanila (2015) indicates that high levels of physical activity and cardiorespiratory fitness are positively related to adolescents’ self-rated health. Similarly, Ransford and Palisi (1996) and Vuillemin et al. (2005) show that exercise improves a person’s self-evaluation of health. Eime et al. (2013) argue that ‘it is widely acknowledged that the health benefits of participation in physical activity [...] also incorporate mental components’ (2). It also is argued that sports sometimes prevents stress and depression, and gives people the perception of being healthy (Fox, 1999). Several researchers, indeed, showed that sport-participation augments feelings of mental well-being (Eime et al., 2013; Fox, 1999; Ransford & Palisi, 1996; Wicker & Frick, 2015). So, being active in sport may be perceived as a form of physical and mental training that stimulates a healthy body and mind (Figure 1, arrow a). Our main hypothesis therefore reads: *A higher sports participation increases a person’s subjective health.*

2.2. Resources as common causes of the sport-health association

When taking a closer look at the relationship between sport-participation and self-rated health, resources and restrictions may function as common causes affecting both sport-participation and health. If these were true, the association between sport and health would be a spurious one, implying no 'actual' relationship between sport and health. We elaborate on this issue by looking at a person's resources as three possible common causes (Figure 1, arrow b).

First, various studies underscore that higher educated are better off in terms of self-rated health (cf. Furnée, Groot, & Maassen van den Brink, 2008; Gesthuizen, Huijts, & Kraaykamp, 2012; Ross & Wu, 1995). This phenomenon is explained by various factors, ranging from the higher educated living in safer neighbourhoods, performing less physically heavy and dangerous work, having more resourceful social networks and expressing less dangerous life-styles (e.g. smoking or over-eating). On the other hand, education is also strongly related to being active in sports (Hoekman, Breedveld, & Scheerder, 2011; Scheerder & Breedveld, 2004). From the work of Bourdieu (1978), it follows that the higher educated more frequently hold dispositions that makes it more likely for them to engage in sports activity. Being active in sport is consistent with the preferences of the higher educated because it exemplifies virtues and behaviours that they regard as valuable (Wilson, 2002). So, educational attainment may stimulate both sport-participation and a person's health status. Our second hypothesis therefore is: *The positive association between sport-participation and subjective health may (partly) be explained by a person's educational attainment.*

Secondly, adverse economic circumstances may affect both sport-participation and a person's health situation. Prior research indicates that economic deprivation negatively influences health in at least three ways. To begin, economic hardship may result in stress because of problems related to making ends meet (Ettner, 1996). Next, it is presumed that a healthy lifestyle is costly, which makes it more difficult for those in financial adversity. Especially, healthy food choices and diet costs seem related to limited financial means (Drewnowski & Darmon, 2005). Also, economic deprivation may hamper a person's access to (preventive) health care (Van Doorslaer, Masseria, & Koolman, 2006). As a consequence, medical problems may be detected later (delaying treatment) or left untreated. The relationship of financial adversity with sport-participation is obvious, for being active in sports brings costs for subscription, clothing and equipment, and travelling (Coalter, 1993; Taks, Renson, & Vanreusel, 1994; Wilson, 2002). All in all, economic hardship may lead to less participation in sports and at the same time affect a person's health negatively. Therefore, our third hypothesis states: *The positive association between sports participation and subjective health may (partly) be explained by a person's economic circumstances.*

Thirdly, time pressure due to combining labour participation and family commitment may affect both sport-participation and a person's health. It seems likely that time pressure leads to higher stress levels with its apparent consequences for self-rated health (Eime et al., 2013; Van der Lippe, Jager, & Kops, 2006). However, people who combine various tasks may also be more capable in handling potentially stressful situations. Moreover, both family care and paid labour provide revenues (e.g. status, love, affection) that may augment a person's well-being (Grzywacz & Marks, 2000;

Sieber, 1974). Having time pressure may affect a person's sport-participation, as well. Combining both labour participation and family care may indicate lower participation in leisure time activities (Folbre & Bittman, 2004). The latter is mentioned often as a reason (or excuse) for not engaging in sports (Taks et al., 1994). So, our fourth hypothesis is: *The positive association between sports participation and subjective health may (partly) be explained by a person's work and family obligations.*

2.3. Resources as moderators of the sport-health association

Next to resources being common causes, individual resources may function as moderators as well, indicating that these resources enhance the health benefits of sports participation for some people, but not for all (see Figure 1). To address this issue, we investigate for which individuals the association between sport-participation and health is most prevalent. Again, we study a person's resources as three possible moderators of the relation between sport-participation and health (Figure 1, arrow c).

First, a person's educational attainment may be influential. As stated above, education goes together with all kinds of behaviours and preferences that are beneficial to a person's health (Gesthuizen et al., 2012; Ross & Wu, 1995). As a consequence, the higher educated may not gain much more from intensive physical activity. In contrast, for the lower educated, sport-participation may compensate for more frequent risky behaviours such as smoking or over-eating. So, we expect that for the lower educated sport-participation will result in more health gains. Our fifth hypothesis reads: *The positive association between sport-participation and subjective health is larger for lower educated than for higher educated.*

Next, a lack of adequate financial resources may cause stress and may have negative consequence for one's health (Ettner, 1996). Sport-participation, on the contrary, is often mentioned to be stress relieving; next to physical benefits, it may boost a person's mental wellbeing (Eime et al., 2013; Ransford & Palisi, 1996). Although for people in an adverse economic situation some sports may be too costly (Coalter, 1993; Wilson, 2002), it may be an important factor in improving one's feelings of health, especially compared to people in wealthy circumstances. Our sixth hypothesis is: *The positive association between sport-participation and subjective health is larger for people in adverse economic circumstances than for people in wealthy circumstances.*

Finally, having enough leisure time may be considered a precious and limited resource (Kraaykamp, van Gils, & van der Lippe, 2009; Van der Lippe et al., 2006). Several developments, among which female labour participation, rising productivity, and more equal divisions of caring, have increased work-family loads (Folbre & Bittman, 2004). Multiple loads theory implies that combining various tasks may lead to higher stress levels with consequences for a person's health (Eime et al., 2013; Grzywacz & Marks, 2000). This is why taking up sports may be beneficial in relieving stress. So, it is presumed that people suffering most from time pressure possibly are the ones profiting to a larger extent from sport-participation, leading to the seventh hypothesis. *The positive association between sport-participation and subjective health is larger for people with high work-family commitment as compared to people low on work-family commitment.*

3. Data

3.1. Data and methods

We test our hypotheses with two waves of the *NEtherlands Longitudinal Lifecourse Study* (NELLS) of 2009 and 2013 (Tolsma, Kraaykamp, de Graaf, Kalmijn, & Monden, 2014). The NELLS consists of a national representative large-scale panel study of 15–45 year olds making it possible to study social dynamics from a life course perspective. NELLS holds extensive information on a person's health status and on sport-participation. A two-stage stratified sampling method was applied. First, a quasi-random selection of municipalities by region and urbanization was taken. Second, a random selection from the population registries was performed. The two largest ethnic minority groups in the Netherlands were purposely oversampled. The NELLS surveying consisted of a face-to-face interview combined with a self-completion or web survey. For our research, we selected 2.829 respondents participating in both waves. The response rate in the first wave was 52%, and in the second wave 75%. We analysed 1120 men (88.7%) and 1364 women (87.0%) after a list wise deletion of respondents with missing information. Robustness analyses leaving out the oversampled ethnic minorities members led to virtually identical results.

3.2. Measurements

For our study, *subjective health* is measured as self-reported health. Answer categories consisted of 'excellent', 'very good', 'good', 'moderate' and 'bad'. We used a scaling from 0 to 4 in which a higher score corresponds with better subjective health. In both waves most respondents report a good to excellent health (91.7% for men and 88.9% for women in wave 1; 91.3% for men and 88.9% for women in wave 2).

Our main explanatory variable is *sport-participation*. In the NELLS-questionnaire respondents could indicate for 10 sports (fitness, jogging, soccer, tennis, field hockey, swimming, martial arts, volleyball, cycling and other) whether they participated '4 times or more per month', '1 to 3 times per month', 'less than once a month' or 'not'. We recoded sporting not at all to 0 times per month (not), less than once a month to 0.5 times per month, 1 to 3 times a month to an average of 2 times a month, and more than 3 times a month to 4 times a month. A scale is constructed adding scores for all 10 sport activities running from 0 to 40. We found an average scale value of 5.2 (wave 1) and 5.0 (wave 2) for men and 4.1 (wave 1) and 4.2 (wave 2) for women. An alternative coding of sports participation of 'more than 3 times a month' into values of 6 or 8 produces similar results.

Educational attainment refers to the highest level completed or the highest level currently following in years, varying from 4 years for not completed primary school to 16.5 years for university. We excluded 57 male respondents (4.8%) and 51 female respondents (3.6%) who reported a decrease in education of more than 2.5 years between the two waves. When in wave 2 respondents reported a decrease of 2.5 years or less, we assigned their educational degree from wave 1. To measure *economic deprivation*, 6 items compassing economic adverse situations were available. Respondents reported whether or not (yes or no) they had experienced the following situations in the past three months: 'being unable to replace broken goods', 'having to

Table 1. Descriptives cross-sectional analyses wave 2 (men = 1120; women = 1364).

	Min		Max		Wave 1				Wave 2			
					Men		Women		Men		Women	
					Mean	SD	Mean	SD	Mean	SD	Mean	SD
Subjective health	0.0	4.0	2.550	0.891	2.400	0.860	2.604	0.918	2.440	0.895		
Sports participation	0.0	40.0	5.224	4.615	4.050	3.725	5.002	4.474	4.175	3.779		
Education (0 = 4 years)	0.0	12.5	7.006	3.293	7.011	3.111	7.632	3.275	7.552	3.115		
Economic deprivation	0.0	1.0	0.108	0.205	0.108	0.204	0.141	0.235	0.136	0.237		
Work–family loads												
No load	0.0	1.0	0.079	0.269	0.098	0.297	0.129	0.335	0.159	0.366		
Child load	0.0	1.0	0.063	0.244	0.466	0.499	0.088	0.284	0.532	0.499		
Work load	0.0	1.0	0.455	0.498	0.349	0.477	0.361	0.480	0.232	0.423		
Multiple loads	0.0	1.0	0.404	0.491	0.088	0.283	0.422	0.494	0.076	0.265		
Age W1(0 = 14)	0.0	35.0	17.738	9.370	17.599	9.080						
Age W2(0 = 14)	5.0	39.0					21.446	9.278	21.285	9.020		
Interview date W1 (0 = 335 days)	0.0	516.0	254.162	157.618	262.683	156.844						
Interview date W2 (0 = 335 days)	1478.0	1809.0					1589.698	92.479	1588.627	91.209		
Ethnicity												
Dutch	0.0	1.0	0.637	0.481	0.632	0.482	0.637	0.481	0.632	0.482		
Western immigrant	0.0	1.0	0.040	0.196	0.054	0.225	0.040	0.196	0.054	0.225		
Non Western immigrant	0.0	1.0	0.323	0.468	0.315	0.464	0.323	0.468	0.315	0.464		
Partner	0.0	1.0	0.694	0.461	0.745	0.436	0.756	0.430	0.770	0.421		

borrow money for indispensable expenses', 'arrear in rent/mortgage or gas/water/light payments', 'having had a creditor or bailiff at the door' and 'having trouble to make ends meet'. Average scores were taken in both waves to construct a scale (both men and women $\alpha = 0.696$ wave 1; men: $\alpha = 0.730$ and women $\alpha = 0.756$ wave 2). The scale ranges from 0 to 1 (being most economically deprived). The measurement of work–family commitment is constructed using information on a person's work hours (more/less than 32 hours), and whether (step) children live at home (yes/no). This leads to four possible work–family load combinations: no work-no children (0), no work-children (1), work-no children (2), and work-children (3). To construct this aspect, we regarded full-time students as working, and people without a paid job as not working.

As controls we include age, ethnicity and partner status. Age is measured as a continuous feature ranging from 14 to 47 years of age. Ethnicity is constructed as Dutch, Western and non-Western. We included partner status as (1) having a partner (married or cohabiting) versus (0) no partner (single, divorced, widowed). Partner status is a time variant characteristic. In our panel analyses we also include an indicator of the time lag (in days) between the two waves. We imputed plausible values for respondents with missing information on day and month (2 female respondents (0.1%)). Information on all variables is found in [Table 1](#).

3.3. Analytical strategy

We performed two types of analyses to gain insight in the roles of educational attainment, economic deprivation and work–family load as common causes and/or moderators. First, we estimated cross-sectional models on data from wave 2 to observe the size of effects and to gain insight in the possibility of a spurious relationship. Second,

Table 2. Descriptives fixed analyses (men = 1120; women = 1364).

			Men				Women			
	Min	Max	Mean	SD	Stable (%)	Decrease (%)	Mean	SD	Stable (%)	Decrease (%)
Subjective health	-4.0	4.0	0.054	0.873	52.232	21.250	0.040	0.879	52.566	22.141
Sports participation	-40.0	40.0	-0.222	4.641	15.179	44.464	0.126	4.134	17.009	41.129
Education	0.0	12.5	0.808	1.616	74.018	0.000	0.709	1.530	77.053	0.000
Economic deprivation	-1.0	1.0	0.034	0.228	60.804	75.893	0.027	0.238	61.070	16.129
Work-family load										
No load	-1.0	1.0	0.050	0.348	87.679	3.661	0.062	0.388	84.604	4.619
Child load	-1.0	1.0	0.025	0.263	93.036	2.232	0.067	0.403	83.358	4.985
Work load	-1.0	1.0	-0.094	0.436	80.089	14.643	-0.117	0.397	82.918	14.370
Multiple loads	-1.0	1.0	0.019	0.379	85.625	6.250	-0.012	0.313	90.176	5.499
Interview date	985.0	1781.0	1335.537	181.317	0.000	0.000	1325.944	176.846	0.000	0.000
Partner	-1.0	1.0	0.063	0.366	86.250	3.750	0.025	0.371	86.217	5.645

we estimated fixed effect models to investigate changes between wave 1 and wave 2, of which descriptive information is shown in Table 2. Fixed effect models are well suited to ascribe changes in experienced health to changes in sport-participation – thereby establishing whether there is indeed a causal relationship between the two, and not merely a correlation. The two above-mentioned analytical procedures elaborate first on differences between respondents and second on differences within (the life courses of) respondents. In the latter case, time-invariant unobserved heterogeneity is ruled out. Therefore, this approach may be seen as a strong test of the sport health association. Men and women are analyzed separately, as mechanisms relating sport-participation to health might be different between the sexes, given that they typically differ on both dimensions (both sport-participation and subjective health (see, e.g. Hoekman et al., 2011).

4. Analyses

4.1. Cross-sectional analyses: differences between individuals

For the linear regression analyses (OLS), we estimate four models. Model 0 contains sports participation ‘predicting’ a person’s health status. Model 1 includes all controls (age, ethnicity and partnership) and in Model 2 we add the three types of resources (education, economic deprivation and work-family load). Finally, moderation is investigated in Model 3 dealing with interactions of sports participation and resources.

Table 3 shows support for our first hypothesis presuming that sport-participation is associated with better subjective health (men $B = 0.049$; women $B = 0.039$). A comparison between a non-sport-participant (score 0) and the most intensive sport-participant (score 40) shows a health difference of 1.96 for men (40×0.049) and 1.56 for women (40×0.039). Model 1 includes the control variables and shows for both men and women that older respondents, non-Western migrants, and people without a partner hold significant lower subjective health conditions. Although the relationship between sport-participation and health declined moderately (men 12.2%; women 12.8%), a significant association remains.

Our hypotheses on resources being common causes are tested in Model 2 compared to Model 1. For men, it shows that including educational attainment, adverse

Table 3. Cross-sectional (OLS) linear regression analysis, B-coefficients, on subjective health (Men = 1120; Women = 1364).^{a,b}

	Men						Women									
	Model 0		Model 1		Model 2 ^a		Model 3 ^b		Model 0		Model 1		Model 2 ^a		Model 3 ^b	
	B	SD	B	SD	B	SD	B	SD	B	SD	B	SD	B	SD	B	SD
Intercept	2.358***	0.040	2.762***	0.085	2.384***	0.132	2.369***	0.168	2.279***	0.036	2.726***	0.078	2.521***	0.114	2.709***	0.142
Sports participation	0.049***	0.006	0.043***	0.006	0.040***	0.006	0.040*	0.021	0.039***	0.006	0.034***	0.006	0.026***	0.006	-0.018	0.021
Age			-0.020***	0.003	-0.018***	0.003	-0.017***	0.004			-0.023***	0.003	-0.021***	0.003	-0.021***	0.003
Ethnicity (Ref. Dutch)																
Western immigrant			0.125	0.134	0.155	0.133	0.161	0.134			0.077	0.105	0.054	0.103	0.062	0.104
Non Western immigrant			-0.159**	0.057	-0.031	0.060	-0.028	0.060			-0.196***	0.052	-0.108*	0.053	-0.107*	0.053
Partner			0.135*	0.067	0.067	0.072	0.061	0.072			0.150**	0.059	0.081	0.061	0.081	0.061
Education					0.032***	0.008	0.020*	0.012					0.017*	0.008	0.000	0.011
Economic deprivation					-0.393***	0.117	-0.447**	0.164					-0.688***	0.102	-0.772***	0.139
Work-family load (Ref. no)																
Child load					0.009	0.123	0.195	0.169					0.176**	0.070	0.107	0.097
Work load					0.181*	0.087	0.318**	0.135					0.248***	0.077	0.247*	0.117
Multiple loads					0.222**	0.093	0.310*	0.134					0.401***	0.103	0.310*	0.149
Sports* Education							0.003	0.002						0.004*	0.002	0.002
Sports* Economic dep.							0.008	0.023						0.020	0.026	0.026
Sports* Child load							-0.041	0.027						0.018	0.017	0.017
Sports* Work load							-0.026	0.019						0.001	0.020	0.020
Sports* Multiple loads							-0.015	0.019						0.022	0.027	0.027
R square	0.057		0.098		0.136		0.140		0.026		0.08		0.131		0.135	

^aWhen including education, economic deprivation and work-family load in separate models, the effects differ only little from the ones presented in model 2 and remain significant.

^bWhen including the moderator variables in separate models, the effects differ only little from the ones presented in model 3 and remain insignificant, which is an exception.

Significance one-tailed:

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.

economic circumstances and work–family circumstance only decreases the estimate of sports participation by 7.0%. For women, 23.5% of the initial effect of sport is mediated. So, it seems that these three factors taken together partly explain the relation between sport and subjective health especially for women. Educational attainment holds a significant positive main relationship with health status mostly for men (men $B = 0.032$; women $B = 0.017$), whereas economic adverse circumstances relates negatively, especially for women (men $B = 0.393$; women $B = 0.688$) to subjective health. Contrary to what we expected, people with a high work–family load report a significantly better subjective health compared to those without work and children. Testing mediation by the three resources separately, we find that educational attainment mediates the sport–health association by 7.0% for men and 11.8% for women and that economic adversity did not explain any part of this relationship for men, but explained 11.8% for women. Work–family loads explained a mere 2.3% of the sport–health association for men, but as much as 8.8% for women. Concluding, the relationship between sport–participation and health is mediated by our proposed common causes foremost for women, while for men this relationship remains rather unchanged by the inclusion of the three common causes.

A small moderating effect of education on the relationship between sport–participation and subjective health is found for women in Model 3; an increase in subjective health of 0.05 ($12.5 * 0.004$) is found between the lowest educated and highest educated for one scale point increase in sport–participation. Apparently, sport–participation is slightly more beneficial for the subjective health of higher educated women, than for lower educated women, which contradicts our fifth hypothesis. The absence of this relationship for men leads to a rejection of our fifth hypothesis. The moderating effects of economic deprivation and work–family loads are not significant, so we cannot confirm our sixth and seventh hypotheses which stated that the relationship between sport–participation and health would be stronger for those who are more economically deprived and those with a single or multiple load, respectively.

4.2. Fixed effects analyses: differences in individual life courses

We use fixed effects models to fully exploit the advantages of our panel information and go beyond merely correlating sport–participation with health. We estimate the effects of change in health within the life courses of respondents, while time-invariant variables, even all unmeasured influences, are controlled for: measured variables that do not change over time drop out of the model because their difference term is always zero. It follows that the B coefficients in the fixed effects models (Table 4) are based on the change values for each variable between wave 1 and 2. In the empty model, we present the effect of a change in sport–participation on the change in health, followed by adding time-variant control variables in model 1 (interview day and having a partner) and time-variant resources in model 2 (educational attainment, economic deprivation and work family load). We no longer study moderating effects, as these appear minor in our cross-sectional analyses and interpretation of such effects in fixed effects models are rather complex.

The results presented in Table 4 show that when an individual increases his or her sport–participation over time, a significant positive change in subjective health

Table 4. Fixed effects estimates, B-coefficients, on subjective health (men = 1120; women = 1364).^a

	Men						Women					
	Model 0		Model 1		Model 2 ^a		Model 0		Model 1		Model 2 ^a	
	B	SD	B	SD	B	SD	B	SD	B	SD	B	SD
Intercept	3.902***	0.436	3.820***	0.441	3.765***	0.458	2.865***	0.441	2.871***	0.446	2.822***	0.456
Sport	0.020***	0.006	0.020***	0.006	0.020***	0.006	0.017**	0.006	0.017**	0.006	0.016***	0.006
Interview day		0.000	0.000	0.000*	0.000	0.000		0.000	0.000	0.000	0.000	0.000
Partner			0.052	0.071	0.05	0.072		-0.024	0.064	-0.033	0.064	
Education					-0.011	0.015					0.019	0.014
Economic deprivation					-0.144	0.115					-0.353***	0.100
Work family load												
Child load					-0.017	0.127					-0.039	0.081
Work load					0.077	0.077					-0.001	0.067
Multiple loads					0.111	0.101					0.051	0.101

Significance one-tailed:

* $p < 0.05$;** $p < 0.01$;*** $p < 0.001$.^aWhen including education, economic deprivation and work-family load in separate models, the effects differ only little from the ones presented in model 2.

condition is reported (men $B = 0.020$; women $B = 0.017$), even though the fixed models rule out any time-invariant influences. Both the empty model and model 1, which include effects of interview date (time effect) and partner, show that a maximum change in sport-participation (40 scale points) results in an 0.80 (40×0.020) scale-point change in subjective health for men, and 0.68 (40×0.017) for women. The control variables indicate that men and women have a rather stable subjective health condition over time and that a change in partnership status does not significantly affect their subjective health. In model 2 with (changes in) all resources added, we see that a change in education and a change in work-family loads over time both lack a significant effect on subjective health for both men and women. However, women who experienced an increase in economic deprivation over time report a significant poorer health condition than 5 years ago ($B = -0.353$), whereas for men this effect is absent. Nonetheless, across all three models, the effect of a change in sport-participation remains fairly stable as there is no reduction in effect for men and only a 5.9% reduction for women.

5. Conclusion and discussion

5.1. Conclusions

The aim of our study was to investigate the relationship between sport-participation and health from a sociological perspective, and to go beyond traditional correlation analyses to demonstrate possible causal relationships. Firstly, we looked at whether resources available to individuals function as determinants for both a person's subjective health and for sport-participation, turning the relationship between the two into a possibly spurious effect. Moreover, we looked for the possibility of moderating effects by resources as for some people sport-participation might be more beneficial than for others. Secondly, we investigated changes over the life course of individuals

to eliminate the selection into healthy lifestyles based on unobserved heterogeneity and gain more insight in the causality of sport-participation and health outcomes.

Summarizing our results, we first conclude that, in line with previous research, sport-participation goes along with improvement in health. However, not only do people who participate in sport more frequently report better subjective health conditions than people who are less active in sports, we could ascertain that it is indeed an increase in sport-participation that determines a positive change in subjective health (rather than vice versa).

Our next point of interest, with which we advance upon previous research, was the inclusion in our models of relevant resources in the domain of sports and health. The lower educated and economically deprived, indeed, show worse levels of subjective health. Regarding work–family loadings, having children, a full-time job or both appears to be beneficial for subjective health, contradicting our theoretical thoughts on having multiple loads. Possibly, social and emotional support is gained by paid work and by family members, thereby buffering the stress of performing multiple social roles. Ultimately, all three resources together partly explain the relationship between women’s sport-participation and subjective health, while the effect of sport-participation remains virtually unaltered for men’s subjective health. So, in the end some indications of a spurious relationship is only present when comparing women. In our fixed effect analyses, however, neither men’s nor women’s relationship between sport-participation and subjective health is explained by changes in resources. This leads us to believe that possible health benefits of sport-participation are rather persistent, and are (in our research) not explained by alternative factors.

The final contribution of our study regards the assumed moderating influence of resources as some people might benefit more from sports participation than others. We must conclude that we found little or no such differences. Some studies indicated that higher educated women profit more from sports (i.e. diverging differences). This might be due to the idea that higher educated women have more knowledge about the positive outcomes of sport-participation, so they induce feelings of being more healthy.

5.2. Discussion and future research

Although there are many advances of using NELLS panel data, there are several limitations that need to be mentioned. Firstly, our study focuses on the age group of 15–45 years in the Dutch population, while experienced health issues obviously are more prevalent among age groups older than 45. Next, when investigating the relationship between sports and health, researchers must be aware of possible health benefits caused by feeling healthy and reduced feelings of vulnerability, rather than explicit benefits from sports-participation (Ransford & Palisi, 1996). An incorporation of more objective measures of health next to subjective indications might give more insight in the actual improvement of physical health.

In measuring sports-participation, we were unable to make a detailed distinction in types of sports (e.g. team sport or individual sport), or in intensity of the physical activity. This prevents us from studying the effects of sport participation in great detail, since in the NELLS data the highest sport participation category is limited to ‘four

times a month or more'. In addition, we could not study possible effects of the social context of sports (club-membership), or of the type of sports accommodations (indoor, surfaces, etc.). Future research could therefore strive for a more detailed registration of types of sports and frequency/intensity of participation to deal with these issues.

Future research could also address the inclusion of more resources which possibly explain the relationship between sports-participation and health, for example, the social networks of individuals and life transitions linked to a change in resources. Also, competing leisure activities (e.g. watching television or internet use) could be incorporated, as these too might influence one's (time for) sport-participation and a person's health condition, thereby functioning as a possible common predictor.

With our research we have made a first effort to establish that the positive association between sport and subjective health is robust (not spurious), and relates to sports-participation causing health improvement. From our study, it follows that indeed intensive sport-participation leads to reporting a better subjective health status. This might make policy makers aware that indeed stimulation of sports participation among the population induces substantial health effects.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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