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Closed due to COVID-19: effects of indoor sports restrictions on suburban adults' physical activity behaviours

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ABSTRACT

During the COVID-19 pandemic, people have been required adaptations in leisure-time physical activity (PA) especially due to restrictive policies concerning indoor sport facilities (ISF). This study investigated the effects of the constraints on ISF among residents of two low socioeconomic status suburbs in Finland. Research questions were: (1) Are sociodemographic characteristics associated with a reduced use of ISF during the pandemic? (2) Are sociodemographic characteristics associated with changes in the overall PA amount among those respondents with a reduced use of ISF? (3) Is the reduced use of ISF associated with an increased use of other PA environments (home environment, built outdoor facilities, unbuilt nature, and streets)? Three rounds of survey data (December 2020, February 2021, and June 2021) were collected (total $n = 738$) and analysed using descriptive statistics and binary and multinomial logistic regressions. A risk of reduced use of ISF was associated with the female gender, higher education, and higher reported PA level. Among those who had reduced their use of ISF, a decrease in overall PA was associated with the female gender and a non-native language. In general, PA declined, but indoor PA was often replaced through other environments. The constraints on ISF seem to not have intensified the socioeconomic polarisation of PA. Versatile PA environments available in the suburbs may have mitigated the negative effects. Public sport administration should continue to pay attention to the provision of diverse PA environments.

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Physical activity; physical activity environment; indoor sport facility; sociodemographic; suburb; COVID-19

Introduction

Since the early spring of 2020, efforts to constrain the COVID-19 pandemic have influenced people's physical activity (PA) in various ways and to varying degrees. Notable changes in the amount and modes of adults' PA have been reported in many regions around the world (Stockwell *et al.* 2021). Studies have also found differences between population groups in the effects on PA (e.g., Smith *et al.* 2020, Grocke-Dewey *et al.* 2021). Concern about health disparities has grown as a result (World Health Organization 2020). Moreover, the crisis has intensified discussion about resilience, which entails the capacity to adapt to adverse conditions, cope with disturbances, and recover from them (Ziglio *et al.* 2017). The exceptional conditions have generally required coping resources as well as abilities and strategies to adapt to find new opportunities for PA (Forsyth *et al.* 2021, Mutz and Gerke 2021). Among the most decisive factors structuring PA behaviours during the pandemic has been

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the limited choice of places to engage in it. Restrictive policies have mostly concerned the use of public indoor sport facilities (ISF), although all activity in public spaces has been affected to varying degrees by recommendations and precautions (Hasson *et al.* 2021).

Before the pandemic, ISF were increasing their popularity among Europeans as one of the main PA environments (Special Eurobarometer 2018, pp. 39–42). Considering its role in people's PA, the need to restrict indoor sports has created a cluster of problems for sport service providers. In Finland, this has concerned especially the public sector which is mainly responsible for PA environment (Act on the Promotion of Sports and Physical Activity 2015/390). During the early stages of the pandemic, public indoor sport facilities were closed for nearly all users based on decisions made by the Finnish government (Finnish Government 2020). As epidemiological knowledge has become more detailed, regional and local authorities have had more responsibility regarding restrictive policies on sport services. Simultaneously, public discussions about the justification and far-reaching consequences of these policies have intensified. A recurring concern in public discussion has been that the negative impacts of the pandemic and the restrictive measures on PA behaviours, as well as on the functions of sport service providers and sport clubs, may be long-standing.

Sport planners have been required to provide both rapid responses and impact assessments in situations where reliable information on the efficiency and effects of different restrictive measures has been scarce. The scientific community was not prepared to answer proactively to the knowledge needs, however, retrospective assessment is a feasible and necessary task. By forming study designs that enable following the effects, it is possible to produce information supporting sport service providers in their efforts to prepare for similar crisis situations and the long-term effects of restrictive measures (Evans *et al.* 2020, Smith and Skinner 2022).

To provide more knowledge on the effects of the COVID-19 pandemic and the related policy measures, the present study focuses on changes in PA behaviours in connection with the limited access to ISF. With a specific interest in social disparities, we investigate whether sociodemographic characteristics explain the impacts on PA. The target of the investigation are the residents of two low socioeconomic status (SES) suburbs in Finland. We seek to answer who have been most affected by the constraints on ISF and whether the PA level of any group of people is more vulnerable to the constraints. Moreover, we examine where people sought compensatory environments for PA. In the background section, we present the framework and context in more detail, placing the study among recent sport scholarship. The context is defined further when introducing the study areas.

Background

The context of Finland

Engaging in PA in ISF is relatively common among Finnish adults, along with the popularity of outdoor PA. Before the pandemic, almost two-thirds of the population aged 15–74 reported having engaged in exercise, sports or outdoor recreation at least once a week (Mononen *et al.* 2019). The most popular forms of PA included many indoor activities, such as gym training, fitness exercise, water sports and yoga, as well as walking, cycling, cross-country skiing and running outdoors (Mononen *et al.* 2019, pp. 20–22). In international comparison, the percentage of Finnish adults performing health-enhancing PA in a typical week (28,2%) was the third highest in Europe and well above the EU average (13,6%) in 2019 (Eurostat 2022). Also, the percentage of Finnish adults with an insufficient PA amount (16,6%) was the lowest among high-income Western countries (averaging 36,8%) in 2016 (Guthold *et al.* 2018).

ISF have been more popular in Finland than in EU countries on average, and also the increasing trend is more observable (Special Eurobarometer 2018, pp. 39–42). In 2017, 25% of Finns used health or fitness centres and 19% sport centres (Special Eurobarometer Factsheets Finland 2018, p. 3). Gyms and swimming halls have been the most commonly used ISF and also increased their amount of regular users most (Suomi *et al.* 2012, pp. 71–72). Green areas such as forests, trails, and parks were

the most popular PA environment and saw approximately a third of Finnish adults' leisure-time PA (Borodulin *et al.* 2011). About a quarter took place in the home environment and another quarter in built outdoor environments, usually on pedestrian streets and cycle paths or built outdoor sport facilities such as cross-country skiing tracks and ball fields. The role of the Finnish public sector is important for ISF as it is obliged by law to promote PA, essentially by building and maintaining PA environments (Act on the Promotion of Sports and Physical Activity 2015/390). Municipalities own most ISF and built outdoor facilities, and private companies own approximately a tenth of facilities, most commonly gyms (Vehkakoski and Salmikangas 2021).

Pandemic-related restrictions have been relatively mild in Finland (The Oxford Covid-19 Government Response Tracker 2022), but PA has nevertheless been affected by varying official closures and restrictions, mainly concerning ISF and organised PA, and by other efforts to limit social encounters. Research from autumn 2020 showed a pandemic-related decrease in the daily amount of PA among 22% of Finnish adults and an increase among 15% (Parikka *et al.*, 2020). In addition, active travel among working-age adults decreased (Jousilahti *et al.*, 2020).

Physical activity environments during the pandemic

Previous research into adults' use of PA environments during the COVID-19 pandemic has highlighted some general trends that are significant for PA levels. First, reduced use of ISF is evident and seen as a major reason for a decrease in leisure-time PA (Folk *et al.* 2021, Mutz and Gerke 2021). Second, several studies have noted the importance of the home environment for exercise during the restrictions (e.g., Dunton *et al.* 2020, Rhodes *et al.* 2020, Mutz and Gerke 2021). Moreover, an increase in active travel (Cross *et al.* 2021) and being active on neighbourhood roads or in green areas (Dunton *et al.* 2020) have been linked to higher odds of being physically active during the pandemic. Studies have also noted an increased use of green areas for recreational PA (e.g., Day 2020, Schweizer *et al.* 2021) and stressed the role of green areas for promoting resilience (e.g., Venter *et al.* 2020, Larson *et al.* 2021).

There are few studies concerning PA environments during the pandemic in Finland, and they focus on the elderly. During spring 2020, a majority of the elderly had either maintained or increased their amount of walking in outdoor environments and almost 40% increased their amount of exercise at home, but clear reductions were seen in gym training, aquatic exercise, and group exercise (Sipilä *et al.* 2020). The elderly also reported markedly fewer activity destinations (Portegijs *et al.* 2021). Otherwise, there is a lack of pandemic-related research involving Finnish adults' use of PA facilities.

Role of sociodemographic characteristics

Promoting opportunities for PA participation equally for all is a central policy aim in European countries (Hoekman and Scheerder 2021), nevertheless, social stratification in participation is evident and persistent (Hoekman *et al.* 2011, Scheerder and Vos 2011). From the perspective of social sciences, social differences in PA behaviour are connected with the social structural context, where factors such as material resources, social position and cultural background influence not only individuals' choices but also their opportunities for PA (e.g. Kay 2016, Strandbu *et al.* 2019). Low SES as a polarising factor calls for particular attention, as studies from pre-pandemic times in Finland and elsewhere have associated it with lower PA levels (e.g. O'Donoghue *et al.* 2018, Borodulin *et al.* 2020, Gidlow *et al.* 2021). Moreover, in Finland, PA in ISF has been most common among people with a higher SES (Borodulin *et al.* 2011) and higher educated Finns have engaged in a wider range of sports (Mononen *et al.* 2019, pp. 12–13).

Public policy efforts in Europe also appear to have been unable to change the patterns of unequal participation between age groups and genders: the elderly and women have lower sport participation levels in many countries (Volf *et al.* 2022). Engaging in weekly health-enhancing exercise

decreases with age also in Finland, although not as drastically as in most other EU countries (Eurostat 2022). The difference between men and women in Finland has also been smaller than average. In fact, when looking at engaging in leisure-time PA within a year, it has been more common for women than men, and women have also engaged in a higher number of different activities (Mononen *et al.* 2019, pp. 10–14). Moreover, despite efforts to increase ethnic equality in sports (Itkonen 2020, pp. 23–24), ethnic minority background is connected to lower participation, most notably among women (Walseth and Fasting 2004, Zacheus *et al.* 2011). Language deficiency has been suggested as a central explanation for this (Jönsson *et al.* 2013, Seppänen *et al.* 2020).

Pandemic-related changes in PA levels also seem connected to socioeconomic and other sociodemographic characteristics, although research evidence appears partly inconsistent. Many studies have associated low SES with a greater decrease in the amount of PA (Folk *et al.* 2021, Grocke-Dewey *et al.* 2021) or a lower likelihood of meeting PA guidelines during the pandemic (L. Smith *et al.* 2020). Studies in Finland and elsewhere have also found somewhat inconsistent differences in the effects of the pandemic on PA according to gender (Maugeri *et al.* 2020, Kekäläinen *et al.* 2021) and age (Lundqvist *et al.* 2020; L. Smith *et al.* 2020; e.g. Wilke *et al.* 2021). Also, an association between ethnic minority background and lower PA levels has been found in several countries (Bann *et al.* 2021, Grocke-Dewey *et al.* 2021).

Moreover, sociodemographic characteristics have had a noteworthy role in explaining the use of different PA environments during the pandemic. The crisis may have reinforced pre-existing disparities based on SES due to differences in access to infrastructure that allows physical distancing (McDougall *et al.* 2020, Jáuregui *et al.* 2021). Disadvantages connected to lower SES have been noted especially regarding opportunities to use green areas (e.g. Burnett *et al.* 2021, Knapp and Raney 2021). Also, elderliness seems to predict more negative effects due to a drastic decrease in all activities outside of the home environment (de Haas *et al.* 2020). In addition, gender differences have been discovered in PA in the home environment (Engels *et al.* 2021) and in the decrease of indoor activities among elderly Finns (Sipilä *et al.* 2020). Lastly, ethnic origin has been associated both with differences in active travel (Cusack 2021) and in the locations of PA (Watson *et al.* 2021).

Aims of the study

The aims of this study are set on the foundation of earlier studies on PA behaviours prior and during to the pandemic. The limited availability of ISF has played an important role in changes in PA behaviours, and this study fills a gap in research by examining its effects and adaptations to it. The precise study aims are set with the purpose to advance knowledge on social disparities in PA. There is a need for pandemic-related research to account for social factors associated with health behaviours such as PA, and this concerns also Finland; although the country is defined as a welfare state among other Nordic countries, the levels of social inequalities in health are relatively high on the European scale (Friedman *et al.* 2021). Drawing from the literature presented above, sociodemographic characteristics are likely to explain pandemic-related changes in PA behaviours to some extent. SES is a factor of particular interest in the study context. To obtain a more complete picture of the influence of social factors, it is useful to create a model in which, in addition to socioeconomic and other sociodemographic factors, also environmental factors are controlled.

This study investigates the effects of the COVID-19 pandemic on PA of adult residents of two low SES suburbs, focusing on changes in the context of reduced use of ISF. We aim to answer the following research questions:

1. Are sociodemographic characteristics associated with a reduced use of ISF during the pandemic?
2. Are sociodemographic characteristics associated with changes in the total amount of PA among those respondents with a reduced use of ISF?
3. Is the reduced use of ISF associated with an increased use of other environments?

We hypothesise that since PA indoors is more common among adults with a high SES it also explains a higher risk for a reduced use of ISF. However, a decrease in the overall amount of PA might be more common among respondents with a lower SES. We also hypothesise that activities at home and outdoors have increased due to a reduced use of ISF.

Study design and methods

This study is part of a research project within a Finnish governmental policy programme aimed at tackling segregation and promoting health equity in suburbs. The research project's main interest is the suburban residents' equal access to all types of PA environments so as to support equal opportunities for a physically active lifestyle. This study uses data collected from the case suburbs within the wider project.

Study areas

The present study focuses on the residents of two case areas: the suburb of Huhtasuo is located in the city of Jyväskylä in central Finland, and the Kontula suburb is part of the capital city, Helsinki, in southern Finland (Figure 1). The areas are defined by administrative boundaries.

The areas enable an examination of the use of a good range of PA environments, and differences between the areas enable some comparison, and, on the other hand, our focus on predefined areas allows the evaluation of sociodemographic and other background characteristics without a possible neighbourhood-effect (e.g. Kwan 2018). Both areas were originally 'forest suburbs': they were erected in the 1960s and 1970s on the outskirts of cities, with the aim of providing a high number

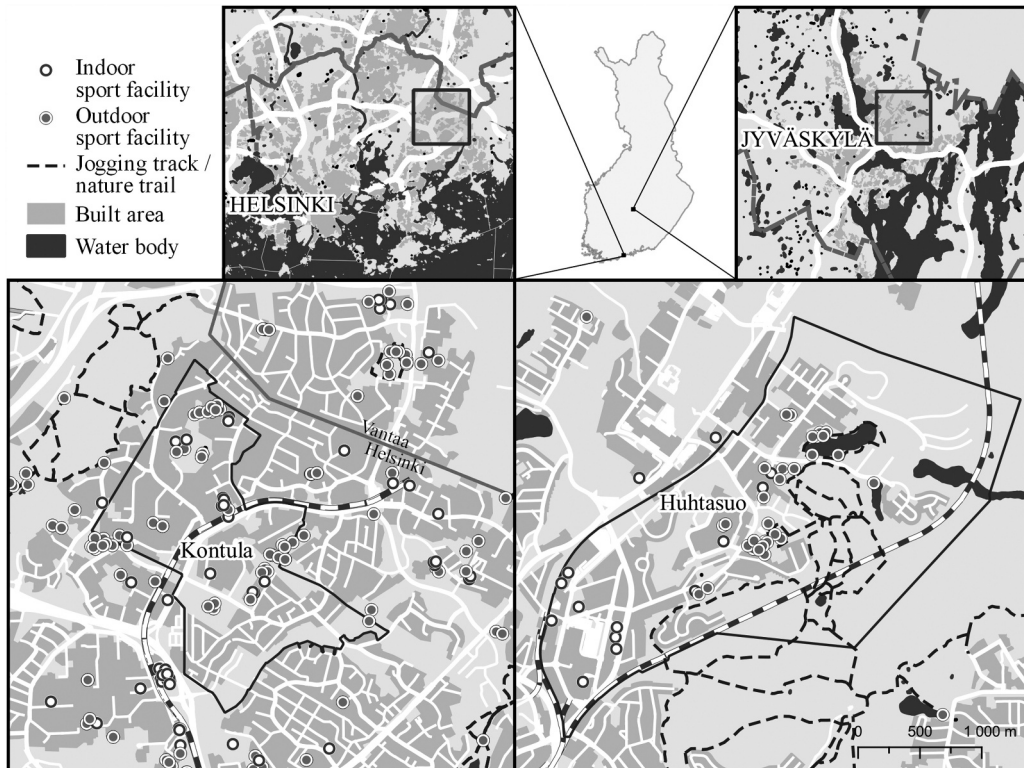


Figure 1. Maps of the study areas and the physical activity environments in the areas and their vicinities.

Table 1. Population characteristics of the study suburbs, compared to the city in total.

	Huhtasuo	City of Jyväskylä in total	Kontula	City of Helsinki in total
Population	9 500	143 000	14 500	657 000
Tertiary education (% of population over 15 years)	21	37	20	45
Average gross income (€/month/capita)	2 300	2 900	2 300	3 500
Employed (% of labour force)	54	64	56	69
Native language Finnish or Swedish (% of population)	83	95	60	78

of homes in apartment buildings located in a healthy living environment, surrounded by green areas (Stjernberg 2019, pp. 3–11). Today, Huhtasuo still fits the definition of a ‘forest suburb’ while Kontula is more urban. Huhtasuo is less densely populated and double the size, and it has more green areas and unbuilt area than Kontula. Of importance during the pandemic are the diverse outdoor PA environments in both neighbourhoods: over thirty outdoor sport facilities (ball fields, ski tracks, fitness training areas, disc golf courses, etc.), green areas, and pedestrian streets and cycle paths. The number of ISF (gyms, school gymnastics halls, etc.) is twelve in Huhtasuo and eighteen in Kontula. The most notable difference concerning popular facilities is that only Kontula has a swimming hall. As Figure 1 illustrates, there are more PA environments located just outside the district borders, catering for the residents of the study areas. Both suburbs offer possibilities for a wide range of popular physical activities and some marginal ones (e.g., bouldering in Huhtasuo).

Focusing on these suburbs also provides information on the effects of the pandemic on low SES population groups (Table 1). Compared to the city population, residents in the study areas in general have a lower SES. There is also a higher proportion of residents with an ethnic minority background in the areas, a factor typically associated with lower PA amount during the pandemic (Bann *et al.* 2021, Grocke-Dewey *et al.* 2021). As with similar suburban housing estates in other Northern and Western European countries, the areas are considered to embody segregation, including a concentration of social problems and health inequalities (Vaattovaara *et al.* 2018, Ministry of the Environment 2021).

Data collection

The study material is from a phone survey with 18–79-year-old residents of the study areas. The interviews were conducted by a private company specialised in surveys. The interviewers have basic training and orientation to interview work according to ISO 20252:2019, and interview quality was also controlled according to that standard. Sample extraction (simple random sampling) was provided by the Finnish Digital and Population Data Services Agency.

Some technical limitations of phone surveys should be noted (see Seefeldt *et al.* 2002), especially non-response (which could lead to some bias). The smaller proportion of respondents among younger age groups was accounted for by correcting it for a weight coefficient that notices age, gender, and region. Due to technical and economic realities, the forms and questions in telephone surveys must be as simple as possible, but concerning our knowledge interests, this was not considered problematic.

The survey was repeated three times: in December 2020 ($n = 304$), in February 2021 ($n = 351$), and in June 2021 ($n = 302$). All three samples were taken from the same database without a control of responses in previous rounds. After identifying and removing possible duplicates, 738 cases remained for the analysis. The proportion of elderly respondents was higher than in the population, so weight coefficients were calculated for the cases according to the population level gender and age group sizes in each area. The survey was available in the two major official languages Finnish and Swedish, and in English. Informed consent was obtained from the survey respondents. Finnish legislation required no formal ethics approval for this study.

The questions assessed PA in any mode in different environments during the previous seven days and pandemic-related changes in the overall amount of PA and the use of different environments.

The use of environments was inquired about in five categories: ISF, built outdoor facilities, unbuilt nature, streets and home environment. (See [Appendix A1](#).)

The data concern three seasons (late autumn/early winter, mid-winter, and early summer) and different phases in the course of the pandemic. Official restrictions on adults' PA were partially wider in the City of Helsinki than in the City of Jyväskylä, following a higher infection rate. During the first round, PA facilities were open in Jyväskylä, while Helsinki had closed municipal ISF and interrupted organised PA in municipal outdoor facilities and ISF for adults aged over twenty (AVI 2021, City of Helsinki 2021, Yle 2021). During the second round, in February 2021, both Helsinki and Jyväskylä experienced municipal ISF closures and restrictions on organised PA both indoors and outdoors. During the third round, in June 2021, all restrictions had recently been removed in Jyväskylä, while in Helsinki there were still limitations on head count and organised PA in ISF. Private PA services could stay open at the times of the surveys, with some restrictions on head count. In addition, social distancing was recommended during all rounds.

Statistical analyses

Binary logistic regression (BLR) analysis was utilised to examine the associations of background factors with a reduced use of ISF. Multinomial logistic regression (MLR) analysis was utilised to examine the probability of a decreased or increased total amount of PA among those with a reduced use of ISF. The decrease and increase are modelled in the same equation so that they can be directly compared to the group that has no change. In the cross-tabulation on how changes in PA in ISF and other environments are related, a chi-square test was used to test the significance of differences between distributions in subgroups.

All analyses were conducted in SPSS (version 26). The statistical confidence interval used is 95%. The explanatory power ratio in the binary model is the average of the R-square ratios of Cox and Snell, and Nagelkerke. In the multinomial model, Cox and Snell, Nagelkerke, and McFadden ratios are reported separately.

Results

This section begins with descriptive statistics on the participants, their pandemic use of PA environments and the role of changes in the use of ISF in a reduced total amount of PA. Next, the factors explaining a reduced use of ISF are presented. Then the focus is on the respondents who had reduced their use of ISF, and the factors explaining changes in the overall PA amount are examined. Finally, the association between the reduced use of ISF with increases in the use of other PA environments is presented.

Descriptive statistics

Characteristics of the study participants are presented in [Table 2](#) (weighted counts and percentages). The age distribution utilised strives to describe differences in PA in different environments with as few categories as possible. Comparing the distributions with the figures in [Table 1](#), the subgroups over-represented in the data are respondents with tertiary education and Finnish- or Swedish-speaking respondents.

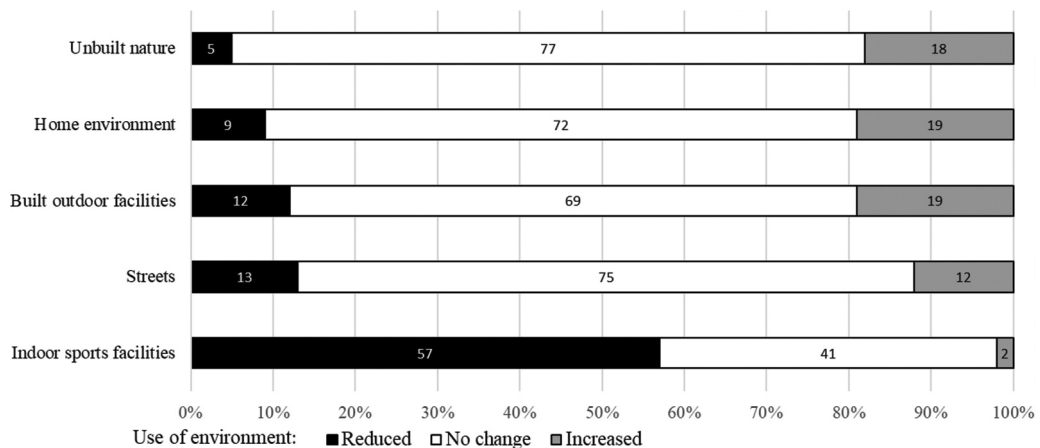
An overview of the data demonstrated the central role of the reduced use of ISF in pandemic-related changes in PA. Among the suburban residents, it has been markedly more common to reduce the use of ISF than other types of environments ([Figure 2](#)). This share (57%) can be considered quite dramatic because presumably not everyone used ISF before the pandemic (see [Borodulin et al. 2011](#)). A clear majority of the respondents reported no change in their use of the other environments. An increase was more common than a decrease in the use of the home environment, unbuilt nature, and built outdoor facilities. As a whole, changes in the use of different outdoor environments have been minor and, as in previous studies, decreased PA is mainly explained by decreased PA in ISF.

Table 2. Descriptive characteristics of the participants (weighted counts and percentages).

		n	%
Area	Kontula, Helsinki	379	51
	Huhtasuo, Jyväskylä	359	49
Age	18–29 yrs.	162	22
	30–64 yrs.	427	58
	65–79 yrs.	149	20
Gender	Man	366	50
	Woman	372	50
Educational level	No vocational training	98	13
	Secondary education	415	56
	Tertiary education	225	31
Household monthly gross income	Under €2500/month	295	40
	≥€2500/month	373	51
	Missing**	70	9
Labour market status	Employed or self-employed	398	54
	Student	72	10
	Unemployed	69	9
	Retired	186	25
	Other**	12	1
Native language	Finnish/Swedish	639	87
	Other	99	13
Physical activity level*	0 times/week	41	6
	1–4 times/week	129	17
	≥5 times/week	568	77
Physical activity in indoor sport facilities	Decreased	421	57
	No change	31	4
	Increased	16	2
Pandemic-related change in overall physical activity	Decreased	279	38
	No change	359	48
	Increased	101	14
Total		738	100

* Calculated total number of times the respondent engaged in different forms of physical activity during the previous seven days.

** Excluded from analysis

**Figure 2.** Pandemic-related changes in the use of different physical activity environments.

A minority of respondents had engaged in PA in ISF during the survey weeks. Table 3 shows that 17% of the respondents on average had used the facilities. Neither the share of PA in ISF in the total PA nor the proportion of users of ISF varies much across survey rounds, which may seem somewhat surprising. Restrictions were much milder at the time of the last survey, but the early summer season, favouring different modes of outdoor PA, may partly explain why the share of PA in ISF was not

Table 3. Percentage of respondents who had used indoor sport facilities (ISF) for physical activity (PA) during the survey week, and percentage of PA in ISF in the total times of PA, by background variables (weighted %).

		Share of respondents who had engaged in PA in ISF during survey week (%)	Share of PA in ISF in total PA (%)
Round	December 2020	15	3
	February 2021	19	4
	June 2021	20	5
Area	Kontula, Helsinki	14	3
	Huhtasuo, Jyväskylä	21	5
Gender	Man	18	5
	Woman	17	3
Age group	18–29 yrs.	32	7
	30–64 yrs.	16	4
	65–79 yrs.	5	1
Education	No vocational training	11	3
	Secondary education	18	4
	Tertiary education	19	4
Household monthly gross income	Less than €2500	17	4
	≥€2500	18	5
Labour market status	Employed or self-employed	22	5
	Student	42	8
	Unemployed	4	1
	Retired	4	1
Native language	Finnish/Swedish	17	4
	Other	17	4
Weekly physical activity	0 times	0	-
	1–4 times	18	6
	≥5 times	19	4
ALL RESPONDENTS		17	4

higher. The sociodemographic characteristics most clearly related to the share and prevalence of PA in ISF are age group and labour market status. The youngest age group, and especially students, have clearly most often used ISF for PA during the pandemic. The unemployed and the retired reported very low levels of participation. (Table 3.)

Changes in the use of ISF are associated with changes in the total amount of PA (Figure 3). The total amount of self-reported PA decreased significantly more often among those who reported reduced PA in ISF: 50% compared to 21% of those whose use of ISF has not changed; or it has increased (very rare). This means that three out of four respondents with a decrease in the total amount of activity reduced activity in ISF. An increase in total PA and possible changes in PA in ISF are not related in one direction or the other (Figure 3).

Factors explaining a reduced use of indoor sport facilities

When the interaction of area and round (this interaction was considered likely because the restrictions were different from region to region at different points in time) and the main effects of other background variables are controlled with BLR, the risk-enhancing characteristics for a reduced use of ISF include female gender and vocational or higher education (Table 4). High weekly PA level was also statistically significant in the analysis, but its actual importance can be questioned because of possible reverse causality. The interaction between area and round was also significant: in Kontula, the risks were significantly higher in the first and third round than in Huhtasuo. The higher risk of reduced use of ISF for Kontula residents is probably due to stricter restrictions related to the pandemic in Helsinki. So, in terms of the areas studied, the respondents from Huhtasuo have been more active indoors and, on the other hand, the risk of decline has been lower for them. Women

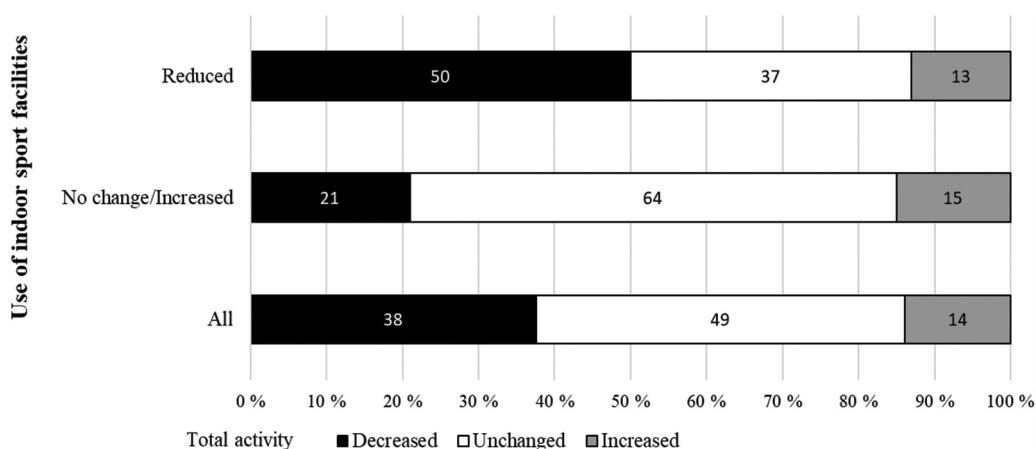


Figure 3. Changes in the total amount of physical activity related to changes in the use of indoor sport facilities during the COVID-19 pandemic (sig. < 0.001).

Table 4. Risk of reduced use of indoor sport facilities: Binary logistic regression (GLM procedure) (OR).

Parameter	Sig.	OR	95% CI interval		Tests of Model Effects		
			Lower	Upper	χ^2	Sig.	
Gender							
		Male	0.6	0.4	0.8	9.012	0.003
		Female (ref.)	1	.	.		
Age group							
	0.621	18–29 yrs.	1.2	0.5	2.7	0.380	0.827
	0.538	30–64 yrs.	1.2	0.6	2.4		
	.	65–79 yrs. (ref.)	1	.	.		
Education							
	0.003	No vocational training	0.4	0.3	0.8	8.984	0.011
	0.152	Secondary education	0.8	0.5	1.1		
	.	Tertiary education (ref.)	1	.	.		
Labour market status							
	0.617	Employed or self-employed	1.2	0.6	2.3	2.880	0.410
	0.305	Student	1.6	0.7	3.6		
	0.597	Unemployed	0.8	0.4	1.8		
	.	Retired (ref.)	1	.	.		
Native language							
	0.720	Finnish/Swedish	0.9	0.5	1.5	0.128	0.720
	.	Other (ref.)	1	.	.		
Weekly physical activity							
	0.314	0 times	0.7	0.4	1.4	11.822	0.003
	<0.001	1–4 times	0.5	0.3	0.7		
	.	≥5 times (ref.)	1	.	.		
Household monthly gross income							
	0.379	Less than €2500	0.8	0.6	1.2	0.775	0.379
	.	≥€2500 (ref.)	1	.	.		
Round * Area							
	0.001	R1*Kontula	2.7	1.5	4.9	13.911	0.016
	0.075	R1*Huhtasuo	1.6	1.0	2.8		
	0.094	R2*Kontula	1.6	0.9	2.9		
	0.108	R2*Huhtasuo	1.6	0.9	2.7		
	0.003	R3*Kontula	2.5	1.4	4.6		
	.	R3*Huhtasuo	1	.	.		
	0.082	Model R2					

appear to be more prone to changes in PA than men (see also, Table 5), i.e., changes in both directions are more common for them. Looking at the level of education, the higher amount of PA in ISF associated with higher education is also associated with a higher risk of reduced use of ISF. (Table 3; Table 4.)

The factors most strongly related to the prevalence and volume of PA in ISF (age group and labour market status, see Table 3) did not have a significant effect on the reduction of PA in ISF. Also, low income or non-native language did not appear to increase the risk either, which is a positive finding

in relation to the concern that the effects of the pandemic will not only reduce PA but also increase polarisation between socioeconomic groups.

Factors explaining changes in physical activity amount among those with a reduced use of indoor sport facilities

The risk ratios in Table 5 describe the over- or under-representation of the categories of background variables in the groups of those who increased (left-hand columns) or decreased (right-hand columns) PA compared to the group whose PA amount did not change. Among the respondents with a reduced use of ISF for PA, only native language was significantly related to the change in the total amount of PA at the variable level. Language background has a statistically significant association with reduced and an almost significant association with increased overall PA. This means that non-natives have been more sensitive to respond to the pandemic situation with changes in PA. Moreover, as noted earlier, women appeared to be more responsive than men. The gender difference is not quite significant at the variable level, but the decrease in the amount of PA has been significantly more common in women than in men. In addition, low household income has a statistically almost significant association with the change in total PA: the association is more unambiguous and significant on decrease. The estimated explanation rate of the model is rather low (Model pseudo $R^2 \sim 6\text{--}13\%$), and it seems that most of the variation in the amount of PA does not revert to easily measurable respondent or environmental characteristics. The low importance of SES is noteworthy: low labour market status, income level or education do not constitute a significant risk

Table 5. Multinomial logistic regression (MLR). The probability of respondents with reduced use of indoor sport facilities ($n = 421$) for decreased or increased total amount of total physical activity, compared to the 'no change' category.

Parameter		Increase				Decrease			
		Sig.	OR	Lower Bound	Upper Bound	Sig.	OR	Lower Bound	Upper Bound
Gender (sig. = 0.076)	Male	0.461	0.8	0.5	1.3	0.027	0.4	0.2	0.9
	Female (ref.)	.	1.0	.	.	.	1	.	.
Age group (sig. = 0.801)	18–29 yrs.	0.413	1.7	0.5	5.5	0.581	0.5	0.1	5.2
	30–64 yrs.	0.480	1.5	0.5	4.2	0.708	0.7	0.1	5.7
	65–79 yrs. (ref.)	.	1.0	.	.	.	1	.	.
Education (sig. = 0.570)	No vocational training	0.115	0.5	0.2	1.2	0.658	0.7	0.2	2.9
	Secondary education	0.224	0.7	0.4	1.2	0.641	0.8	0.4	1.8
	Tertiary education (ref.)	.	1.0	.	.	.	1	.	.
Labour market status (sig. = 0.581)	Employed or self-employed	0.846	1.1	0.4	3.0	0.208	4.0	0.5	35.7
	Student	0.730	0.8	0.2	2.7	0.444	2.5	0.2	26.6
	Unemployed	0.283	0.5	0.2	1.7	0.410	2.5	0.3	22.8
Native language (sig. = 0.041)	Retired (ref.)	.	1.0	.	.	.	1	.	.
	Finnish/Swedish	0.078	0.5	0.2	1.1	0.016	0.3	0.1	0.8
Weekly physical activity (sig. = 0.221)	Other (ref.)	.	1.0	.	.	.	1	.	.
	0 times	0.900	1.1	0.4	3.0	0.700	0.7	0.1	4.3
	1–4 times	0.045	2.2	1.0	4.6	0.894	0.9	0.3	3.1
Household monthly grossincome (sig. = 0.099)	≥ 5 times (ref.)	.	1.0	.	.	.	1	.	.
	Less than €2500	0.033	1.9	1.1	3.3	0.438	1.4	0.6	3.3
Round * Area (sig. = 0.228)	$\geq €2500$ (ref.)	.	1	.	.	.	1	.	.
	R1*Kontula	0.547	0.8	0.3	1.9	0.295	2.2	0.5	9.6
	R1*Huhtasuo	0.776	1.1	0.5	2.8	0.189	2.8	0.6	12.5
	R2*Kontula	0.743	1.2	0.5	2.9	0.615	1.5	0.3	7.0
	R2*Huhtasuo	0.731	1.2	0.5	2.9	0.279	2.3	0.5	10.6
	R3*Kontula	0.317	0.6	0.3	1.5	0.377	0.5	0.1	2.5
	R3*Huhtasuo (ref.)	.	1	.	.	.	1	.	.
Model pseudo R^2									

Cox: 0.109, Nagelkerke: 0.127, McFadden: 0.059

for a decrease in total PA. It seems that the PA level reduction associated with a reduced use of ISF is not clearly related to material or time-based resources. (Table 5.)

Association of the reduced use of indoor sport facilities with an increased use of other environments

For the respondents who had reduced their use of ISF, an increased use of other environments was more common than for the other respondents. A majority of respondents (55%) who had reduced their indoor PA increased PA elsewhere (not shown in the table). Generally speaking, PA practiced at home increased most often during the pandemic – in total, 29% of the respondents who had reduced their use of ISF reported an increase in PA in the home environment. PA also increased considerably in outdoor sport facilities (28%) and unbuilt natural environments (23%). No statistically significant differences between the areas are shown, but differences in the characteristics of the areas may be linked to that an increase in the use of unbuilt nature was more common in the ‘greener’ Huhtasuo area, and street environments have been utilised more in the more urban Kontula. (Table 6.)

Discussion

We investigated COVID-19 pandemic-related changes in PA behaviours of adult residents of two suburbs in Finland, focusing on adaptations to the limited use of ISF. Similar to wider population groups, a majority of the suburban residents had reduced their PA in ISF (compare e.g., Spence *et al.* 2020, Folk *et al.* 2021) and a reduced use of ISF was strongly related to a self-reported decrease in the amount of PA (compare Mutz and Gerke 2021). Our study revealed that the constraints on ISF did not increase differences in the PA amount between different socioeconomic groups. Adding to earlier findings on the role of different PA environments during the pandemic, this study showed that compensatory places for PA were sought from the whole range of available PA environments in the study areas.

Differences according to sociodemographic characteristics

A reduced use of ISF was associated with high education, as hypothesised, and with weekly PA level. Since earlier research has linked a higher educational level with a broader range of practiced and available sports (see Mononen *et al.* 2019, pp. 12–13, Mutz and Müller 2021), it appears that ISF restrictions required more adaptation from a group that also has more resources for changing its PA routines. Although physical accessibility of sports environments does not strongly explain PA, especially disadvantaged people in low SES areas can benefit from the proximity of the places (Lee *et al.* 2007).

Table 6. Increased physical activity in different environments among those with a reduced use of ISF, by area (%).

Increased PA in:		%	sig. (χ^2)
Home environment	Kontula	30	0.755
	Huhtasuo	28	
	Both	29	
Build outdoor facilities	Kontula	24	0.610
	Huhtasuo	27	
	Both	28	
Unbuilt nature	Kontula	20	0.166
	Huhtasuo	28	
	Both	23	
Streets	Kontula	21	0.132
	Huhtasuo	13	
	Both	17	

Prepandemic, there were differences between population groups in the use of different PA environments, especially ISF (Borodulin *et al.* 2011). Consequently, the effects of restrictions focus on the groups that had used the facilities the most. Women reduced PA in ISF more often than men, similar to a difference between Finnish elderly men and women in the spring of 2020 (Sipilä *et al.* 2020). The gender difference may partially be explained by prepandemic PA habits, such as the popularity of the now-restricted group fitness exercise among Finnish women (Mononen *et al.* 2019, pp. 14–15). Other possible explanations may be women's increased caution against infection in indoor PA (Puustinen *et al.* 2021) and their increased care work and domestic chores due to staying more at home (Forsyth & al., 2021).

The risk for a reduced use of ISF was also more common in Kontula than in Huhtasuo. This is likely to be connected to higher COVID-19 infection rates and wider restrictions during data gathering in Kontula (AVI 2021, City of Helsinki 2021, Yle 2021). For example, the closure of the swimming hall in Kontula has likely affected many people's PA. Also, in Huhtasuo, all gyms are privately owned and were not subjected to closures to the same extent as in Kontula, where gyms are mostly owned by the municipality. It may be questioned if all suburban residents benefited from the availability since privately owned PA services are more often used by those with a higher SES (Mononen *et al.* 2019). The unemployed and less educated were less active indoors than higher SES respondents, and they did not reduce indoor PA more often than higher SES respondents. Yet, our data cannot tell whether this is more related to prepandemic or pandemic-related differences.

Finding alternative places for PA and substitutes for PA routines may be seen as an indication of resilience, which is significant for health in pandemic conditions (compare Anyan *et al.* 2020). To assess potential differences in the capacity to adapt to the restrictions, we examined changes in PA amount among the respondents who had reduced their use of ISF, and only gender and language explained the changes. In contrast to our hypothesis, low SES did not explain a decrease. Non-native language was a risk factor for decreased PA amount but also almost significantly associated with increased PA amount, rejecting a conclusion of a disadvantaged status. Changes in PA amount in either direction were more common among women than men, although the difference was statistically significant only with the decrease. Based on previous findings (Sipilä *et al.* 2020), the difference in the decrease may be partly explained, at least among the elderly, by that women had more often decreased also walking outdoors, which is a very common form of their PA. It appears that although restrictions on group fitness exercise and other indoor sports constrained women's PA more often than men's, it was also more common for women in general to find compensatory activities. Some of the difference in the increased PA amount was likely connected to the growing supply of guided online exercise and its popularity among women (see Elovainio *et al.* 2020) or women's increased levels of physically active housework and gardening (see Engels *et al.* 2021). As previous research has pointed to differences between age groups in pandemic-related effects on PA (e.g., Smith *et al.* 2020, Mutz and Gerke 2021), it is noteworthy that age was not associated with the decrease in this study. Although there is a justified concern for pandemic-related growth in the polarisation of PA levels and health (Lesser and Nienhuis 2020), our results suggest that the pandemic constraints on ISF have not substantially weakened the position of low SES groups or exacerbated differences between socio-economic groups in the suburbs. For the issue of growing disparities in PA (e.g., McDougall *et al.* 2020), other processes as well as disparities beyond pandemic restrictions presumably play a more significant role.

From a public health perspective, it is important to stress that these results do not indicate an improvement regarding the socioeconomic disparities in PA participation. Particularly among low SES and less physically active groups, it is common to not use PA facilities at all (Borodulin *et al.* 2011, Hoekman *et al.* 2017).

Finding compensatory physical activity environments in the suburbs

This study adds to earlier research on the role of different places for PA under pandemic constraints. Most of the respondents who had reduced their use of ISF had increased their use of other types of environments. In line with our hypothesis, compensatory opportunities for PA were most commonly found in the home environment but nearly as often in outdoor sport facilities and unbuilt nature. Research elsewhere has found a clear shift from closed ISF to nature and the home environment (e.g., Spence *et al.* 2020, Mutz and Gerke 2021), and especially the importance of green space has been emphasised (Venter *et al.* 2020, Larson *et al.* 2021, Wang *et al.* 2021). However, the suburban residents oriented themselves to all types of PA environments. These adaptations may speak of a good range of suitable compensatory PA opportunities in the areas. Thus, a versatility of PA environments appears significant in preventing the negative health effects of the pandemic.

In addition, the versatility of available PA environments in residential neighbourhoods may be particularly significant for maintaining socioeconomic equity in leisure-time PA. Research elsewhere has pointed to a disadvantage among low SES groups during the pandemic, deriving from poor access to outdoor PA opportunities (e.g., Burnett *et al.* 2021, Knapp and Raney 2021) or from disparities concerning the home environment, including the availability of sporting equipment (Rhodes *et al.* 2020) and access to digital PA services (Hasson *et al.* 2021, Mutz *et al.* 2021). Our results lack evidence of the same disadvantage since the negative impact of the limited choice of ISF was not connected to low SES. The relatively high prepandemic PA participation and variety of popular activities in Finland can partly explain differences with international studies; for the more active persons, it may have been easier to maintain some modes of PA. Also, it may be assumed that the unequal distribution of the negative effects has been somewhat buffered by access to versatile public outdoor environments (see Figure 1), which enable many popular forms of informal PA (compare Borodulin *et al.* 2011). The importance of the supply of outdoor PA environments within the neighbourhood among urban Finnish adults with different PA levels has been highlighted in many studies before the pandemic (e.g. Pyky *et al.* 2019, Kajosaari and Laatikainen 2020). During the pandemic, access to diverse suburban outdoor PA environments has assumably contributed to the residents' resilience against the negative impact on PA.

The COVID-19 pandemic has meant rapid changes and increased unpredictability, and this poses a challenge for sport management and policy to be adaptive (Hansen *et al.* 2022). Situations with similarities to the pandemic will occur also in the future. For example, the impact of climate change on municipal sport service provision will be substantive, as maintaining outdoor winter sports facilities becomes harder. The winter of 2021 was snowy and cold enough to enable popular winter sports in both study areas, but cold winters are not to be taken for granted. The pandemic closed many ISF – in contrast, mild winters will close many popular outdoor facilities, and compensatory PA environments will have to be sought elsewhere. In such situations, a versatile supply of public PA environments may shield different population groups from the effects on PA opportunities.

Policy implications

Based on our results, we propose following policy implications:

First, local authorities should evaluate the versatility of PA environments in their operational area and act accordingly to ensure that compensatory PA environments both indoors and outdoors are available in case one type of environment becomes unusable.

Second, a local and regular collaboration between the residents, municipal administration and sports planners, researchers, and other service providers such as sports clubs, companies etc. should be established to evaluate the need of different PA environments. Cooperation is needed in efforts to plan ahead despite the uncertainty concerning the permanency of the newly emerged behaviours and spatial patterns.

Third, the accessibility and use of different PA environments among sociodemographic groups should be assessed extensively, regularly and locally to evaluate the equity of PA environments.

Strengths and limitations of the study

This study has some noteworthy strengths and limitations. The sample is sociodemographically representative of residents in the study areas, thus the results are well representative of these populations with known risk factors for poor health. The data also cover different seasons and pandemic phases and, therefore, complement recent research. Another strength is the wide definition of PA in the investigation, including leisure-time PA from active travel to recreation and sports. However, self-reports on changes in PA amount and the number of times the PA environments were used include some uncertainty. In lack of data on prepandemic PA, the data essentially indicate perceived changes. Moreover, the results concern residents of the two suburbs. The study design enabled some comparison between the areas, yielding some insight into the reasons for place-specific pandemic-related effects on PA. However, generalising the findings to other Finnish suburbs or residential neighbourhoods elsewhere requires caution. In drawing conclusions about the effects of the COVID-19 pandemic, it is important to account for regional differences in infections and restrictions; this was indicated in the differences found between Kontula and Huhtasuo in the reduced use of ISF.

Our results may partially relate to PA environments not located in the suburbs, as leisure-time PA environments are often located in a wider area (see Kajosaari and Laatikainen 2020). As residents' everyday activity spaces likely extend beyond the administrative boundaries of neighbourhoods, it is important to understand the variation in and limitations of the neighbourhoods' effect (Kwan 2018). Population groups with limited mobility are more exposed to the environmental and societal settings of their neighbourhood, relying more on the nearby PA environments than others. However, the pandemic has decreased the sizes of activity spaces for many of those who had been mobile before, increasing the effect that neighbourhoods have on their residents' well-being (Toger *et al.* 2021).

Suggestions for future research

We recommend that future research more closely examines the importance of different types of PA environments for different social groups. Our results concern the reduced use of ISF, and other PA-related effects may be more significantly associated with social background as well as with the social environment in the suburbs. For instance, a deeper inquiry might reveal differences in experienced access to PA environments (Rivera-Navarro *et al.* 2021) or other perceived barriers to PA (Farah *et al.* 2021). In addition, research needs to follow to what extent the changes in the use of PA environments prevail. Based on our findings, it seems justified to suggest that versatility explains why restrictive policies did not increase polarisation between the population groups. To confirm this hypothesis, a similar study could be conducted in a suburb without the same kinds of versatile public PA services.

Overall, for the development of public sport services, the understanding of the accessibility of PA environments and sports activities should be refined. Research should place a particular focus on social accessibility. This would mean investigating, for instance, which social factors determine the use of PA environments and participation in organised sports among different populations. It is important to extend the investigations beyond the examination of associations between socio-demographic characteristics and realised PA. Instead, approaching accessibility from the viewpoint of people's lifeworlds would yield greater understanding as regards a wide range of social determinants of PA (see also Kay 2016). Thus, an understanding regarding measures for developing public sport service delivery serving wider populations could be deepened. As for particularly segregated suburbs, comparative study designs including both low and higher SES neighbourhoods might yield

important insights on issues of equal accessibility to PA opportunities and inform policies aimed at preventing the negative health consequences of residential segregation.

Conclusion

This study has shown that the COVID-19 pandemic-related restrictions on the use of ISF had notable effects on the PA behaviours of the adult residents of two suburbs in Finland. Gender differences were noteworthy; the restrictions seem to have resulted in more adaptations in PA behaviours in women than in men. Low SES was not an explaining factor for the effects of the restrictions; neither the risk for a reduced use of ISF nor a decrease in the amount of PA was associated with low SES. The home environment, outdoor facilities, nature, and streets were used as compensatory places. Versatile PA environments available in the suburbs may have mitigated the intensification of the socioeconomic polarisation of PA. The study results imply that when planning, building, and developing PA environments in suburbs as well as other residential neighbourhoods, the versatility and use of different PA environments should be assessed and accounted for. Future research should further examine social disparities in access to PA opportunities.

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Appendices

Appendix A1. Operationalisation of the dependent variables.

	Original question	Scale
Physical activity environment		
Streets	Have you been physically active on pedestrian streets, cycle paths, or roads during the previous seven days, for example walking, running or cycling?	Yes/No
Unbuilt nature	In the previous seven days, have you been physically active in a forest or other unbuilt nature environment (e.g. forest/marsh/lake/ ice/ wasteland/meadow or similar)?	Yes/No
Indoor sport facilities	In the previous seven days have you been physically active at indoor sports facilities such as school gyms, basketball courts, swimming pools, gyms, indoor activity parks or similar?	Yes/No
Built outdoor facilities	In the previous seven days, have you been physically active at outdoor sports facilities such as walking or jogging trails, football fields, frisbee golf courses, outdoor gyms, parks or similar	Yes/No
Home environment	How many times have you done fitness exercise in your home or yard in the previous seven days? Exercise can be, for example, muscle fitness training, indoor cycling, yard games, trampoline hopping or similar forms of exercise	0 None 1 Once 2 Two days a week 6 Six days a week 7 At least once per day
The impact of the pandemic on physical activity		
Change	Have the restrictions caused by the pandemic affected the total amount of your leisure-time physical activity?	1 Increased a lot 2 Increased somewhat 3 No change 4 Decreased somewhat 5 Decreased a lot 6 I can't tell