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How did the COVID-19 lockdown affect leisure-time exercise patterns? The case of Spain
¿Cómo afectó el confinamiento durante la pandemia de la COVID-19 a la práctica de ejercicio? El caso de España

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Abstract. This paper explores the effects of the lockdown measures on the population's exercise patterns and aims to answer three questions: Were lockdown exercise patterns different from the ordinary patterns? What are the variables that explain the difference between ordinary habits and lockdown exercise frequency of participants? What are the correlates of the changes in post-lockdown exercise habits among people who exercised during lockdown? We estimated binary logits for participation and ordered logits to analyse frequency and the changes in sporting habits using the 2020 Spanish Survey of Sporting Habits. Our sample consisted of 5,154 observations, of which 3,060 people exercised at least once a month (59.4%) and 2,178 exercised during lockdown (42.3%). The results show that some determinants of the probability and frequency of exercising lost significance during lockdown. Moreover, women and higher-educated people exercised more frequently during lockdown –comparing to their ordinary habits– and women physically active during lockdown exercised less once mobility restrictions were lifted. According to our results, policy makers should focus their attention on men and lower-educated people in the event of future stay-at-home restrictions.
Keywords: Exercise, participation, frequency, lockdown, COVID-19

Resumen. Este trabajo analiza los efectos del confinamiento sobre el ejercicio físico de la población, con el propósito de responder a tres cuestiones: ¿En qué medida los patrones de ejercicio durante el confinamiento fueron diferentes de los habituales? En el caso de las personas que realizaban ejercicio ¿qué variables explican la diferencia entre la frecuencia de práctica durante el confinamiento y su frecuencia habitual? Y, por último ¿qué factores explican los cambios en los hábitos de ejercicio después del confinamiento de las personas activas durante dicho período? Para responder a estas preguntas, se estimaron logits binarios de participación y logits ordenados para analizar la frecuencia y los cambios en los hábitos de ejercicio. El análisis empírico emplea la Encuesta de Hábitos Deportivos de 2020. La muestra está formada por 5,154 observaciones, de las que 3,060 hicieron ejercicio al menos una vez al mes (59,4%) y 2,178 practicaron ejercicio durante el confinamiento (42,3%). Los resultados indican que algunos determinantes de la probabilidad y la frecuencia de ejercicio perdieron significatividad durante el confinamiento. Además, las mujeres y las personas de mayor nivel educativo aumentaron la frecuencia de práctica durante el confinamiento, en comparación con su práctica habitual, y las mujeres activas durante el confinamiento redujeron su práctica una vez que se relajaron las restricciones. Por tanto, los responsables de la formulación de políticas públicas deberían centrar su atención en los hombres y en las personas con menor nivel educativo en caso de futuras restricciones de movilidad.
Palabras clave: Ejercicio, participación, frecuencia, confinamiento, COVID-19

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Introduction

The COVID-19 virus was declared an international public health emergency by the WHO on 30 January 2020. A few weeks later, on 11 March 2020, by which point approximately 118,000 cases had been confirmed and the disease had spread to 114 countries, it was declared a pandemic due to its speed of transmission and severity. At the time this article was written, there have been more than 775 million confirmed cases around the world and over 7 million global deaths. Spain is among the countries that have been most affected by this pandemic, with around 14 million confirmed cases and more than 122,000 deaths.[1] These figures, however, do not reflect the true expanse of the virus, given the insufficient testing in the early stages and a focus on the most vulnerable groups in many countries afterwards.

The WHO has declared an end to the COVID-19 as a public health emergency on 5 May 2023, since the severity of the disease was much lower than in the initial phase, and mortality rates decreased sharply thanks to mass vaccinations and enhanced treatment knowledge (Christie et al., 2021; Schneider et al, 2021). Nevertheless, health systems might still be strained due to hospitalisations resulting from this disease or others that might arise in the future.

The exponential expansion of infections and deaths that took place in 2020 led many governments to restrict people's mobility and social contacts, particularly in the early stages of the pandemic, although mobility restrictions were again tightened in some countries in 2021 and 2022. In Spain, the government declared a state of alarm on 14 March 2020, with a view to protecting the health and safety of Spanish citizens and strengthening the public health system. The extraordinary measures it adopted were among the most restrictive in the European Union and included prioritising telework and closing all commercial premises, restaurants, hotels, cultural and artistic centres, sports facilities, educational institutions, and so on –the only exception being establishments that offered basic goods and services. Essentially, people were only allowed to leave their homes to go to work –if they worked in essential sectors–, shop for basic items or visit the hospital or health centre.[2] In May 2020, some of these mobility restrictions started to be lifted in areas that met certain requirements, and the first state of alarm declared as a result of COVID-19 ended on 21 June 2020. These extraordinary measures prompted a drastic change in the labour and leisure habits of citizens,

including the practice of physical activity. The Spanish case is especially interesting because outdoor physical activity was forbidden during the first weeks of the lockdown, unlike other European countries.

The COVID-19 pandemic and the policies implemented to stop its expansion have had a strong impact on the economies of different countries, as well as consequences on the labour markets, the population physical and mental health, and the environment (Brodeur et al., 2021). Given the association between physical activity (or sedentary behaviour) and physical and mental health (e.g. Rhodes et al., 2017; Cheval et al. 2021) and the health expenditure savings and productivity increases that it entails (Hafner et al., 2019), the study of how this exogenous shock affected exercise and sporting habits remains of interest from the perspective of both the current pandemic and any that may occur in the future.

There is extensive literature on the factors associated with the practice of physical activity, as shown in the reviews by Cabane and Lechner (2015), Rhodes et al. (2017) and Downward and Muñiz (2019). In general, the economics literature follows the theoretical neoclassical approach, in which rational individuals seek to maximize their welfare subject to monetary and time constraints. Specifically, the theoretical framework is usually the income-leisure model, in which the time allocated to exercise directly affects utility, and Becker's time allocation model (Becker, 1965), in which individual`s well-being depends on domestic goods produced at home, using time and goods bought in the market as inputs. Therefore, sport and exercise are considered as a leisure activity that provides utility directly or indirectly - through its effect on health. Consequently, decisions regarding exercise are conditioned by individual preferences, time restrictions and economic variables. Sociological and psychological theories, which pay more attention to the formation of tastes and the influence of social values on behaviour, have also been applied (Downward, 2007), as well as ecological models that incorporate numerous factors that may affect behaviour at multiple levels and take into account the interaction of individuals with their physical and sociocultural environment (Sallis et al., 2006).

The analysis of how individual's physical activity practice was affected by the mobility constraints imposed in many countries has also received attention. Several studies have been published on physical activity during lockdown and/or changes in behaviour before and during lockdown. For instance, Cheval et al. (2021) analysed changes in physical activity in France and Switzerland during the pandemic compared to previous behaviour; Luciano et al. (2021) and Barreto et al. (2023) used samples of university students; Eshelby et al. (2022) focused on changes among UK population, and Strain et al. (2022) examined changes in duration and types of physical activity in England. There are also studies for the Spanish case, such as Castañeda-Babarro et al. (2020), López-Bueno et al. (2020), López-Sánchez et al. (2020), García-Tascón et al. (2021), Pérez-Rodrigo et al. (2021), Santos-Miranda et al. (2022) and Barreto et al (2023). However, most papers are either based on data from online surveys or target specific population groups (e.g. López-Sánchez et al., 2020; Luciano et al., 2021; Barreto et al., 2023), and fail to analyse what happened once mobility restrictions were lifted. Moreover, many of them are simply descriptive analyses. The systematic reviews on the topic performed by Stockwell et al. (2021) and Wunsch et al. (2022) conclude that lockdown did reduce physical activity, as expected.

There are fewer studies about the changes in sports or physical activity habits after relaxation of the COVID mobility restrictions. Castañeda-Babarro et al. (2022) and Kantyka et al. (2023) applied descriptive analyses using data from Spain and Poland, respectively, and Hoekman et al. (2024) estimated a multinomial logit to examine changes in sports participation during and after the pandemic of Dutch people who used to play sports before it.

The aim of this paper is to compare the correlates of ordinary and lockdown exercise patterns and analyse changes in habits that occurred during and after lockdown, using the 2020 Spanish Survey on Sporting Habits. Specifically, we tried to answer three research questions:

- Were lockdown exercise patterns different from ordinary exercise patterns?
- What are the correlates of the gap in exercise frequency (ordinary habits versus lockdown) of ordinary participants?
- What are the correlates of the changes in post-lockdown exercise habits among people who exercised during lockdown?

As compared to previous contributions to the literature on the effects of the COVID-19 pandemic on exercise, this paper uses a representative sample of the entire Spanish population aged 15 and over that provides information about exercise during lockdown, during the rest of the year and after lockdown. Furthermore, in contrast to many articles published to date, we performed regression-type analyses that offer a more complete picture of the factors associated with the population's exercise habits and changes. Finally, unlike the study by Hoekman et al. (2024) for the Netherlands, we do not only analyse participation, but also frequency of practice.

Materials and Methods

Data

The dataset used in the empirical analysis is the 2020 Spanish Survey on Sporting Habits (*Encuesta de Hábitos Deportivos*), a cross-sectional survey conducted every five years by the Spanish Ministry of Education, Culture and Sport, in cooperation with Spain's Higher Sports Council. The survey design meets the requirements of anonymity and consent of the participants. One of the advantages of this database is that it is an official survey representative of the whole population aged 15 and over, unlike many previous studies on this topic, which either targeted specific population

groups or drew from surveys conducted through social media, resulting in the underrepresentation of people unfamiliar with new technologies. Another advantage of our database is its large sample size compared to others that, although they may have a more precise measure of physical activity, they frequently have small samples.

The questionnaire compiles information about general exercise habits, but also about practice during lockdown (March-April 2020) and post-lockdown changes in exercise habits, being all the information collected at once, at the end of 2020. More specifically, the questions we used to define our dependent variables were as follows:

- Did you practise sport last year? If so, how often (daily or almost daily, at least once a week, at least once a month, at least once a quarter, at least once a year)?
- Did you practise sport in April and May 2020? If so, how often (daily or almost daily, at least once a week, at least once a month)?
- After lockdown, how have your sporting habits changed (I do more sport, my habits are the same, I do less sport, I stopped doing sport)?

The list of activities included in the survey does not include sports exclusively, but also activities such as gymnastics, bodybuilding, running or jogging, which may be considered exercise based on the definitions of physical activity, exercise and sport provided by Khan et al. (2012).[3] However, activities such as walking and other physical activities related to household chores (e.g. gardening) or work are not included in the list.

The survey information reveals that 59.6% of the population exercised to some extent in 2020 (58.1% at least once a month), while the percentage of people who exercised during lockdown dropped to 41.8% (Ministerio de Economía y Deporte, 2021). With regards to changes in post-lockdown exercise habits (question posed to the entire sample cohort, regardless of whether they exercised or not), 62.4% of respondents claimed that their habits had not changed, 17.1% did less exercise, 12.9% did more exercise and 2.1% stopped exercising (5.5% did not answer).

From the total sample, comprised of 5,233 observations, individuals who exercised for professional reasons or who exercised during lockdown but not during the year, were excluded from our empirical analysis. These conditions eliminated 79 observations and the preliminary estimates revealed that the general conclusions were not much different. This gave us a final sample of 5,154 observations, of which 3,060 people exercised at least once a month (59.4%) and 2,178 exercised during lockdown (42.3%). These percentages are similar to those corresponding to the total population mentioned above.

In our analysis, we defined participation as exercising at least once a month. The reason for this choice is that monthly practice was the minimum frequency recorded in the survey during the stay-at-home restrictions. As a result, our definition makes it possible to compare the results with the lockdown period. However, it is worth mentioning that most people who exercised on a monthly basis tended to do so at least once a week.

Table 1 provides information about the definitions of the variables used in the empirical analysis and the main descriptive statistics.

Table 1.
Variable definition and summary statistics

Variables	Definition	#Obs.	Mean	Std. Dev.
Exercise variables				
Ordinary participation	=1 if monthly exercise practice	5154	0.594	0.49
Lockdown participation	=1 if monthly exercise practice during lockdown	5154	0.423	0.49
Ordinary frequency (if participant)		3060	2.397	0.60
	=1 if at least once a month	184		
	=2 if at least once a week	1476		
	=3 if daily (or almost)	1400		
Lockdown frequency (if lockdown participant)		2178	2.685	0.51
	=1 if at least once a month	44		
	=2 if at least once a week	597		
	=3 if daily (or almost)	1537		
Ordinary vs lockdown freq. (if ordinary participant)		3060	1.571	1.11
	=0 if stop exercise during lockdown	882		
	=1 if less exercise during lockdown	170		
	=2 if keeping the same frequency	1388		
	=3 if more exercise during lockdown	620		
Changes after lockdown (lockdown participants)		1894	0.959	0.65
	=0 if stop or decrease in exercises	435		
	=1 if keeping the same habits	1101		
	=2 if doing more exercise	358		
Individual characteristics				
Female	=1 if female	5154	0.506	0.50
Age				
16-24 (ref.)	=1 if age between 16-24	5154	0.105	0.31
25-34	=1 if age between 25-34	5154	0.126	0.33
35-44	=1 if age between 35-44	5154	0.185	0.39
45-54	=1 if age between 45-54	5154	0.194	0.40
55+	=1 if age between ≥ 55	5154	0.390	0.49
Education				
Primary or less (ref.)	=1 if primary education or less	5154	0.137	0.34
Secondary	=1 if secondary education	5154	0.240	0.43
GCE/Vocational	=1 if GCE or VET	5154	0.281	0.45
Higher/University	=1 if higher education or university degree	5154	0.342	0.47
Health status				
Very good (ref.)	=1 if very good health status	5154	0.245	0.43
Good	=1 if good health status	5154	0.527	0.50
Fair	=1 if fair health status	5154	0.176	0.38
Poor/Very poor	=1 if poor or very poor health status	5154	0.052	0.22
Marital status				
Single (ref.)	=1 if single, divorced, separated, widowed	5154	0.359	0.48
Married	=1 if married or cohabiting	5154	0.597	0.49
Other	=1 if other personal situation	5154	0.044	0.21
#Children<15	= No. of people in the household	5154	0.321	0.70

	under 15			
Foreign or Double Nat.	=1 if double nationality (Spanish and other) or foreign nationality	5154	0.087	0.28
Worker	=1 if working	5154	0.506	0.50
Municipality size				
Province capital (ref.)	=1 if province capital	5154	0.449	0.50
>50000	=1 if more than 50000 inhabitants	5154	0.191	0.39
≤50000	=1 if less than 50001 inhabitants	5154	0.360	0.48
Reasons for doing sports (Regular players)				
Fun	=1 for fun	3060	0.355	0.48
Keeping fit	=1 to keep fit	3060	0.527	0.50
Relaxing	=1 to relax	3060	0.250	0.43
Health	=1 for health	3060	0.384	0.49
Social relationships	=1 to interact socially	3060	0.052	0.22
Liking sports	=1 because s/he likes it	3060	0.200	0.40
Liking competition	=1 because s/he likes competition	3060	0.025	0.16
Self-improvement	=1 for self-improvement	3060	0.045	0.21

Notes: Binary variables take the value 0 when the condition is not met. GCE is the acronym for General Certificate of Education and VET stands for Vocational Education and Training

According to the table, the sample is evenly distributed between men and women, 60% of the people are married or have a partner, the vast majority are Spanish and their self-reported health status is good to very good. 23% of the sample are under 35 years old, around 14% have a low level of education, 60% reside in provincial capitals or municipalities with more than 50,000 inhabitants. Finally, the main reasons for practising sport are: to keep fit, health and enjoyment.

Methods

Based on the information provided by the survey, we sought to answer three questions: Were lockdown exercise patterns different from ordinary exercise patterns? What are the correlates of the differences in normal versus lockdown practice of people who exercise at least once a month? What are the correlates of the changes in post-lockdown habits among people who exercised during lockdown? It is essentially a sequential analysis in which, after comparing the correlates of ordinary and lockdown exercise for the whole sample, we attempted to find out what happened during stay-at-home restrictions with people who exercise at least once a month, and what happened after lockdown with active people during lockdown.

To answer the first question, we estimated two-part models, which enabled us to determine participation and frequency using different factors. Given that participation is defined as exercising at least once a month, we decided to use this specification because we believe that the main reason for not exercising is a lack of interest rather than a corner solution. Analysing participation and frequency decisions separately is common in sports economics literature, although different specifications have been applied, mainly depending on the nature of the dependent variable, the assumed reasons for non-participation and the relationship between participation and frequency/intensity. García and Suárez (2023) do a comparative analysis of methodologies and conclude that two-part models seem to be an appropriate specification for studying the frequency of physical activity.

For the participation decisions, we specified two binary logit models. One explains exercise participation during the year (the dependent variable is a dummy equal to 1 if the individual exercises at least once a month), and the other explains lockdown participation (the dependent variable is a dummy equal to 1 if the individual exercised at least once a month during lockdown). We then estimated two ordered logits to study the frequency of practice by participants. The categories of the dependent variables in this stage are as follows: at least once a month, at least once a week, and daily or almost daily.

To answer the second question, we estimated an ordered logit comparing normal and lockdown frequency of exercise among ordinary participants. The dependent variable in this specification has four categories: stopped doing exercise during lockdown, exercised less during lockdown, kept the same frequency as the rest of the year and exercised more during lockdown.

Finally, we addressed the third question by estimating an ordered logit whose dependent variable is the change in exercise habits among lockdown participants once mobility restrictions were lifted. In this case, the dependent variable has three categories: less or no exercise after lockdown, the same habits and more exercise after lockdown.

Logit models are appropriate when the dependent variable is dichotomous. In these models, the expected value of the dependent variable is the probability of the dependent variable being equal to one, which is specified as:

$$E(Y_i = 1/\boldsymbol{X_i}) = (\Pr(Y_i = 1/\boldsymbol{X_i}) = \frac{e^{\boldsymbol{\beta' X_i}}}{1+e^{\boldsymbol{\beta' X_i}}} \quad (1)$$

In the previous equation Y is the dichotomous dependent variable, $\boldsymbol{X}$ is the vector of covariates, $\boldsymbol{\beta}$ is the vector of coefficients and i refers to the individual. The model is estimated by maximum likelihood (Wooldridge, 2010).

Ordered logit models apply when the dependent variable has several categories with an ordinal meaning so that the values are not completely arbitrary. As an example, in the case of a dependent variable with three categories, the probability of observing each category is:

$$\begin{aligned} Pr(Y_i = 0/\boldsymbol{X_i}) &= \Lambda(\alpha_1 - \boldsymbol{\beta' X_i}) \\ Pr(Y_i = 1/\boldsymbol{X_i}) &= \Lambda(\alpha_2 - \boldsymbol{\beta' X_i}) - \Lambda(\alpha_1 - \boldsymbol{\beta' X_i}) \\ Pr(Y_i = 2/\boldsymbol{X_i}) &= 1 - \Lambda(\alpha_2 - \boldsymbol{\beta' X_i}) \end{aligned} \quad (2)$$

where α_1 and α_2 are unknown cut points and Λ is the logistic distribution function (Wooldridge, 2010).

The covariates considered in the different estimations were dummies for gender, age group, level of education, labour status, self-perceived health status, marital status, number of children under 15, nationality, municipality population and reasons for exercising –in those estimates done with the subsample of participants. These variables are common in the empirical literature on the correlates of sports practice (Cabane & Lechner, 2015; Downward & Muñiz, 2019), and were included due to their influence on individual preferences (e.g. nationality, education or age),

or time or monetary constraints (e.g. children or labour status).

Results

Differences between Ordinary and Lockdown Exercise Practice and Frequency

Table 2 shows the coefficients and their level of significance corresponding to the two-part models for explaining ordinary exercise practice (columns 1 and 2) and lockdown practice (columns 3 and 4). Both consist of two independent equations: the decision to participate, through the estimation of binary logits, and the frequency of practice by practitioners, through the estimation of ordered logit models with three categories: at least once a month, at least once a week and daily or almost daily.

Table 2.
Ordinary and lockdown participation and frequency: logit and ordered logit estimates

	Ordinary practice		Lockdown practice	
	Logit	Ordered Logit	Logit	Ordered Logit
Variables	Participation	Frequency	Participation	Frequency
Female	-0.413***	-0.059	-0.075	-0.113
	(0.063)	(0.075)	(0.061)	(0.099)
Age				
25-34	-0.519***	0.041	-0.465***	0.431**
	(0.153)	(0.146)	(0.132)	(0.189)
35-44	-0.736***	0.089	-0.624***	0.370*
	(0.149)	(0.148)	(0.131)	(0.193)
45-54	-1.040***	0.309**	-0.838***	0.681***
	(0.147)	(0.153)	(0.132)	(0.203)
55+	-1.460***	0.283**	-1.118***	0.700***
	(0.137)	(0.144)	(0.122)	(0.190)
Education				
Secondary	0.328***	-0.433***	0.319***	-0.119
	(0.107)	(0.163)	(0.119)	(0.234)
GCE/Vocational	0.768***	-0.323**	0.761***	-0.058
	(0.108)	(0.158)	(0.117)	(0.227)
Higher/University	1.251***	-0.319**	1.245***	-0.107
	(0.109)	(0.156)	(0.116)	(0.225)
Health Status				
Good	-0.352***	-0.429***	-0.321***	-0.293***
	(0.082)	(0.083)	(0.073)	(0.110)
Fair	-0.933***	-0.408***	-0.883***	-0.336*
	(0.103)	(0.129)	(0.103)	(0.176)
Poor/Very poor	-1.283***	-0.596**	-1.027***	-0.741**
	(0.161)	(0.238)	(0.170)	(0.304)
Personal situation				
Married	0.058	-0.172*	-0.032	-0.521***
	(0.076)	(0.090)	(0.074)	(0.124)
Other	-0.155	-0.141	-0.224	0.127
	(0.159)	(0.189)	(0.155)	(0.270)
#Children<15	-0.116**	-0.181***	-0.082*	-0.036
	(0.049)	(0.057)	(0.047)	(0.074)
Foreign or Double Nat.	-0.357***	-0.112	-0.306***	-0.347**
	(0.110)	(0.133)	(0.109)	(0.173)
Worker	0.173**	-0.280***	0.067	-0.086
	(0.074)	(0.089)	(0.073)	(0.119)
Municipality size				
>50000	0.090	0.377***	0.169**	0.273**
	(0.086)	(0.101)	(0.083)	(0.137)
≤50000	0.203***	0.142*	0.288***	0.006
	(0.071)	(0.081)	(0.068)	(0.107)
Reasons for doing sports				
Fun		-0.074		-0.104
		(0.119)		(0.166)
Keeping fit		0.506***		0.207
		(0.114)		(0.162)
Relaxing		-0.161		-0.127
		(0.120)		(0.167)
Health		0.368***		0.201
		(0.120)		(0.169)
Social relationships		-0.361*		-0.590**
		(0.184)		(0.240)
Liking sports		0.412***		0.181
		(0.130)		(0.185)
Liking competition		0.358		0.270
		(0.256)		(0.346)
Self-improvement		0.423**		-0.095
		(0.197)		(0.256)
Constant	1.179***		0.019	
	(0.163)		(0.154)	
Observations	5,154	3,060	5,154	2,178
log L	-3015.4013	-2592.2961	-3171.0103	-1442.8723

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard deviations in brackets.
Cut points have not been included but are available upon request.

Starting with the analysis of the probability of participation, the most striking results are those corresponding to gender and labour status. Men are more likely to exercise. However, there were no significant differences by gender during lockdown. With regard to labour status, we saw that workers are more likely to exercise but, again, this variable loses its significance during lockdown.

Switching our focus to the subsamples of participants, the ordered logits used to explain the frequency of exercise during and outside lockdown (columns 2 and 4 in Table 2) reveal some divergent results. When analysing exercise during the year, individuals with higher education levels and workers exercise less frequently. In contrast, none of these variables was significant when examining lockdown frequency. We saw a similar change with respect to people with children. As for the effect of age, only those over 44 are more likely to exercise daily (or almost daily) than the youngest group (aged 16-24) during the year, whereas all age dummies were positive and significant during lockdown.

Regarding the motivation for doing exercise, it is worth mentioning that there was no need to set a reference category, as individuals could give two reasons as to why they exercise. This meant that there was no perfect collinearity problem. In this regard, keeping fit, health, liking sports and self-improvement increased the frequency of practice among regular practitioners. Social relations, on the other hand, had a negative association with frequency. Yet, when studying lockdown frequency, social relations was the only significant reason, with a higher negative effect.

Changes in Exercise Frequency among Ordinary Practitioners during Lockdown

Another interesting topic is how exercise patterns among ordinary practitioners changed during lockdown. To answer this question, we estimated an ordered logit using the subsample people who use to exercise at least once a month. In this specification, the dependent variable had four categories: stopped exercising during lockdown,

exercised less frequently than regularly, kept the same frequency and exercised more frequently.

The first column in Table 3 provides information about the estimated coefficients and significance level of the main variables of interest. Moreover, the first four columns in Table 4 show the marginal effects, i.e. the average changes in the probability of stopping exercising, reducing frequency, keeping frequency and exercising more frequently during lockdown, when the corresponding covariate goes from 0 to 1 or increases by one unit (in the case of the number of children, which is the only continuous variable). The most striking result is the positive effect of gender and education. The probability of increasing frequency during lockdown is about 5 percentage points (pp) higher in the case of women. Similarly, higher education increases this probability by around 7 pp. In contrast, married people and those with a fair health status were more likely to stop exercising during lockdown. Another interesting result is that we found no significant differences in behaviour by age.

Table 3.
Ordinary versus lockdown exercise frequency by ordinary participants and changes in habits after lockdown (ordered logits)

Variables	Lockdown vs Ordinary frequency	Changes in habits after lockdown
Female	0.301***	-0.311***
	(0.070)	(0.094)
Age		
25-34	-0.080	-0.307*
	(0.135)	(0.180)
35-44	-0.180	-0.164
	(0.137)	(0.187)
45-54	-0.205	-0.201
	(0.143)	(0.192)
55+	-0.167	-0.069
	(0.134)	(0.178)
Education		
Secondary	0.027	0.041
	(0.151)	(0.206)
GCE/Vocational	0.302**	0.070
	(0.146)	(0.200)
Higher/University	0.458***	0.064
	(0.144)	(0.197)
Health Status		
Good	-0.018	-0.427***
	(0.077)	(0.103)
Fair	-0.255**	-0.566***
	(0.121)	(0.170)
Poor/Very poor	0.020	-0.867***
	(0.221)	(0.295)
Personal situation		
Married	-0.204**	-0.024
	(0.085)	(0.113)
Other	-0.168	0.084
	(0.175)	(0.232)
#Children<15	0.099*	-0.103
	(0.055)	(0.073)
Foreign or Double Nat.	-0.163	-0.196
	(0.126)	(0.175)
Worker	0.014	-0.021
	(0.083)	(0.111)
Municipality size		
>50000	0.086	0.258**
	(0.094)	(0.126)
≤50000	0.142*	-0.034
	(0.076)	(0.103)
Reasons for doing sports		
Fun	0.374***	-0.153
	(0.115)	(0.157)
Keeping fit	0.665***	0.066
	(0.108)	(0.152)
Relaxing	0.487***	-0.215
	(0.115)	(0.157)
Health	0.501***	0.067
	(0.115)	(0.158)
Social relationships	0.201	0.152
	(0.173)	(0.246)
Liking sports	0.485***	0.146
	(0.124)	(0.170)
Liking competition	0.474**	-0.313
	(0.233)	(0.310)
Self-improvement	0.403**	0.101
	(0.181)	(0.244)
Observations	3,060	1,894
log L	-3610.2757	-1801.2105

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard deviations in brackets. Cut points have not been included but are available upon request.

Table 4.
Ordinary versus lockdown exercise frequency by ordinary participants and changes in habits after lockdown (marginal effects)

	Lockdown vs Ordinary frequency				Changes in habits after lockdown		
Variables	ΔPr (stop exercising)	ΔPr (reduce frequency)	ΔPr (keep frequency)	ΔPr (increase frequency)	ΔPr (stop or decrease exercise)	ΔPr (keep exercise)	ΔPr (increase exercise)
Female	-0.060***	-0.006***	0.018***	0.048***	0.054***	-0.008**	-0.046***
Age							
25-34	0.015	0.002	-0.004	-0.013	0.054*	-0.008	-0.046*
35-44	0.035	0.004	-0.010	-0.029	0.028	-0.002	-0.025
45-54	0.040	0.004	-0.012	-0.033	0.034	-0.003	-0.031
55+	0.033	0.003	-0.009	-0.027	0.011	-0.000	-0.011
Education							
Secondary	-0.006	-0.000	0.003	0.004	-0.007	0.001	0.006
GCE/Vocational	-0.064**	-0.005**	0.025*	0.044**	-0.012	0.002	0.010
Higher/University	-0.094***	-0.008***	0.033**	0.069***	-0.011	0.002	0.009
Health Status							
Good	0.004	0.000	-0.001	-0.003	0.071***	-0.003	-0.068***
Fair	0.053**	0.005**	-0.019*	-0.038**	0.097***	-0.011	-0.086***
Poor/Very poor	-0.004	-0.000	0.001	0.003	0.160**	-0.040	-0.120***
Personal situation							
Married	0.040**	0.004**	-0.012**	-0.032**	0.004	-0.001	-0.004
Other	0.033	0.003	-0.009	-0.027	-0.014	0.001	0.013
#Children<15	-0.020*	-0.002*	0.006*	0.016*	0.018	-0.003	-0.015
Foreign/ Double Nat.	0.033	0.003	-0.012	-0.025	0.035	-0.008	-0.028
Worker	-0.003	-0.000	0.001	0.002	0.004	-0.001	-0.003

Municipality size							
>50000	-0.017	-0.002	0.006	0.013	-0.043**	0.002	0.041**
≤50000	-0.028*	-0.003*	0.009*	0.022*	0.006	-0.001	-0.005
Reasons for doing sports							
Fun	-0.075***	-0.007***	0.023***	0.059***	0.027	-0.004	-0.023
Keeping fit	-0.133***	-0.013***	0.041***	0.104***	-0.011	0.002	0.010
Relaxing	-0.097***	-0.009***	0.030***	0.077***	0.037	-0.005	-0.032
Health	-0.100***	-0.010***	0.031***	0.079***	-0.012	0.002	0.010
Social relationships	-0.040	-0.004	0.012	0.032	-0.026	0.004	0.023
Liking sports	-0.097***	-0.009***	0.030***	0.076***	-0.025	0.004	0.022
Liking competition	-0.095**	-0.009**	0.029**	0.074**	0.054	-0.008	-0.047
Self-improvement	-0.080**	-0.008**	0.025**	0.063**	-0.017	0.002	0.015
Observations			3060			1894	

Note: *** p<0.01, ** p<0.05, * p<0.1

As for the reasons for exercising, the results reveal that keeping fit and health were the reasons with the highest negative effect on the probability of stopping exercising during lockdown (-13.3 pp and -10.1 pp, respectively), whereas social relations had no significant association with changes in habits.

Changes in Exercise Habits among Lockdown Practitioners once the Mobility Restrictions were Lifted

The last question we set out to answer was what happened after lockdown with people who exercised during April-May 2020. Again, an ordered logit was estimated for the subsample of lockdown participants, in which the explained variable had three categories: exercised less or stopped exercising after lockdown, kept the same habits and exercised more.

The results of this estimation are shown in column 2 of Table 3, while the corresponding average marginal effects are included in the last three columns of Table 4. According to our estimates, women were more likely to stop exercising or exercise less after lockdown, although the highest marginal effects were those of self-reported health status. The probability of stopping exercising or exercising less after lockdown was about 16 pp higher among people who reported having a poor health status, while the probability of increasing practice was around 12 pp lower than that of people with a very good health status. Nonetheless, we found no significant differences with regard to changes in habits following the stay-at-home restrictions by level of education or reasons for doing sport.

Discussion

The estimates presented in the previous section show some interesting patterns. When analysing the general population, the results are in line with previous literature on the subject (e.g. Cabane & Lechner, 2015). An interesting outcome is that the impact of certain sociodemographic variables on participation and frequency waned during lockdown. The probability of exercising during the year is higher among males and workers. The effect of gender may be explained by the unequal distribution of housework and childcare (Álvarez & Miles-Touya, 2019), whereas working is a proxy of personal earnings, and the probability of exercising generally increases with earnings (García et al., 2016), as it is a leisure activity that often entails costs such as facility fees, training classes, attire, etc. By contrast, neither of these two covariates was significant in explaining the probability of exercising in April-May 2020. Many workers were forced to stop working during that period (Adams-Prassl et al., 2020), with the economic uncertainty and reduction in income this might imply, closing the gap with respect to differences in monetary and time constraints between workers and non-workers.

Something similar happens with education attainment and labour status when analysing the frequency of practice by participants. Higher-educated or working people used to exercise less frequently than the rest, probably because the opportunity cost of time is higher for these groups. In this sense, Giménez-Nadal and Sevilla (2012) document a growing inequality in leisure time in developed countries, in favour of the less-educated population. But, during lockdown, there were not relevant differences in participants' frequency of practice by level of education or labour status. Again, this is likely due to the fact that time use among different population groups was more similar while the mobility restrictions were in place given that many workers had to stay home.

Moreover, among ordinary participants, women and people with higher education levels exercised more frequently during stay-at-home restrictions. One possible explanation for the differences in gender behaviour may have to do with the type of exercise practised: men are more likely to play team sports (Gómez & Suárez, 2023; Humphreys & Ruseski, 2007; Scheerder et al., 2005), which they were unable to engage in while the stay-at-home restrictions were in force. On the other hand, people with higher education levels may be more aware of the benefits of exercise for health and tried to compensate for the decrease in mobility, or they may have enjoyed a higher increase in leisure time during lockdown, given that highly educated people tend to have less leisure time than low educated people, according to Giménez-Nadal and Sevilla (2012). Similar results have also been found in other studies. Using data from the first weeks of lockdown, Castañeda-Babarro et al. (2020) determined that women increased the amount of time allocated to moderate physical activity, while López-Bueno et al. (2020) identified a decrease in the amount of time spent exercising, a decline which was nonetheless less pronounced in the case of women and people with higher education levels. Pérez-Ro-

drigo et al. (2021) applied a cluster analysis to identify patterns of behavioural change five weeks after the start of the stay-at-home constraints, and concluded that women were more likely to belong to the cluster that increased their physical activity during lockdown. Barreto et al. (2023) conclude that although the lockdown decreased the levels of physical activity of university students, the decline was greater among males. Hoenker et al. (2024) obtain that higher-educated individuals were more likely to participate continuously during the course of the COVID pandemic.

Our estimates also reveal that keeping fit and health were the covariates with the highest negative effect on the probability of stopping doing exercise during lockdown, whereas seeking social relationships is not associated with changes in exercise patterns, either during or after the mobility restrictions. García and Suárez (2023) show that physical fitness is the most important reason among Spanish population for engaging in sports followed by health, in the case of women, and entertainment, in the case of males.

Finally, among lockdown practitioners, women reduced the amount of exercise they did once mobility restrictions ceased to be in effect, which seems to indicate that they readjusted their habits. This may be because the motivation for being active is usually greater among males, as corroborated by the meta-analysis by Ortega et al. (2024). The same does not apply to people with higher education levels. In fact, education does not explain the changes in sporting habits post-lockdown. The results also reveal that there are no significant differences in behaviour after lockdown by reason for exercising.

Conclusions

This paper studies the changes in exercise patterns and its correlates resulting from the mobility restrictions imposed during the most acute phases of the COVID-19 pandemic. Using the 2020 Spanish Survey of Sporting Habits, we estimated the correlates of ordinary and lockdown participation and frequency of practice, the changes in behaviour among practitioners while the stay-at-home restrictions were in place, and subsequent changes in practice among lockdown practitioners once mobility restrictions were lifted.

The strict mobility restrictions imposed in Spain in April and May 2020 in an attempt to reduce the spread of the disease altered the exercise habits of the population, as is to be expected. Some of the sociodemographic determinants of the probability of exercising and the frequency of practice lost their significance during lockdown. Moreover, female and higher educated practitioners exercised more frequently during lockdown (with respect to their behaviour during the rest of the year), while, after the mobility restrictions were lifted, women who were physically active during lockdown exercised less.

Thus, according to our results, the groups on which the government should focus its attention in the event of future stay-at-home restrictions are men and people with lower education levels, due to their higher probability of stopping exercising or exercising less while mobility restrictions are in force. Furthermore, campaigns aimed at raising awareness of the health benefits of physical activity and its influence in keeping fit may help maintain or increase exercise practice during lockdown periods.

This research has some limitations. The information provided by the survey on exercise habits is not very precise. In turn, we have a representative database of the Spanish population with a large sample size. In particular, the survey does not include questions about the time people spent exercising during the stay-at-home restrictions, only about days of practice, and greater frequency does not necessarily imply more time. In fact, Sánchez-Sánchez et al. (2020) found a decrease in the time spent exercising per week, yet an increase in the number of sessions during lockdown. In addition, mobility restrictions likely prompted changes in the physical activity performed during household chores, at work or commuting, information that is not available. It would be interesting to check whether there was some kind of substitution between domains and to what extent those who increased their sporting habits fully compensated for the reduction in physical activity in other areas of everyday life, such as commuting or work-related physical activity. We cannot study the long-term effects of stay-at-home restrictions on ordinary sporting habits either. Other topic for future research is the effect of the pandemic on the type of sport or physical activity performed by individuals.

Ethics statement

The database used has been conducted by the Spanish Ministry of Education and Culture and the Higher Sports Council complying with the ethical requirements of anonymity and consent. The personal data are subject to protection and are covered by statistical secrecy (Art. 13.1. of the Law of the Public Statistical Function of May 9, 1989). Furthermore, the researchers who request the microdata commit to maintain the anonymity of the individuals surveyed.

Data availability statement

The data that support the findings of this study are available from the Higher Sports Council. Restrictions apply to the availability of these data, which were used under license for this study.

Disclosure statement

The authors have no competing interests to declare that are relevant to the content of this article.

Notes

1. This information is provided by the WHO and

available at https://covid19.who.int/ [accessed 23 July, 2024].

2. *Royal Decree 463/2020, of 14 March, declaring a state of alarm to manage the health crisis caused by COVID-19*. Available at: https://www.boe.es/eli/es/rd/2020/03/14/463.

3. This is probably because the definition of sport according to the Royal Spanish Academy is: physical activity, exercised as a game or competition, whose practice involves training and following some rules, or recreation, pleasure, amusement, or physical exercise, usually outdoors. The Academy points out exercise as a synonym for sport.

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