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Data Article

Analysis of a comprehensive dataset: Influence of vaccination profile, types, and severe acute respiratory syndrome coronavirus 2 re-infections on changes in sports-related physical activity one month after infection

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ABSTRACT

This dataset was created with the primary objective of elucidating the intricate relationship between the incidence of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) re-infections and the pre-illness vaccination profile and types concerning alterations in sports-related physical activity (PA) after SARS-CoV-2 infection among adults. A secondary objective encompassed a comprehensive statistical analysis to explore the influence of three key factors—namely, Vaccination profile, Vaccination types, and Incidence of SARS-CoV-2 re-infections—on changes in PA related to exercise and sports, recorded at two distinct time points: one to two weeks prior to infection and one month after the last SARS-CoV-2 infection.

The sample population (n = 5829), drawn from Hellenic territory, adhered to self-inclusion and exclusion criteria.

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Data collection spanned from February to March 2023 (a two-month period), involving the utilization of the Active-Q (an online, interactive questionnaire) to automatically assess weekly habitual sports-related PA among adults both before and after their last SARS-CoV-2 infection. The questionnaire also captured participant characteristics, pre-illness vaccination statuses (i.e., unvaccinated, partially vaccinated, fully vaccinated, and vaccine types), and occurrences of SARS-CoV-2 re-infections. The dataset sheds light on two noteworthy phenomena: (i) the intricate interplay between post-acute SARS-CoV-2 infection and a decline in sports-related physical activity (-27.6 ± 0.6%, 95%CI: -26.1 – -29.1), influenced by the pre-illness vaccination profile factor ($p = 0.040$); and (ii) the divergence in sports-related physical activity decline between partially vaccinated (-38.2 ± 0.7%, 95%CI: -35.3 – -41.1, $p = 0.031$) and fully vaccinated respondents (-19.2 ± 0.5%, 95%CI: -17.2 – -21.2).

These phenomena underscore the imperative for tailored interventions and further investigation to promote the resumption of physical activity and mitigate long-term repercussions. Furthermore, this dataset enriches our understanding of the dynamics of sports-related physical activity and provides valuable insights for public health initiatives aiming to address the consequences of COVID-19 on sports-related physical activity levels. Consequently, this cross-sectional dataset is amenable to a diverse array of analytical methodologies, including univariate and multivariate analyses, and holds potential relevance for researchers, leaders in the sports and medical sectors, and policymakers, all of whom share a vested interest in fostering initiatives directed at reinstating physical activity and mitigating the enduring ramifications of post-acute SARS-CoV-2 infection.

Specifications Table

Subject	Public Health and Health Policy.
Specific subject area	The dataset pertains to the impact of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) re-infections, pre-illness vaccination profiles, and vaccination types on changes in sports-related physical activity among adults one month after SARS-CoV-2 infection.
Data format	Raw, analyzed. Body mass (kg) and height (cm) values transformed to body mass index ($kg{\cdot}m^{-2}$); age (yr), and sports-related physical activity changes data are in raw format ($MET{\text{-}}min{\cdot}week^{-1}$), sex at birth, ethnicity, region of residence, education level, number of underlying medical conditions that could be related to severe illness with COVID-19, SARS-CoV-2 re-infections and pre-illness vaccination profiles/types classification are in nominal and categorical formats.
Type of data	Table, Figure
Data collection	Data were collected in two consecutive months (February to the end of March 2023), through an internet survey source providing an interactive web-based questionnaire (see Supplementary file 1_Active-Q_modyfied). An Excel file with the aforementioned data and metadata has been uploaded (see Supplementary file 2_Data).

(*continued on next page*)

	Self-eligibility criteria for participation in the survey: confirmed SARS-CoV-2 infection within the last 30-40 days (confirmed by diagnostic tests such as polymerase chain reaction or blood antigen tests); ≥ 18 years old; Hellenic territory (Greece) residency. Self-exclusion criteria: recent vaccination within the two weeks prior to the last SARS-CoV-2 infection; participation in strict weight loss programs; recent gestation or childbirth within one year of the survey's start date.
Data source location	Region: Europe Country: Hellas (Greece) Institution: National and Kapodistrian University of Athens
Data accessibility	Data and metadata are hosted with the article.
Related research article	This dataset is part of a collaborative project and builds on previous research with the same sample. (D.I. Bourdas, P. Bakirtzoglou, A.K. Travlos, V. Andrianopoulos, & E. Zacharakis. Exploring the Impact of COVID-19 on Physical Activity One Month after Infection and Its Potential Determinants : Re-Infections, Pre-Illness Vaccination Profiles / Types, and Beyond, Vaccines (Basel). 11 (2023) 1431. https://doi.org/10.3390/vaccines11091431).

1. Value of the Data

- **Comprehensive Insight into Post-SARS-CoV-2 Infection Physical Activity**: This dataset provides a unique opportunity to investigate the impact of SARS-CoV-2 re-infections and vaccination profiles/types on sports-related physical activity among adults. It offers researchers valuable insights into the complex interplay between these factors, allowing for a deeper understanding of post-infection health consequences.
- **Relevance for Public Health and Policy**: Policymakers, public health officials, and healthcare practitioners can leverage this dataset to inform evidence-based interventions aimed at mitigating the long-term effects of COVID-19 on physical activity levels. The findings can guide strategies to promote healthier lifestyles among individuals recovering from the virus.
- **Multidisciplinary Research**: Researchers across various disciplines, including epidemiology, sports medicine, and public health, can benefit from this dataset. It offers a multidimensional perspective on the impact of SARS-CoV-2 re-infections and vaccination on sports-related physical activity, encouraging interdisciplinary collaboration.
- **Baseline for Comparative Studies**: This dataset serves as a valuable baseline for comparative studies investigating the effects of other infectious diseases on physical activity. Researchers can use this dataset as a reference point to assess the unique characteristics of post-SARS-CoV-2 infection physical activity changes.
- **Enhanced Scientific Understanding**: By exploring the intricate relationship between vaccination, re-infections, and physical activity, researchers can contribute to a broader scientific understanding of the long-term consequences of COVID-19. This dataset encourages further investigation into tailored interventions to promote physical activity and overall well-being in post-acute SARS-CoV-2 infection scenarios.

2. Data Description

The principal aim for creating this dataset was to gain a comprehensive understanding of how the incidence of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) reinfection, the pre-illness vaccination profile, and types may influence alterations in sports-related physical activity (PA) one month after the last SARS-CoV-2 infection. The second aim was to conduct a comprehensive statistical analysis to explore the potential influence of three independent factors (i.e., "Vaccination profile", "Vaccination types", and "Incidence of SARS-CoV-2 re-infections") on changes in sports-related PA recorded between two time points (i.e., one–two weeks before infection and one month after the last SARS-CoV-2 infection). This dataset is an extension of a prior research endeavor, representing a collaborative effort within a broader project. It builds upon an earlier study conducted with the same sample population [1], thereby

enhancing the continuity and depth of our investigations into the multifaceted aspects of post-acute SARS-CoV-2 infection and its implications on physical activity. However, some variables of the sample that have already been presented (e.g., Sex at birth, Age, Body mass index, and PA) are also mentioned in the present study. Furthermore, this data article enhances the value of the previously published research in several significant aspects. Firstly, it enriches the existing body of knowledge by providing comprehensive and granular participant information within the dataset. Secondly, it introduces an array of additional variables that were not previously explored in the published article. Lastly, researchers will find utility in this dataset for conducting a diverse range of statistical analyses, augmenting the original study that primarily centered on descriptive statistics and population averages. This extension broadens the potential applications of the data for future investigations.

Data was acquired from a cohort comprising 5829 volunteers recovered from COVID-19. The sports-related domain of the Active-Q questionnaire and additional incorporated items (i.e., simple questions) was used for data collection [1,2] (see Supplementary file 1_Active-Q_modyfied). Respondents stated their anthropometric characteristics (Table 1), ethnicity, region of residence, education level, habitual sports-related physical activity between two time points (i.e., one–two weeks before infection and one month after last SARS-CoV-2 infection), number of underline medical conditions that could be related to severe illness with COVID-19, pre-illness vaccination profile, pre-illness vaccine type(s) received, incidence of SARS-CoV-2 re-infections; and subgrouped accordingly (through the online interactive platform, see Supplementary file 2_Data, in the sheet under the name data-metadata). The frequency and relative frequency of subgroups are presented in Table 2.

Table 1
Anthropometric traits, presented as the mean ± SD (95% CI), of the respondents.

Variable	Overall (n = 5829)	Males (N = 1962)	Females (N = 3867)
Age (yr)	45.6±10.3 (45.4 – 45.9)	47.5±10.8 (47.0 – 48.0)	44.7±10.0 (44.4 – 45.0)
Height (cm)	170.0±9.0 (169.7 – 170.2)	178.7±7.3 (178.3 – 179.0)	165.5±6.1 (165.3 – 165.7)
Body mass (kg)	75.7±17.1 (75.3 – 76.2)	88.3±15.0 (87.6 – 88.9)	69.4±14.3 (68.9 – 69.8)
BMI ($kg{\cdot}m^{-2}$)	26.1±5.0 (26.0 – 26.2)	27.6±4.4 (27.4 – 27.8)	25.3±5.1 (25.1 – 25.5)

Abbreviations: BMI, body mass index; CI, confidence interval; N, subgroup's sample size; n, group's sample size; SD, standard deviation; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Table 2
Frequency, relative frequency, and 95% CI of respondents[†] (n = 5829) subgrouped by ethnicity, region of residence, education level, number of underlying medical conditions, pre-illness vaccination profile, pre-illness vaccine type(s) received, and incidence of SARS-CoV-2 re-infections.

Variable	Subgroup, Frequency (%), 95% CI
Ethnicity	Caucasian, 5789 (99.3), 99.1 – 99.5
	African, 10 (0.2), 0.1 – 0.3
	Latino, 8 (0.1), 0.0 – 0.2
	Asian, 11 (0.2), 0.1 – 0.3
	Other, 11 (0.2), 0.1 – 0.3
Region of residence	Urban region, 4184 (71.8), 70.6 – 72.9
	Peri-urban region, 1358 (23.3), 22.2 – 24.4
	Rural or off-the-grid region, 287 (4.9), 4.4 – 5.5
Education level (certificate)	Primary school certificate or lower, 5 (0.1), 0.0 – 0.2
	Lower secondary school certificate, 60 (1.0), 0.8 – 1.3
	Upper secondary school certificate, 660 (11.3), 10.5 – 12.1
	Post-secondary school certificate, 428 (7.3), 6.7 – 8.0
	Bachelor degree, 2271 (39.0), 37.7 – 40.2
	MSc/master's degree, 2120 (36.4), 35.1 – 37.6
	PhD/doctorate, 285 (4.89), 4.3 – 5.4

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Table 2 (*continued*)

Variable	Subgroup, Frequency (%), 95% CI
Number of underlying medical conditions	No conditions, 2410 (41.3), 40.1 – 42.6
	1 condition, 2858 (49.0), 47.7 – 50.3
	2–5 conditions, 539 (9.2), 8.5 – 10.0
	6–10 conditions, 22 (0.4), 0.2 – 0.5
	≥10 conditions, 0 (0.0), –-
Pre-illness vaccination profile	Unvaccinated, 1222 (21.0), 19.9 – 22.0
	Partially vaccinated, 2421 (41.5), 40.3 – 42.8
	Fully vaccinated, 2186 (37.5), 36.3 – 38.7
Pre-illness vaccine type(s) received	No vaccine, 1222 (21.0), 19.9 – 22.0
	mRNA, 3732 (64.0), 62.8 – 65.3
	Viral vector, 226 (3.9), 3.4 – 04.4
	Protein subunit, 4 (0.1), 0.00 – 0.1
	Combination of vaccines, 645 (11.1), 10.3 – 11.9
Incidence of SARS-CoV-2 re-infections (frequency)	Infected one time, 4093 (70.2), 69.0 – 71.4
	Infected two times, 1552 (26.6), 25.5 – 27.8
	Infected three times, 171 (2.9), 2.5 – 3.4
	Infected four times, 8 (0.1), 0.0 – 0.2
	Infected five times, 3 (0.05), 0.0 – 0.1
	Infected six times, 2 (0.03), 0.0 – 0.1

† Pre-SARS-CoV-2 last infection.Abbreviations: CI, confidence interval; mRNA, messenger ribonucleic acid; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

The energy expenditure related to exercise and sports activities demonstrated a reduction one month after SARS-CoV-2 infection [in all respondents (-27.6 ± 0.6 %, 95%CI: -26.1 – 29.1) and subgroups] in comparison to the pre-infection levels [1], as depicted by the alterations in PA illustrated in Fig. 1 [see also Supplementary file 2_Data in the sheet under the name PA change (%)]. However, there was no statistically significant difference between subgroups according to respondents' pre-illness vaccine type(s) received, and incidence of SARS-CoV-2 re-infections. On the contrary, there was a statistically significant difference between subgroups according to respondents' pre-illness vaccination profile as determined by one-way ANOVA ($F(2,5826) = 3.232$, $p = 0.040$). A Tukey post hoc test revealed that the PA reduction was statistically significantly greater in the "Partially vaccinated" subgroup (-38.2 ± 0.7 %, 95%CI: -35.3 – -41.1, $p = 0.031$) compared to the "Fully vaccinated" subgroup (-19.2 ± 0.5 %, 95%CI: -17.2 – 21.2). For data and metadata, please see Supplementary file 2_Data, in the sheet under the name data-metadata. The data contains: body mass (kg) and height (cm) values transformed to body mass index ($kg \cdot m^{-2}$); age (yr), sports-related physical activity changes ($MET\text{-}min \cdot week^{-1}$); sex at birth, ethnicity, region of residence, education level, number of underlying medical conditions that could be related to severe illness with COVID-19, SARS-CoV-2 re-infections, and pre-illness vaccination profiles/types classification (nominal and categorical formats).

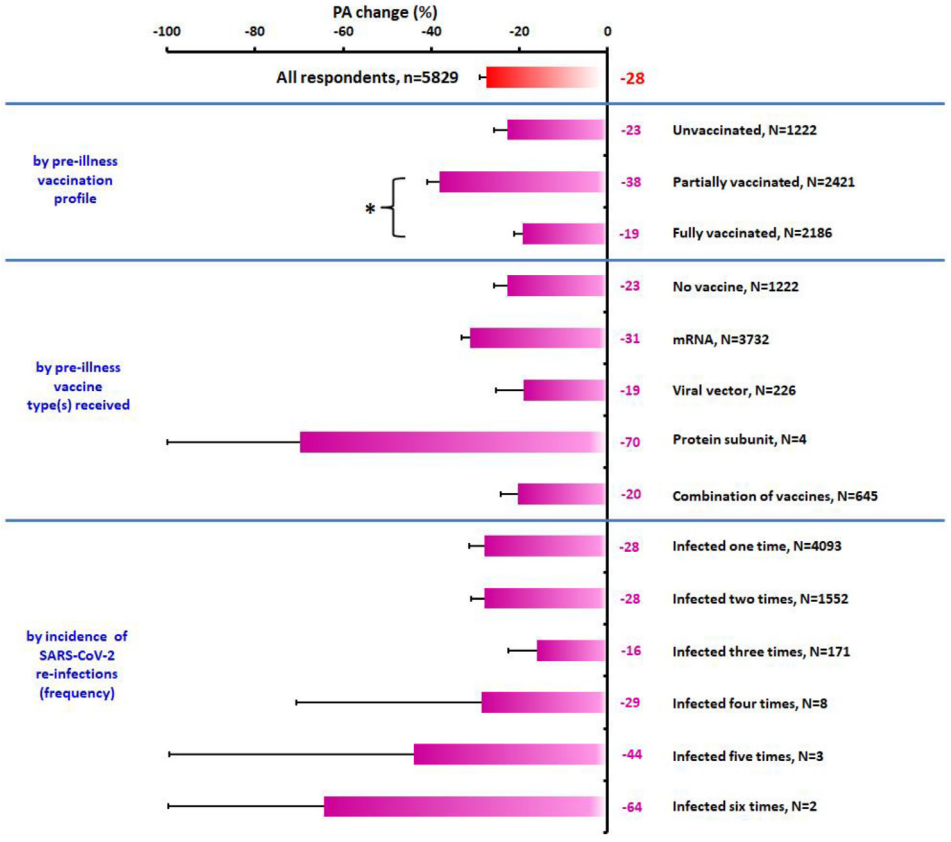

Fig. 1. Change in regular PA [%, between two time points (i.e., one–two weeks before infection and one month after last SARS-CoV-2 infection)] on a weekly basis in all participants and in the subgroups according to respondents' pre-illness vaccination profile, pre-illness vaccine type(s) received, and incidence of SARS-CoV-2 re-infections. Error bars present the lower bounds of the 95% confidence intervals. Statistical analysis was performed using one-way analysis of variance (ANOVA) tests for each independent variable, with "change in PA recorded between two time points" as the dependent variable. Significance levels were set at $p < 0.05$. In cases where the ANOVA revealed significant differences, we conducted post hoc tests (Tukey pairwise comparisons) to identify specific group differences. * $p \leq 0.05$, significant difference between the subgroups. Abbreviations: mRNA, messenger ribonucleic acid; n, sample size; N, subgroup's sample size; PA, exercise and sports-related physical activity; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

3. Experimental Design, Materials and Methods

Prospective study participants were recruited through an open invitation approach employing a snowball sampling strategy, which encompassed the dissemination of study information via various channels, (e.g., social media platforms, email networks, nationwide public advertisements). The self-eligibility criteria for willingly participating in the study included a confirmed SARS-CoV-2 infection within the last 30–40 days (confirmed by diagnostic tests such as polymerase chain reaction or blood antigen tests); moreover, the participants needed to be at least 18 years old and to be a resident of the Hellenic territory (Greece). Self-exclusion criteria consisted of recent vaccination within the two weeks prior to the last SARS-CoV-2 infection, participation in strict weight loss programs, and recent gestation or childbirth within one year of the study's start date. Prior to their voluntary participation, participants (Table 1) were provided with written information detailing the study's objectives and procedures and next provided their

informed consent. This study received approval from the institutional bioethics committee at the local university, ensuring compliance with ethical research standards.

Part (i.e., sports-related domain) of the Active-Q (online, interactive questionnaire; see Supplementary file 1_Active-Q_modyfied) [2,3] was used, from February to the end of March 2023, to automatically calculate the adults' weekly habitual PA transformed to energy expenditure per week (MET-min·week^{-1}) according to the updated version of the 2011 Compendium of Physical Activities as adequately described in a previous article [2,4]; see Supplementary file 3_Corresponding MET values. Participants were required to complete the Active-Q web-based questionnaire twice: once providing information on their exercise and sports-related physical activity one–two weeks before their last SARS-CoV-2 infection, and again one month after this infection. Both sets of data were submitted in a unified format. The change in PA for each respondent was automatically calculated between the two time points by subtracting the PA score of the one–two weeks before infection from the PA score of the one month after last SARS-CoV-2 infection. In addition, five questions about participants' ethnic origin, sex at birth, age, body mass, height, one about their region of residence (urban proximity), one on their education level, one question regarding the existence of certain underline medical conditions that could be related to severe illness with COVID-19 (e.g., cancer, chronic kidney disease, cystic fibrosis, tuberculosis, diabetes, neurocognitive disorders, essential hypertension, chronic heart disease, chronic liver disease, chronic lung disease, stroke or cerebrovascular disease, organ transplant recipient, substance use disorders, sickle cell anemia or thalassemia, HIV, $\geq$65 years of age, obesity, physical disabilities, smoking) (yes or no), and a follow-up question on the underline medical conditions (yes or no) in order to automatically compute the number of specific conditions, were incorporated to the questionnaire. Moreover, one to nine questions (depending on the previous responses and follow-up questions) on the pre-illness vaccination status (vaccinated/unvaccinated, vaccine type(s), number of administered doses, time to infection from the last vaccine dose, and/or time between last two vaccine doses if they were applicable) and one about the frequency of SARS-CoV-2 re-infections occurrence were attached to the questionnaire. All questions, except for the questionnaire items regarding anthropometric characteristics and the incidence of re-infections, had a fixed set of answers [1]. Furthermore, as part of the data collection process, we implemented an additional measure, reCAPTCHA v3, to validate the authenticity of each prospective participant, ensuring they were not automated bots, before permitting questionnaire submission. Additionally, to minimize the potential for multiple submissions by the same individual, we enforced a restriction based on personal email addresses that were not recorded in the response sheet or by any other means, thus preventing multiple responses from the same email address. Validity and reliability as well as additional details on the methodology of the current online questionnaire has been adequately described elsewhere [1–3].

Based on the responses, the respondents were automatically divided into groups i.e., six for incidence of SARS-CoV-2 re-infections (i.e., "Infected one time" – "Infected six times"), three for pre-illness vaccination profile (i.e., "Unvaccinated", "Partially vaccinated", "Fully vaccinated"), five for pre-illness vaccine type(s) received [i.e., "No vaccine", "messenger ribonucleic acid" (mRNA), "Viral vector", "Protein subunit", "Combination of vaccines"] subgroups (see Table 2 and Fig. 1). Due to the vaccine doses administered in the sample population included various combinations, participants meeting the criteria of having received two or more doses of mRNA-type or protein subunit-type vaccines, one dose of a viral vector-type vaccine, or a heterologous vaccine combination at least six months before their most recent SARS-CoV-2 infection were categorized as "Fully vaccinated" within the scope of this study. Additionally, individuals who had either received a single dose of a multi-dose COVID-19 vaccine series or completed the primary vaccination series but had an interval exceeding six months between their last dose or booster and their most recent SARS-CoV-2 infection were categorized as "Partially vaccinated."

We also performed separate one-way analysis of variance (ANOVA) tests for each independent variable: "Vaccination profile," "Vaccination types," and "Incidence of SARS-CoV-2 re-infections". In each ANOVA test, "change in PA recorded between two time points (i.e., one–two weeks before infection and one month after last SARS-CoV-2 infection)" served as the dependent variable. Significance levels were set at $p < 0.05$. In cases where the ANOVA revealed significant

differences, we conducted post hoc tests (Tukey pairwise comparisons) to identify specific group differences [5]. However, the "Protein subunit-type vaccine", "Infected four times", "Infected five times", and "Infected six times" subgroups (due to their small sample sizes) were not practically significant, and therefore, were not considered in the analysis. Statistical analyses were conducted using SPSS (v. 29.0, IBM Corp, Armonk, NY, USA). Descriptive statistics were employed to represent data, with categorical variables presented as frequencies and relative frequencies (expressed as percentages) along with their corresponding 95% confidence intervals (CIs). Continuous variables were presented as means accompanied by their standard deviations and 95% CIs.

4. Limitations

Our study has several limitations pertaining specifically to the dataset and data collection. The findings are primarily applicable to the adult population in the Hellenic territory. Vaccine combinations were based on medical recommendations, personal preferences, and vaccine availability [6], making it challenging to account for variations such as additional doses, heterologous schemes, and boosters. The study couldn't control for specific virus variants due to their coexistence. Some respondents may have had asymptomatic SARS-CoV-2 infections that remained undetected. Some subgroups had small sample sizes, limiting the generalizability of findings within those groups. Data on sporting activity relied on self-reporting, which could introduce recall bias, whereas several factors, such as psychological and socioeconomic aspects, were not accounted for in the analysis.

Ethics Statement

Ethical approval was obtained by the National and Kapodistrian University of Athens review board (approval protocol number: 1454/11-01-2023, ClinicalTrials.gov identifier: NCT05787431). Informed consent was obtained from all participants, data has been fully anonymized and the platform(s)' data redistribution policies were complied with.

CRediT Author Statement

Dimitrios I. Bourdas: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Panteleimon Bakirtzoglou**: Data curation, Funding acquisition, Investigation, Project administration, Resources, Supervision, Validation, Accessed and verified the underlying data, Writing – review & editing. **Antonios K. Travlos**: Data curation, Formal analysis, Investigation, Methodology, Software, Resources, Validation, Writing – review & editing. **Vasileios Andrianopoulos**: Funding acquisition, Investigation, Resources, Writing – review & editing, **Emmanouil Zacharakis**: Data curation, Investigation, Methodology, Project administration, Resources, Supervision, Accessed and verified the underlying data, Writing – review & editing.

Data Availability

Data of Vaccination Profile, Types, severe acute respiratory syndrome coronavirus 2 Re-Infections and Changes in Sports-Related Physical Activity One Month after Infection (Reference data) (Mendeley Data)

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2023.109723.

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