Effects of quarantine on Physical Activity prevalence in Italian Adults: A pilot study

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Background. Covid-19 is a respiratory disease that caused a global pandemic status in March 2020. Due to its fast diffusion, many governments adopted forced solutions including social restrictions, which could negatively affect citizens' habits as physical activity. Our study aimed to investigate how and why the physical activity prevalence varied from the period before the quarantine up to the period after it, and understand what citizens thought of physical inactivity covid-19 related to and whether they were satisfied with physical activity promotion during the lockdown. **Methods**. A new questionnaire was created and administered online. A sample of 749 interviews (female = 552 (73.7%), male = 197 (26.3%)) was collected and analysed. **Results**. The prevalence of people who were older than 50 years reduced both during and after the lockdown (P < 0.05) and the most common reason for which they have quitted physical activity practice was related to psychological problems (lockdown = 64.57%; post-lockdown = 62.17%). In addition, youngers seemed to be more sensitive than elders to unhealthy consequences generated by forced isolation (P < 0.05), and they believed that children/adolescents and older adults practised an insufficient amount of physical activity and/or sport, which could negatively impact public health. **Conclusions**. Although many strategies were implemented during the lockdown to promote regular physical activity practice, several results suggested that quarantine negatively affected citizens' habits. The future government should focus on adequate measures to improve health behaviours.

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Abstract

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Methods. A new questionnaire was created and administered online. A sample of 749 interviews (female = 552 (73.7%), male = 197 (26.3%)) was collected and analysed.

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Conclusions. Although many strategies were implemented during the lockdown to promote regular physical activity practice, several results suggested that quarantine negatively affected

39 citizens' habits. The future government should focus on adequate measures to improve health
40 behaviours.
41
Introduction
43 Coronavirus 2019 (COVID-19) is a respiratory disease caused by severe acute respiratory
44 syndrome coronavirus 2 (SARS-CoV-2) that was first noted as a case of unexplained pneumonia
45 in December 2019 (Guo et al., 2020). Since COVID-19 showed fast human-to-human
46 transmission through aerosols, droplets, and close contact, the World Health Organization
47 (WHO) declared a global pandemic on March 11 (World Health Organization). The earliest
48 appearance of COVID-19 in Italy was on January 30 and after two weeks it spread progressively
49 over the national territory (La Maestra, Abbondandolo & De Flora, 2020). As a method to
50 control and reduce individual interaction, many countries used a combination of several non-
51 pharmaceutical interventions such as the isolation of infected people, the tracking of exposed
52 people, travel restrictions, lockdown, wearing masks and frequent sanitization (Goenka & Liu,
53 2022). Italian government adopted strategies such as quarantine and social restrictions, which
54 had consequences on social and economic aspects.
55 However, authorities and policymakers are supposed to consider how these preventive measures
56 impacted citizens' lives and public health. Some researchers found that social restrictions
57 negatively affected economic and employment status, reduced education levels decreased
58 general well-being, and physical and mental health of several social groups (Diedhiou, Yilmaz,
59 Fikriye & Yilmaz, Atakan, 2021; Osterrieder et al., 2021). Many studies reported that quarantine
60 and isolation measures were associated with an increased risk of experiencing mental health
61 burdens, especially in people who have reported previously disorders (Regehr et al., 2021; Wang
62 et al., 2021). In addition, a review evidenced that longer quarantine duration, infection fears,
63 frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma
64 acted as stressors, which negatively affected psychological aspects (Brooks et al., 2020).
65 As a strategy of prevention, promoting healthy habits has elicited interest. Of these, the regular
66 practice of physical activities (PA) plays a key role in preventing the onset of cardiovascular,
67 metabolic, cancer, and neuromuscular diseases, such as viral infections, and it could reduce the
68 risk of hospitalization, morbidity, and mortality (Liu et al., 2019; Damiot et al., 2020; Lippi,
69 Henry & Sanchis-Gomar, 2020; Silva Filho et al., 2020; Després, 2021). Also, the daily practice
70 of PA can delay senescent muscle atrophy, and fragility, can reduce the risk of fall, and generates
71 mental health benefits in older adults (Campa, Silva & Toselli, 2018; Cruz-Jentoft et al., 2019;
72 Callow et al., 2020; Campa et al., 2021). To promote and facilitate the PA practice, the WHO
73 recommended easy guidelines for different populations (World Health Organization, 2020).
74 Despite this, many studies showed that social restrictions negatively impacted people's habits
75 and made them less active (Lesser & Nienhuis, 2020; Gjaka et al., 2021; Zaccagni, Toselli &
76 Barbieri, 2021; Puccinelli et al., 2021; Mauro et al., 2022; Dallolio et al., 2022).
77 Although several researchers investigated the PA parameters during the lockdown, to the best of
78 our knowledge no authors have analysed the prevalence of the PA practice in Italian citizens

79   over the pandemic. Our main hypothesis saw a reduced prevalence after the quarantine,

80   expecting it negatively impacted the citizens' habits. Also, more information on what citizens

81   thought of socio-political government strategies and whether these could have affected people's

82   lives is needed. Therefore, this study aimed (1) to develop a questionnaire that analyses the effect

83   of quarantine on PA and/or sports by comparing the pre, during, and post-lockdown prevalence

84   among gender and age classes, and (2) to research opinions regarding the link between the PA

85   and lockdown, and (3) to investigate whether Italian citizens retained that government strategies

86   could have caused negative consequences on Public Health.

87

Materials & Methods

89   *Participants and Study design*

90   The current study is a retrospective observational design, which used a questionnaire to record

91   and gather data. The surveys were shared on the Web from 2nd December 2020 up to 10th

92   January 2021 and involved 749 participants (female = 552 (73-7%), male = 197 (26.3%), table

93   1). During this period, the Italian Government declared the end of many social restrictions,

94   allowing citizens to practice all types of physical activity in outdoor spaces, and few physical

95   activities in indoor spaces, in respect of every emergency measure (wearing a mask, social

96   distancing of almost one meter, body-temperature measurement, and hand sanitation).

97   The questionnaire selection criteria included adult people who were at least 18 years old, who

98   lived in Italy during the COVID-19 pandemic, and who spoke the Italian language. No country

99   or region limitations were explained. Written informed consent was provided by the participants

100   before the study began. The study was approved by the Bioethics Committee of the University of

101   Bologna (Approval code: 224254, October 9, 2020).

102

103   *Questionnaire*

104   We created the questionnaire with Google Forms and shared it on one global social network

105   (Facebook®, Meta Platforms, Inc, Cambridge, MA, USA) and WhatsApp® (Meta Platforms,

106   Inc, Cambridge, MA, USA). All participants were informed and gave us privacy consent to treat

107   their data. They could fill out the survey with no Google sign-in request. They could manually

108   enter all general information or allow social networks to report them. The questionnaire was self-

109   administered in the Italian language. Each completed survey was saved on a Google database,

110   and we gathered all data as an Excel spreadsheet (Microsoft Office®, Microsoft Corporation,

111   Redmond, WA, USA).

112   The questionnaire was of two parts: the first part included general and demographic information

113   such as age (in years), sexes (male or female), educational status (primary school, secondary

114   school, high school, degree, master's degree, PhD, or other), occupational status (student,

115   employed, freelance, unemployed, homemade, retired, other), information on PA prevalence

116   over the quarantine (example: "Did you practice PA and/or sports before the COVID-19

117   quarantine?"), and information about motivations that negatively or positively affected citizens'

118   PA habits (example: if you did not practice any PA during the lockdown, why?);

119 the last part included 13 questions that investigated whether the sample believed physical
120 inactivity could negatively impact people's health and whether the sample thought that socio-
121 political strategies affected the citizens' habits.
122 Several types of data were collected and transformed before the analysis. Questions on PA
123 prevalence and gender were recorded as binary data (yes or no, male or female) and transformed
124 in Bernoulli data (0 or 1) where 0 was not and female, and 1 was yes and male. The citizens' age
125 was collected as years and successively grouped into four categories (a) 18-39 years (young
126 adults), (b) 40-49 years (early middle-aged adults), (c) 50-64 years (late middle-aged adults), and
127 (d) ≥ 65 years (old adults). A previous study reported four age intervals stratified into 12 age
128 subsets (Horng, Lee & Chen, 2001); however, we divided the middle-aged category into two
129 groups and we settled on 65 years as the cut-off point for the elder category (Italian retired age).
130 Information that investigated why citizens did not practise PA were registered as nominal data
131 with five options for the period during and after the lockdown respectively: "Covid-19
132 problems", "Environmental problems", "Health problems", "Psycho-social problems",
133 "Technological problems"; "Covid-19 problems", "Environmental problems", "Health
134 problems", "Psychological problems", "Socio-economics problems". Differently, the reasons for
135 which people did PA and/or sport during lockdown were: "General well-being", "Physical well-
136 being", "Psychological well-being", "Physical and General well-being", "Psychological and
137 General well-being", and "Psychological and Physical well-being". Finally, the 13 items were
138 recorded as ordinal data such as "disagree, partially disagree, partially agree and agree", and then
139 transformed into discrete items (Likert-type scale) from 1 (disagree) to 4 (agree).
140
141 *Statistical Analysis*
142 We reported the frequencies of occurrence as the number of observations for categorical and
143 binary data and mean ± standard deviation (SD) and the minimum and maximum observed
144 values for numerical (continuous and discrete) data. The prevalence of PA was analysed among
145 sexes and age groups: the McNemar's test (χ^2) was assessed with the exact McNemar
146 significance probability (P) (Brunner & Giannini, 2011). In addition, the Risk Ratio (RR) was
147 calculated as the previous study suggested (Ranganathan, Aggarwal & Pramesh, 2015).
148 The reliability of the questionnaire items was tested through homogeneity and internal
149 consistency. To identify the dimensions of our questionnaire, the exploratory factor analysis
150 (EFA) of tetrachoric correlations was assessed (Schreiber, 2021). To measure the sampling
151 adequacy, the Kaiser–Meyer–Olkin (KMO) value was calculated; values > 0.80 were considered
152 meritorious. To test the null hypothesis that variables were not intercorrelated, Bartlett's test of
153 sphericity was performed, and the determinant of matrix correlation value, χ^2, degree of freedom
154 (df), and the p-value (P) were reported. The choice of the number of factors was based on the
155 eigenvalues, and we used the unweighted least-squares method and the Kaiser rule to extract
156 only factors with an eigenvalue ≥ 1. Finally, the orthogonal Varimax rotation was used and the
157 related χ^2 and p-values (P) were settled. Items with a loading value < 0.40 were dropped, and the
158 final model included only items with loadings of ≥ 0.40 on their specific factors. In addition, to

159 give a measure of the common variance proportion of the variable not associated with the
160 factors, the Uniqueness (1 – commonality) was calculated (Lawley & Maxwell, 1962).
161 Then, to provide the internal consistency of our questionnaire, we calculated Cronbach's alpha
162 on all items and each factor, respectively. We considered the alpha value acceptable ranging
163 from 0.70 to 0.95 (Tavakol & Dennick, 2011), and we reported the average interitem correlation
164 and alpha values (α). Finally, the test-retest reliability was assessed through Spearman's rank
165 correlation coefficient (ρ), where a value equal to 1 was considered perfect reliability, a value
166 between 1 and ≥ 0.90 was considered excellent, a value ≥ 0.80 and ≤ 0.90 was considered good, a
167 value ≥ 0.70 and ≤ 0.80 was considered acceptable, a value ≥ 0.60 and ≤ 0.70 was considered
168 questionable, and all values <0.60 was considered poor reliable. (Shou, Sellbom & Chen, 2022)
169 The ANOVA methods were used to compare the mean differences among age groups, sexes, and
170 age-sexes interactions. The Snedecor-Fisher test value (F) and p-value (P) were reported.
171 We selected a priori hypothesis test significance levels as equal to 0.05 (α). In addition, we used
172 G*Power 3.1.9.7 for Windows 10 (Heinrich-Heine-Universitat Düsseldorf, Universitätsstraße 1,
173 40225 Düsseldorf, Germany) to compute an a priori sample size analysis. which equalled to 731
174 with the following parameters: type I error = 0.05, Effect Size = 0.15, Statistical Power = 0.80
175 and number of groups = 8 (gender*Age). All statistical analyses were performed by STATA®
176 software (version 17, Publisher: StataCorp. 2021. Stata Statistical Software: Release 17. College
177 Station, TX, USA, StataCorp LP).
178
179 **Results**
180 *Sample characteristics*
181 We collected 751 interviews. Two of these were excluded for missing values and we finally
182 analysed 749 interviews.
183 Table 1 shows participants' characteristics of gender type, educational level, occupational kind,
184 and age. Most of the sample was female and younger than 50 years old, and approximately half
185 participants had high school graduation. Just 3.87% of the sample was unemployed.
186
187 **Table 1: Socio-cultural characteristics of people interviewed.**
188
189 *Physical Activity prevalence*
190 Table 2 shows the prevalence of PA before, during, and after the forced lockdown, among age
191 groups and sexes. Generally, a decreasing prevalence of PA trend was observed with significant
192 differences between the period before lockdown and periods during and after. When stratified for
193 gender, no significant differences emerged between the periods before and during the lockdown
194 in both sexes, while the number of women and men who practised PA before lockdown
195 decreased after quarantine drastically. As regards the age classes, a negative trend was observed
196 for the elder categories (≥ 40 years), which decreased both during and after the lockdown. The
197 number of younger individuals (18-39) who remained active during lockdown did not decrease
198 significantly, but a greater reduction was observed after the quarantine.

199   In sexes analysis, female people showed a negative trend with lower prevalence post the
200   lockdown, whereas male subjects did not report significant differences.
201   In age comparisons, a significant reduction of people who practised PA before the lockdown was
202   observed post the lockdown in subjects who were 40-64. Also, a lower prevalence was recorded
203   post-lockdown than during lockdown in the youngest group.
204   Successively, the motivations for which individuals chose to practice (or not) PA and/or sport
205   during lockdown were investigated. Generally, most of the sample who did not practice PA
206   and/or sport experienced Psycho-social problems (64.57%), while 16.54% reported
207   Environmental problems. Only ten individuals (3.94%) had problems with technology. When
208   gender differences were analysed, most of both male and female samples were inactive due to
209   Psycho-social problems (M = 35, 59.32%; F = 129, 66.15%); also, the percentage of women and
210   men who did not practice PA and/or sport for Health problems was similar, 8.72% and 8.47%
211   respectively. In addition, figure 1 (A) shows the percentage of responses divided by gender and
212   age. Differently, 74.95% of the sample who were active during the lockdown selected answers
213   with psychological benefits, while just 3.23% practised PA and/or sport for physical well-being
214   alone. This prevalence in psychological responses remained same in gender analysis too, despite
215   was more prevalent in women (F = 276, 77.31%; M = 95, 68,84%). Figure 1 (B) shows the
216   percentage of responses divided by gender and age.
217   In addition, the reasons why individuals chose to not practice PA and/or sport after the lockdown
218   was investigated. Generally, 189 people (62.17%) did not practice PA and/or sport due to
219   Psychological problems, while 12.83% experienced Socio-Economic problems. Just 18
220   individuals (5.92%) were influenced by Environmental problems. When gender differences were
221   analysed, 62.08% of women and 62.5% of men experienced Psychological problems, while the
222   minor problems for both females and males were Environmental related (F = 16, 6.67%; M = 2,
223   3.12%). Finally, figure 2 shows the percentage of responses divided by gender and age.
224
225   **Figure 1**. **Motivations that led Italian citizens to not practice (A) or practice (B) physical**
226   **activity and/or sport during the lockdown.**
227
228   **Figure 2. Motivations that led Italian citizens to not practice PA and/or sport after**
229   **lockdown.**
230
231   **Table 2**. **Differences in PA frequencies before, during and post lockdown, among sexes and**
232   **age groups.**
233
234   *Questionnaire Characteristics*
235   We included 11 items in the model (Table 3). In the beginning, 18 questions were considered, of
236   which five were excluded because data was not on the Likert scale and two were excluded due to
237   poor loading values. Each item was labelled as PAA#, which indicates Physical Activity Aspects
238   and the number (order) of the question. The questions were the following:

239   1. PAA2: "Do you think the lack of practice of physical activity and/or sport during lockdown
240   has negatively affected your health?"
241   2. PAA3: "Do you think the lack of practice of physical activity and/or sport in older adults
242   during lockdown has negatively affected their health?"
243   3. PAA5: "Do you think the lack of practice of physical activity and/or sport during lockdown
244   could cause problems for the national health system and public health?"
245   4. PAA6: "Do you think the lack of practice of physical activity and/or sport could have
246   affected emotional/psychological wellbeing during the lockdown?"
247   5. PAA7: "Do you think the lack of practice of physical activity and/or sport could have
248   affected emotional/psychological growth in children/adolescents during the lockdown?"
249   6. PAA8: "Do you think children/adolescents have practised enough amount of physical
250   activity and/or sport during the lockdown?"
251   7. PAA9: "Do you think the lack of practice of physical activity and/or sport could have
252   affected emotional/psychological status in older adults (>65 years old) during the
253   lockdown?"
254   8. PAA10: "Do you think the Italian government adequately considered the practice of physical
255   activity and/or sport during the lockdown?"
256   9. PAA11: "Do you think the usage of tech devices to practice physical activity and/or sport
257   during lockdown could have affected social interaction negatively?"
258   10. PAA12: "Do you think sports federations and societies adequately promoted the practice of
259   physical activity and/or sport during the lockdown?"
260   11. PAA13: "Do you think public and private schools adequately promoted the practice of
261   physical activity and/or sport during the lockdown?"

262   Firstly, we analysed the sample adequacy (KMO = 0.81), the correlation matrix determinant (Det
263   = 0.09), and the Bartlett's test of sphericity (χ^2 = 1743.66; dfs = 55; P < 0.001). Figure 3 shows
264   the scree plot of eigenvalues with the Kaiser rule. Two factors met our criteria and the Varimax
265   rotation reported a LR test of significant results (χ^2 = 1746; P < 0.001; n = 749). Table 3 shows
266   that factor 1 (how participants thought physical inactivity impacted people's health) included
267   seven items and factor 2 (what participants thought about socio-political strategies on PA habits)
268   included four items. In addition, we assessed Cronbach's alpha on 11 items. The last row of table
269   3 shows all Cronbach's alpha values. We used the mean test scale on standardized items,
270   deleting missing values from the analysis. The average interitem correlation on 749 observations
271   was 0.097 and the scale reliability coefficient (α) was 0.724. In addition, we reported each
272   consistency factor data: factor one α was equal to 0.779, whereas factor two α equalled 0.603.
273
274   **Table 3**. **Rotated factor loadings (pattern matrix) and Cronbach's alpha values.**
275
276   **Figure 3. Scree-plot. The grey horizontal line (Y=1) indicates the value under which factors**
277   **were excluded.**
278

279 After assessing EFA computations, test-retest reliability was assessed in a sample of 149 citizens
280 (Table 4). The retest period was of one month. The lowest value of ρ was 0.738 (acceptable),
281 while the highest value was equal to 0.914 (excellent).
282
283 **Table 4. Test-retest correlation coefficients in 149 citizens.**
284
285 *Physical Activity Aspects*
286 Table 5 shows the ANOVA outcomes. As regards factor 1, both female and younger subjects
287 exhibited higher value than men, which means they believed that physical inactivity due to
288 Covid19 social restrictions impacted the psychological status of adolescents and adults and will
289 negatively affect global health. About factor 2, male and elder people reported significantly
290 higher values than women and youths on items 8 and 10, which indicates that younger women
291 thought of Italian government adopted inadequate solutions to promote PA during the lockdown,
292 and adolescents did an insufficient amount of PA.
293
294 **Table 5. ANOVA outcomes of factors 1 and 2 aspects related to the PA practice, by sexes**
295 **and age groups.**
296
297

Discussion

299 The main purpose of the present study was to evaluate the effects of social restrictions on
300 citizens' habits after the COVID-19 quarantine and to investigate its rationale. As predicted, we
301 found that the prevalence of individuals who did PA decreased after lockdown, which should
302 indicate a negative effect of quarantine on people's habits. The psychological aspects were the
303 most common problem that affected the Italian citizens.
304 Generally, we observed that the PA prevalence decreased after the lockdown, which is in
305 agreement with some authors who found that the lockdown negatively affected vigorous and
306 moderate PA measured as METs (metabolic equivalents) per week (Hargreaves et al., 2021). As
307 regards gender and age, the PA prevalence has fallen after the lockdown in both male and female
308 subjects and in citizens who were 40 or more, but only the number of active women has
309 decreased from lockdown up to the period after quarantine. Although the beginning larger
310 number of women could have influenced the observed gender discrepancy, some authors
311 suggested that this significant female decline could reflect the fact that women were more
312 negatively affected by COVID-19 fear-related, which increased depression, anxiety, and stress
313 levels and impacted their lifestyle habits (Koçak, Koçak & Younis, 2021). Our results showed
314 that female citizens experienced many psychological problems than males, which could be the
315 most relevant rationale that has influenced their PA habits. However, although several studies
316 have investigated people's habits' differences during the lockdown, to the best of our knowledge
317 few researchers analysed whether the citizens' PA practice varied after the quarantine, and no
318 one analysed how the prevalence of PA varied. Of these, just one study showed a female
319 decreasing trend in PA prevalence, but the authors examined the habits of Italian older adults (≥

320   65 years) and considered the PA responses as levels increment (Gallè et al., 2021). Differently,
321   our results are comparable with many studies that considered the differences between the period
322   before and during the lockdown. Of these, one study suggested that most of the sample (679
323   Italian adults) maintained their training habits during the lockdown, and people who remained
324   active tend to experience higher levels of energy and calm, and lower levels of perceived fatigue
325   (Di Corrado et al., 2020). In addition, one research did not show discrepancies in PA prevalence
326   and suggested that both men and women tried to stay active in quarantine (Mauro et al., 2022).
327   However, we observed that the reduction in PA prevalence during the lockdown was more
328   evident in older adults, in agreement with the above-mentioned results.
329   Concerning age, just one longitudinal study showed that both younger and elder adults were
330   more active (30 minutes to 2 hours of training per week) after the home forced period (Bu et al.,
331   2021). Despite our study focusing on the PA prevalence and did not investigate its amount, our
332   results suggested that the number of active individuals younger than 49 decreased after
333   lockdown, while the number of older people had a larger decrement during the lockdown. These
334   results could suggest that younger individuals have been most negatively affected by long-term
335   effects related to quarantine. In addition, we found that many youths selected the socio-
336   economics problems as motivation that conducted them to not practice PA after the quarantine.
337   Differently, several studies agreed with our outcomes and found that the PA levels decreased in
338   elder people during the lockdown, which may represent a relevant threat to public health
339   (Giustino et al., 2020; Ferrante et al., 2020; Gallè et al., 2021; Mauro et al., 2022). Although the
340   psychological aspects (meant as problems and/or benefits) were the main reasons that influenced
341   the PA practice, many elders motivated their inactivity through health problems, which could
342   indicate they saw the PA practice as harmful to their disease status. Differently, other authors
343   showed a PA reduction in university students and an increased usage of sedentary behaviours
344   (Gallè et al., 2020a,b). Although the practice of daily PA should be promoted to any individual,
345   our data suggest that great attention should be focused on promoting healthy habits in people
346   who were elder than 40. These categories are more sensitive to cardiovascular, metabolic and
347   cancer diseases. Also, the 40-50 years classes could be considered the target sensible age range
348   in which began the senescent decline of the appendicular muscle mass and functional strength,
349   which could cause Sarcopenia, obesity, fragility, muscle-skeletal injuries, hospitalization and
350   decline in quality of life (Cruz-Jentoft et al., 2019). In addition, a recent review showed that
351   quarantine had the most negative impact on lifestyle habits in people who were affected by
352   pathologies such as diabetes, obesity, Parkinson's, and cardiovascular and neuromuscular
353   diseases (Zaccagni, Toselli & Barbieri, 2021).
354   The second aim of this study was to understand what people thought of physical inactivity's
355   effects on public health and whether they retained the restrictive measures enforced by the Italian
356   government were adequate to favourite the PA habits.
357   We found that younger and female people considered that the lack of PA and/or sports practice
358   negatively impacted the psycho-emotional dimension during the lockdown, especially in
359   children/adolescents (items 6 and 7). Differently, both younger and older adults retained that the

360 lack of PA and/or sports practice negatively affected the psycho-emotional status of elder
361 individuals, but women resulted more sensitive than men (item 9). Several studies showed that
362 quarantine led to deteriorated psychological aspects such as stress, anxiety, depressive
363 symptoms, social isolation, and mood (García et al., 2020; Antunes et al., 2020; Stanton et al.,
364 2020). Consistent with our outcomes, one of these found that both women and people who were
365 younger than 34 revealed higher scores for the anxiety state and trait (Antunes et al., 2020). In
366 addition, Stanton and collaborators (Stanton et al., 2020) found that women, young adults, and
367 people with chronic illnesses showed higher levels of anxiety, stress, and depression, and higher
368 psychological distress was associated with negative lifestyle changes. Recently, some authors
369 suggested that younger adults may spend a lot of time thinking and worrying about the outbreak,
370 which may lead to general anxiety disorders and mental illness (Huang & Zhao, 2020). Also, one
371 recent research showed that younger adults could be distressed by quarantine secondary
372 consequences such as the social standstill and the economic decline, because they attempted to
373 tackle many of life's key transitions (educational, professional, social, etc.), but they were
374 temporarily frustrated in these efforts (Shanahan et al., 2020). As regards the gender differences,
375 some researchers found that female psychological distress was higher than men, and female
376 athletes reported higher levels of depression, loss of energy and demotivation during COVID-19
377 lockdown (Pillay et al., 2020; Shechter et al., 2020). These gender disparities in psychological
378 and emotional distresses could be due to genetic and epigenetic factors (McLean & Anderson,
379 2009). However, our results emphasized that the youngest citizens were more worried than elder
380 individuals about public health and the consequences of unhealthy habits due to physical
381 inactivity (items 2 and 3). In addition, younger women were more concerned about consequences
382 caused by the lack of PA and/or sports practice in the national health system (item 5).
383 As regards the government measures adopted to slow the virus spread, we found that younger
384 and female citizens disagreed with socio-political decisions more than male and older
385 individuals, and they retained that the Italian government did not adequately consider the role
386 and importance of PA and/or sports practice (item 10). Also, younger citizens retained that the
387 adolescents did not practice enough amount of PA and/or sports during the lockdown (item 8),
388 and they believed that school PA promotion was inadequate to involve them in exercise (item
389 13). Although many studies investigated on lives' habits during the lockdown, to the best of our
390 knowledge no similar results were published. However, governments should make more effort to
391 promote and enhance healthy habits and improve public health after the pandemic status due to
392 COVID-19. Several strategies were proposed by previous studies to promote the PA practice
393 through policies, schools, hospitals, transport, and the public sector, accessibility to adequate
394 places, communications campaigns, and social support (National Academy of Sciences, 2015;
395 Tuso, 2015; Board & Medicine, 2015; CDC, 2022).
396 This study presents many limitations as the fact that we did not analyse how the amount of PA
397 varied, and we could not exclude the presence of other motivations not correlated with
398 quarantine, which may have affected the PA prevalence. Also, a larger sample size could have
399 explained more evidence and the unbalanced gender size may affect the robustness of the

400   questionnaire. In addition, we did not request the individual medical record, and we did not know
401   whether each participant was affected by the Sars-Cov-2 during or after lockdown. Finally, we
402   did not assess the test-retest reliability in the whole sample, but just 149 citizens were tested
403   twice. Further studies that may fill these gaps are needed.

404

405   Conclusions

406   Italian citizens lived at least three months of home-forced quarantine, which could have had
407   negative consequences on their lifestyle habits. The physical activity prevalence reduced after
408   the lockdown, and this may represent any trouble for public health. Despite this, citizens who
409   were active during the lockdown experienced both psychological and physical well-being related
410   to the practice of physical activity. So, promoting healthy behaviours as the practice of physical
411   activity could be a cheap and easy solution to face negative quarantine consequences on public
412   health. The government's attention should focus on adequate preventive strategies to improve
413   citizens' health.

414

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416

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607

Figure 1

Motivations which led Italian citizens to do not practice (A) or practice (B) physical activity and/or sport during lockdown.

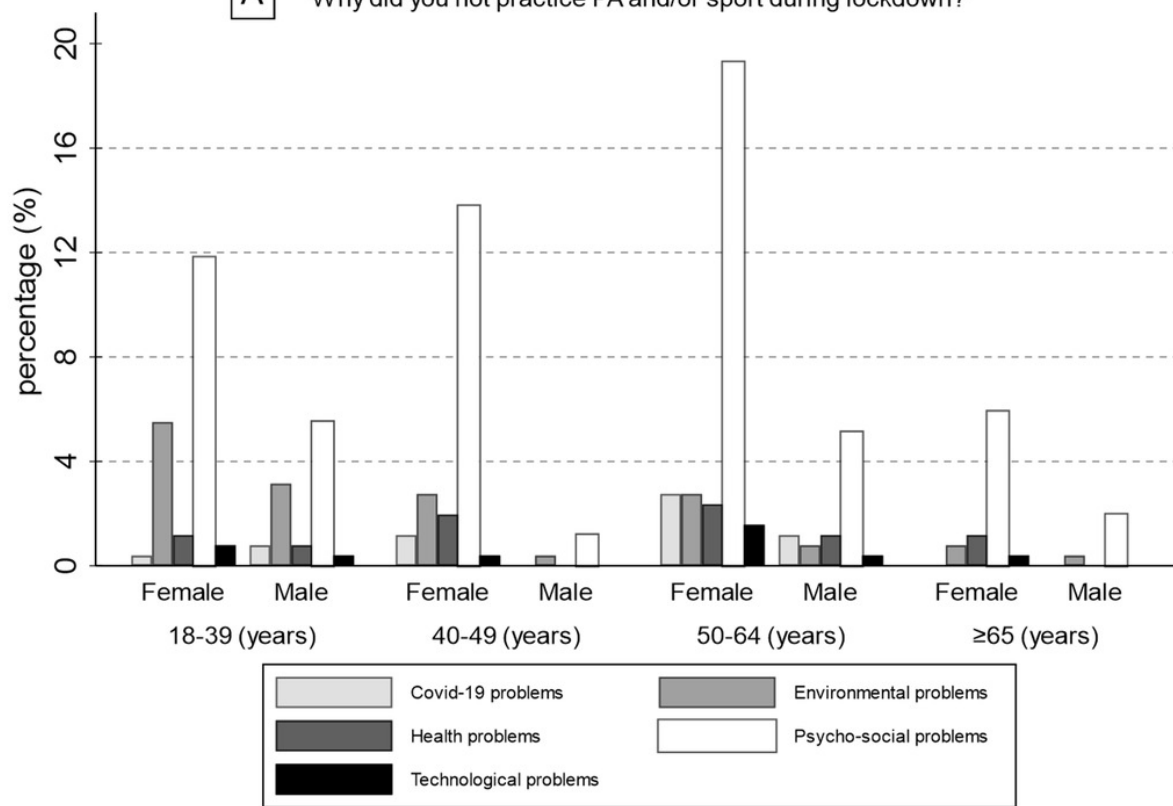
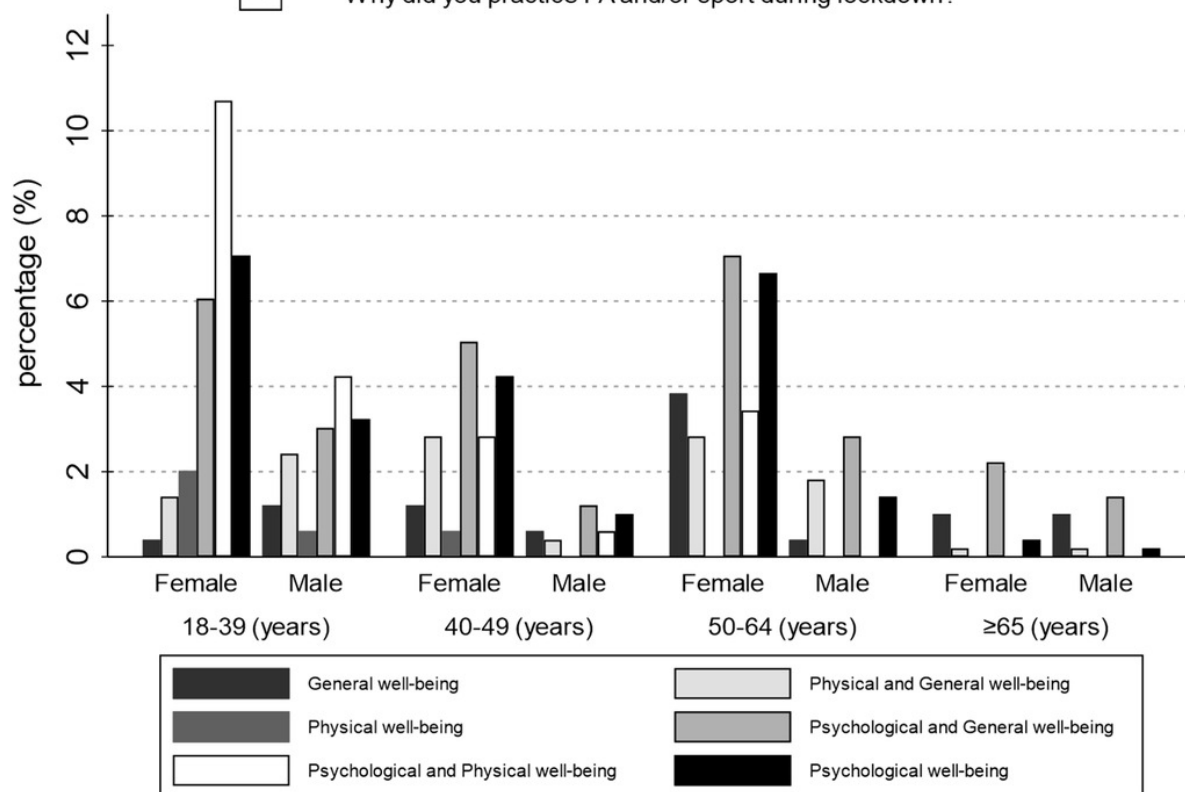



Figure 2

Motivations which led Italian citizens to do not practice PA and/or sport after lockdown.

Why did you not practce PA and/or sport after lockdown?

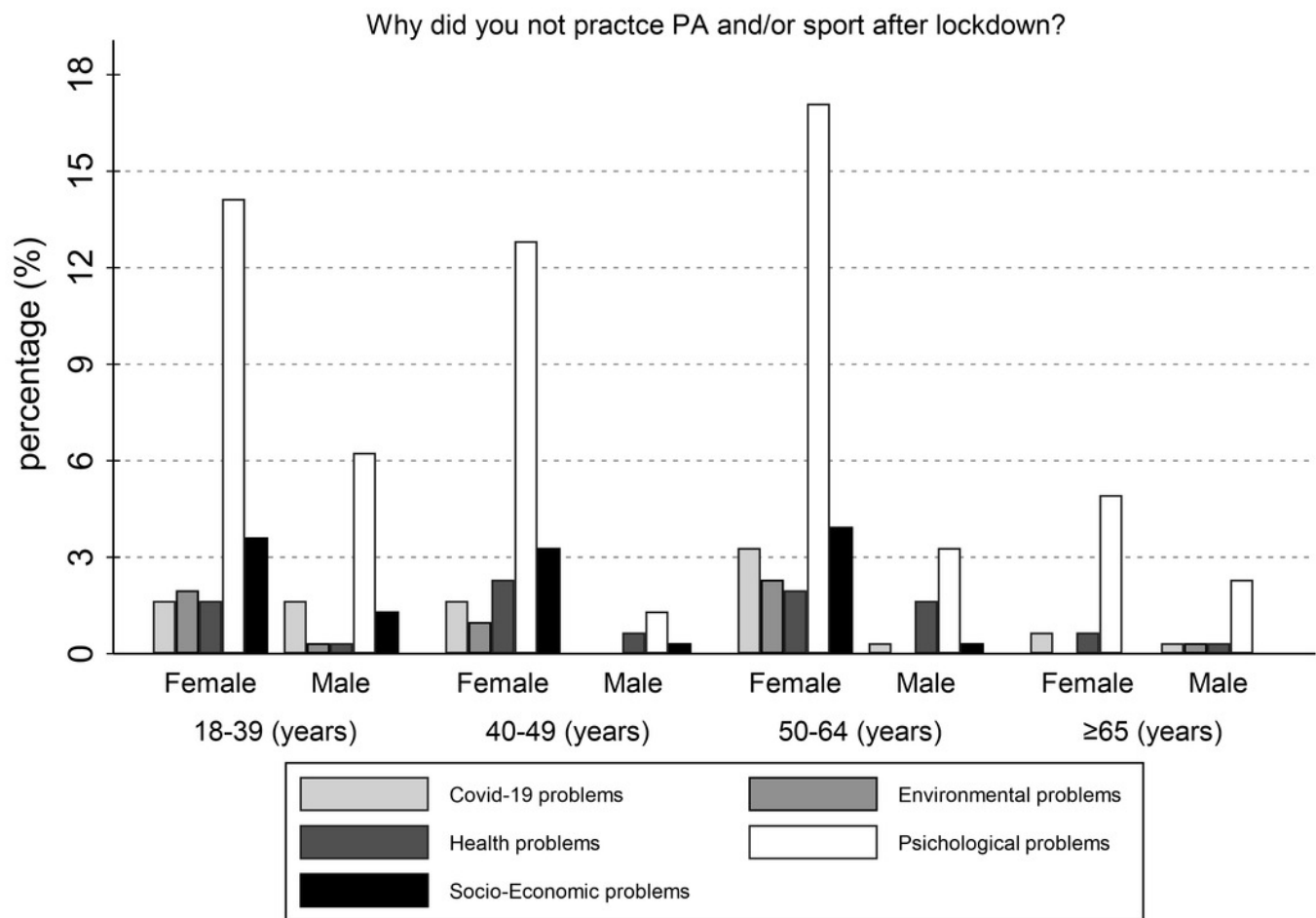
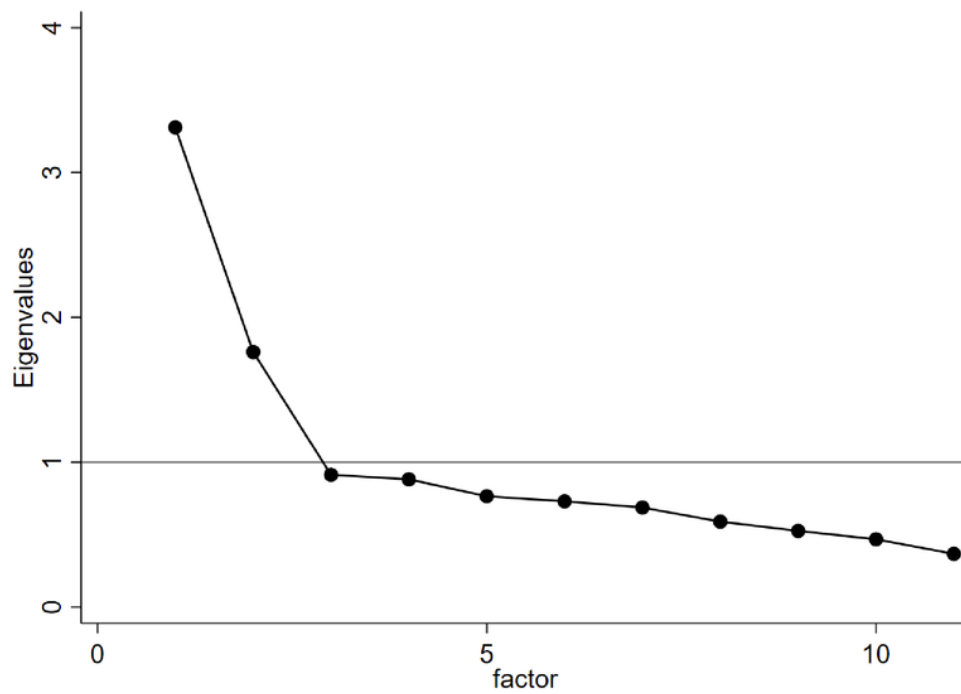



Figure 3

Scree-plot. The grey horizontal line (Y=1) indicates the value under which factors were excluded.

Socio-cultural characteristics of people interviewed

SD, standard deviation; n, number of observations; Freq, frequencies.

Table 1:
Socio-cultural characteristics of people interviewed.
Note: SD, standard deviation; n, number of observations;
Freq, frequencies.

	Category	Freq	(%)	*n*
Gender	Male	197	26.3	749
	Female	552	73.7	
Education	Primary School	4	0.53	749
	Secondary School	75	10.01	
	High School	369	49.27	
	Degree	163	21.76	
	Master's degree	118	15.75	
	PhD	14	1.87	
	Other	6	0.80	
Occupation	Employed	414	55.27	749
	Freelance	115	15.35	
	Retired	75	10.01	
	Student	73	9.75	
	Unemployed	29	3.87	
	Homemade	15	2	
	Other	28	3.74	
	Mean (± SD)	Min	Max	*n*
Age (year)	44.14 (14.55)	18	84	749
Category	Mean (± SD)	Freq	(%)	
18-39	28.28 (5.46)	287	38.32	
40-49	45.12 (2.63)	157	20.96	
50-64	55.96 (3.85)	245	32.71	
>64	69.15 (4.21)	60	8.01	

Differences in PA frequencies before, during and post lockdown, among sexes and age groups.

pre, before the lockdown; lockdown, during the lockdown; post, after the lockdown; χ2, McNemar χ2; RR, Risk Ratio; P, Exact McNemar significance probability; *, significant level

Table 2:

Differences in PA frequencies before, during and post lockdown, among sexes and age groups.

Note: pre, before the lockdown; lockdown, during the lockdown; post, after the lockdown; χ2, McNemar χ2; RR, Risk Ratio; P, Exact McNemar significance probability; *, significant level

		PA pre lockdown		PA lockdown		PA post lockdown		Δ PA (pre - lock)			Δ PA (pre - post)			Δ PA (lock - post)		
		No	Yes	No	Yes	No	Yes	χ^2	P	RR	χ^2	P	RR	χ^2	P	RR
Gender	F	176	376	195	357	240	312	2.27	0.15	0.90	34.13	<0.001*	0.73	16.46	<0.001*	0.81
	M	49	148	59	138	64	133	2.50	0.15	0.83	8.33	<0.01*	0.76	0.64	0.52	0.92
Age	18-39	87	196	77	210	100	187	1.47	0.27	1.13	3.45	0.09	0.91	8.67	<0.01*	0.48
	40-49	49	108	55	102	71	86	0.82	0.45	0.89	14.24	<0.001*	0.69	6.40	0.01*	0.77
	50-64	71	174	95	150	104	141	8.23	<0.01*	0.75	20.55	<0.001*	0.68	1.65	0.25	0.91
	>64	18	42	27	33	29	31	4.76	<0.05*	0.67	11.00	0.001*	0.62	0.33	0.77	0.93
Total		225	524	254	495	304	445	4.23	<0.05*	0.88	42.46	<0.001*	0.74	15.43	<0.001*	0.83

Rotated factor loadings (pattern matrix) and Cronbach's alpha values.

Loadings ≥ 0.4 are shaded.

Table 3:
Rotated factor loadings (pattern matrix) and Cronbach's alpha values.
Note: Loadings ≥ 0.4 are shaded.

Items (11)	Factor 1 7	Factor 2 4	Uniqueness
PAA6	0.771	-0.062	0.4
PAA3	0.731	-0.01	0.464
PAA5	0.722	-0.012	0.478
PAA2	0.71	-0.111	0.483
PAA9	0.634	-0.022	0.598
PAA7	0.627	0.129	0.59
PAA11	0.415	0.019	0.827
PAA13	-0.045	0.766	0.411
PAA12	0.119	0.676	0.529
PAA8	-0.067	0.623	0.607
PAA10	-0.273	0.623	0.537
α=0.724	α=0.779	α=603	

Test-retest correlation coefficients in 149 citizens.

ρ, Spearman's ρ correlation coefficient; P, p-value; n, number of observations; *, statistically significant

Table 4:
Test-retest correlation coefficients in 149 citizens.
Note: ρ, Spearman's ρ correlation coefficient; P, p-value; n, number of observations; *, statistically significant

Variable	ρ	P
PAA2	0.738	<0.001*
PAA3	0.815	<0.001*
PAA5	0.914	<0.001*
PAA6	0.778	<0.001*
PAA7	0.814	<0.001*
PAA8	0.825	<0.001*
PAA9	0.899	<0.001*
PAA10	0.907	<0.001*
PAA11	0.747	<0.001*
PAA12	0.826	<0.001*
PAA13	0.756	<0.001*

ANOVA outcomes of factor 1 and 2 aspects related to the PA practice, by sexes and age groups.

F, female; M, male; SD, standard deviation; F, Fisher test value; P, p-value

Table 5:
ANOVA outcomes of factors 1 and 2 aspects related to the PA practice, by sexes and age groups.
Note: F, female; M, male; SD, standard deviation; F, Fisher test value; P, p-value

Factor 1	18-39 years (287)		40-49 years (157)		50-64 years (245)		>65 years (60)		Sexes		Age		Sexes*Age		Range
	M (100)	F (187)	M (23)	F (134)	M (54)	F (191)	M (20)	F (40)							
	mean (±SD)		mean (±SD)		mean (±SD)		mean (±SD)		F	P	F	P	F	P	
PAA6	3.44 (0.66)	3.60 (0.56)	3.43 (0.59)	3.57 (0.51)	3.26 (0.68)	3.34 (0.57)	2.90 (0.72)	3.32 (0.65)	8.61	<0.01*	12.01	<0.01*	7.17	<0.01*	1-4
PAA3	3.31 (0.69)	3.25 (0.78)	3.26 (0.45)	3.33 (0.66)	3.11 (0.72)	3.21 (0.69)	2.90 (0.79)	3.10 (0.81)	0.41	0.52	2.87	<0.05*	1.59	0.13	1-4
PAA5	2.85 (0.69)	3.05 (0.68)	2.83 (0.78)	3.03 (0.76)	2.81 (0.70)	2.96 (0.67)	2.65 (0.81)	2.80 (0.72)	9.64	<0.01*	2.14	0.09	2.30	<0.05*	1-4
PAA2	3.18 (0.64)	3.25 (0.72)	3.30 (0.70)	3.25 (0.70)	2.98 (0.71)	3.09 (0.67)	2.60 (0.60)	3.15 (0.70)	3.32	0.07	4.95	<0.05*	3.62	<0.05*	1-4
PAA9	2.85 (0.80)	3.09 (0.79)	2.87 (0.87)	3.07 (0.82)	2.87 (0.78)	2.99 (0.71)	2.80 (0.83)	3.03 (0.70)	9.34	<0.01*	0.40	0.75	2.63	<0.05*	1-4
PAA7	3.45 (0.67)	3.67 (0.53)	3.39 (0.66)	3.68 (0.53)	3.35 (0.59)	3.35 (0.62)	3.15 (0.81)	3.42 (0.81)	19.9	<0.01*	4.54	<0.05*	4.87	<0.05*	1-4
PAA11	2.59 (0.77)	2.76 (0.80)	3 (0.80)	2.72 (0.83)	2.59 (0.81)	2.71 (0.84)	2.40 (0.82)	2.60 (0.78)	2.27	0.13	1.13	0.33	1.33	0.25	1-4
Factor 2															
PAA13	1.73 (0.63)	1.72 (0.57)	1.96 (1.02)	1.69 (0.74)	1.78 (0.60)	1.87 (0.63)	1.95 (0.61)	1.90 (0.64)	0.09	0.75	2.96	<0.05*	2.25	0.06	1-4
PAA12	2.23 (0.69)	2.41 (0.82)	2.52 (0.79)	2.23 (0.83)	2.19 (0.68)	2.34 (0.74)	1.95 (0.69)	2.38 (0.58)	3.31	0.06	0.51	0.67	1.37	0.24	1-4
PAA8	1.83 (0.70)	1.74 (0.68)	2 (0.90)	1.62 (0.72)	1.89 (0.50)	1.82 (0.65)	2.05 (0.69)	1.85 (0.58)	6.38	<0.01*	2.65	<0.05*	3.41	<0.05*	1-4
PAA10	1.91 (0.88)	1.87 (0.72)	2.26 (0.81)	1.84 (0.79)	2.19 (0.70)	1.97 (0.74)	2.15 (0.59)	2.08 (0.72)	5	<0.05*	2.41	0.06	3.22	<0.05*	1-4