

# The Psychological Effect of COVID-19 and Lockdown on the Population: Evidence from Italy

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## Research Article

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19   **Conflict of interest**

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22 The Psychological Effect of COVID-19 and Lockdown on the Population:  
23 Evidence from Italy

24

25 **Abstract**

26 The COVID-19 pandemic and the lockdown measures adopted to prevent the spread of the disease  
27 had a huge impact on a personal, social, and economic level for the world population. In Europe,  
28 Italy was one of the frontrunner countries dealing with an emergency that significantly affected  
29 people's lives. Previous research on the psychological impact of the pandemic revealed an increase  
30 in anxiety, depression, and feelings of distress; however, these studies were conducted on non-  
31 representative samples of the population reached through social media channels, a method that is  
32 likely to lead to many forms of statistical and methodological bias. For the first time to our  
33 knowledge, we measured depressive symptoms on 6,700 Italian individuals, representative of the  
34 Italian population in terms of age, gender, and geographical areas revealing higher scores of  
35 depressive symptoms in females, younger adults, people reporting professional uncertainty and  
36 lower socio-economic status. A positive correlation was also found for individuals living alone,  
37 those who could not leave home for going to work, and people with a case of COVID-19 in the  
38 family, whereas the region of residence was not a significant predictor of depressive symptoms.  
39 These findings underline the importance of considering the psychological effects of COVID-19 and  
40 providing support to individuals seeking mental health care.

## 41 **Introduction**

42 On 31 December 2019, the World Health Organization (WHO) received information of cases of  
43 pneumonia of unknown cause in Wuhan City, China. The cause was identified by Chinese  
44 authorities as being a novel coronavirus afterwards named the “COVID-19 virus”. Due to the rapid  
45 increase in the number of cases outside China, on 11 March 2020, WHO Director-General  
46 announced that the outbreak could be characterized as a pandemic.

47 After China, Italy was the first European country to report a case of death due to COVID-19 dated  
48 on 21 February 2020 in Lombardy, followed by a series of outbreaks in the Northern regions and a  
49 rapid increase of deaths and cases of infection. In response to this emergency, Italy was the first  
50 country in Europe to adopt restrictive physical and social distancing measures to limit the spread of  
51 the disease which led to a full lockdown of the entire country from 9 March 2020 until 3 May 2020  
52 (so-called “phase 1”), and other measures, such as the prohibition of individual movements outside  
53 people's region of domicile, until 2 June (“phase 2”; for more information see COVID-19 Health  
54 System Response Monitor). Since the beginning of the emergency there have been 233,515  
55 confirmed cases of COVID-19 with 33,530 deaths reported (as of 2 June 2020, data retrieved from  
56 the Italian Ministry of Health).

57 The period of lockdown has been characterised by travel restrictions and the mandatory closure of  
58 schools, nonessential commercial activities and industries. People were requested to stay at home  
59 and socially isolate themselves to prevent the spread. Such an experience has the potential to  
60 influence people’s mental state evoking fear of contagion, worry about disease and death, in  
61 addition to anxiety due to health and economic uncertainties (Asmundson and Taylor, 2020). Severe  
62 pandemic lockdowns and quarantine are a further source of distress since individuals are confined,  
63 socially isolated, might lose their income, and their activities are restricted (Brooks et al., 2020).  
64 This situation is worsened by an “infodemic”, i.e., an overabundance of information, some of which  
65 can be misleading or even harmful (World Health Organization, 2020).

66 Recent studies have shown that the COVID-19 pandemic affected the mental health. One recent  
67 narrative review (Rajkumar, 2020) comprises 28 articles addressing the issue of mental health  
68 revealed the presence of symptoms of anxiety, depression, and self-reported stress associated with  
69 disturbed sleep in response to the pandemic. These articles include samples from China, Iran,  
70 Canada, Brazil, Singapore, India, and Japan. The results showed that variables such as female  
71 gender, being a student, having symptoms suggestive of COVID-19, and poor perceived health  
72 were associated with higher rates of anxiety and depression. Other characteristics that contributed to  
73 stress and mental morbidity were unpredictability, uncertainty, seriousness of the disease,  
74 misinformation, and social isolation. Another review (Kontoangelos et al., 2020) pointed out that  
75 maladaptive behaviours, emotional distress, and defensive responses are psychological reactions  
76 that can be experienced during a pandemic. More specifically, data reported the prevalence of  
77 significant post-traumatic stress symptoms and anxiety. Sibley and colleagues (2020) conducted a  
78 pre- and post-lockdown study showing an increase in psychological distress after the lockdown.  
79 However, higher levels of sense of community and resilience were also found, providing support to  
80 the presence of some positive outcomes related to the challenges faced during the pandemic.

81 A study on a sample from the Italian population (Rossi et al., 2020) showed high rates of post-  
82 traumatic stress symptoms, depression, anxiety, sleep disorders, perceived stress reported during the  
83 lockdown, with females expressing higher impact on their mental health. Other risk factors  
84 identified were being under quarantine, having a significant one deceased by COVID-19, working

85 discontinuity, or experiencing other stressful events (i.e. working, financial, relationship or housing  
86 problems) linked to the pandemic or lockdown measures.

87 Another study by Casagrande and colleagues (2020) showed a relationship between COVID-19  
88 spread and feelings of anxiety, depression, distress, sleep disorders and post-traumatic stress  
89 disorders. A similar research (Forte et al., 2020) revealed that being of younger age, student,  
90 female, and having had a direct contact with COVID-19 infection were associated with a greater  
91 psychological impact on psychopathological dimensions such as anxiety, distress, and sleep  
92 disturbance. Mazza and colleagues (2020) found that female gender, negative affect, and  
93 detachment were related to higher levels of psychological distress. Higher depression and stress  
94 levels were found in people with an acquaintance infected with COVID-19 and in individuals with a  
95 history of stressful situations and medical problems. Other factors affecting anxiety and stress levels  
96 were having a family member infected with COVID-19, being young in age and needing to leave  
97 one's domicile to go to work.

98 Additional research identified moderating variables that have an impact on reported mental health  
99 during the lockdown (Pakenham et al., 2020). This study included a measure of psychological  
100 flexibility described as the ability to adapt to changing situation with a resilient attitude. The results  
101 of the survey revealed that psychological flexibility is a protective factor which helps to mitigate the  
102 negative effects of the pandemic and lockdown, such as depression, anxiety, and distress.

103 To our knowledge, this is the first study conducted on a representative sample of the Italian  
104 population exploring the psychological effects of COVID-19 pandemic and lockdown. Previous  
105 research adopted a convenient sampling strategy administering the questionnaire through social  
106 media channels and snowball technique which is likely to lead to recruitment bias (i.e. sample  
107 selection, hence biases in statistical results).

108 The aim of the present research was to explore the effects of COVID-19 on mental health, focusing  
109 on depressive symptoms. To this end, the Short Mood and Feelings Questionnaire (SMFQ) was  
110 administered to a representative sample of the Italian population. Given the sample age range (16-  
111 65+), the SMFQ was chosen for its simplicity and ease of understanding. The study was conducted  
112 right after the lockdown phase, in June 2020, in order to collect the immediate reactions to the  
113 emergency. Socio-demographics were also collected to analyse which kind of moderators might  
114 represent risk or protective factors for mental health symptoms. Socio-demographics variables  
115 included age, gender, education, and socio-economic status. Information on profession and  
116 household (living alone or not) and working (still going out to reach workplace or not) conditions  
117 were also gathered. Lastly, questions on the municipality of residence and the presence of a case of  
118 COVID-19 in the family were included.

119

## 120 **Method**

121 To evaluate the effect of the pandemic on mood and feelings of the Italian population a  
122 psychometric approach was adopted. Due to the special nature of the period which prevented to  
123 conduct experimental studies meeting participants face-to-face, a psychometric self-reporting  
124 methodology was chosen. We adopted the short version of the Mood and Feelings Questionnaire  
125 (SMFQ; Messer et al., 1995) which includes 13 items indicating how much individuals have felt or  
126 acted depressed during the last few weeks (e.g., "I felt miserable or unhappy", "I didn't enjoy  
127 anything at all"). The answers are given on a three-point scale where respondents are asked to  
128 decide if the statements are "true", "sometimes true", or "not true". Scoring of the SMFQ is

129 obtained by summing together the point values of responses for each item. The response choices  
130 and their designated point values are as follows: “not true” = 0 points, “sometimes true” = 1 point,  
131 “true” = 2 points. Higher scores on the SMFQ indicate more severe depressive symptoms. The  
132 range of scores on the SMFQ varies from 0 to 26. A score of 12 or higher may indicate the presence  
133 of depression in the respondent (see among others Thabrew et al., 2018). As reported by Jarbin et  
134 al. (2020) suggested cut-offs on the SMFQ self-report have been divergent with cut-offs ranging  
135 from 4–5 in studies with just fair AUC and younger subjects to a high of 10–12 in studies with good  
136 AUCs and older subjects.

137 The SMFQ has been validated with children and young people aged between 6 and 19, however a  
138 study by Turner et al. (2014) showed that it is a useful and valid diagnostic tool for studying  
139 depression within a community-based sample in late adolescence and that it relates well to an adult  
140 measure of depression, namely the Clinical Interview Schedule-Revised form (CIS-R; Lewis et al.,  
141 1992). The SMFQ has a number of important (psychometric and implementation) features (i.e.  
142 internal consistency, test-retest reliability, validity, sensitivity to change as to the former, and  
143 brevity, availability, ease of scoring as to the latter), thus making it a useful tool for analysing mood  
144 and feelings attitude, especially during a pandemic when other methodologies such as experimental  
145 lab studies present severe and objective constraints.

146 In this work, we focused on young adults (16-24) and adults (25+) so as to proceed with a self-  
147 administered questionnaire that was completed by the sampled respondents<sup>1</sup>. The final sample was  
148 composed of 6,692 Italian individuals, representative of the Italian population in terms of age,  
149 gender, and geographical area. More specifically, the sample design and the stratification were  
150 based on the following variables: i) age (7 age groups: 16-17; 18-24; 25-34; 35-44; 45-54; 55-64;  
151 65+); iii) gender, iii) geographical breakdown (all Italian regions and size of the residential  
152 community; 7 classes), iv) education (2 classes: graduates and non-graduates). The field data  
153 collection was conducted in June 2020 (from the 4<sup>th</sup> of June to the 19<sup>th</sup> of June) with a mixed  
154 technique CATI (Computer Assisted Telephone Interviewing) and CAWI, (Computer Assisted Web  
155 Interviewing) as to limit any risks in terms of sample’s distortion and self-selection.

156 All methods were carried out in accordance with the Declaration of Helsinki. The experiment was  
157 approved by Autorità per le Garanzie nelle Comunicazioni. Informed consent was obtained from all  
158 participants and from a parent and/or legal guardian for participants under 18.

159 Since the SMFQ has mainly been validated for children and young adults (Turner et al., 2014), in  
160 our analysis we separated young adults (aged between 16-24) from adults (25+). Table 1 illustrates  
161 the age distribution (weighted and not weighted) of our sample and offers a comparison with the  
162 Italian population, showing very similar values.

163 As a preliminary remark regarding data consistency, it should be noted that Cronbach’s alpha – i.e.,  
164 a measure of the reliability of the questionnaire – is equal to 0.91 for the overall sample, 0.90 for  
165 the young adult group and 0.91 for the adult group, where alpha 0.90 or above is considered  
166 excellent for internal consistency reliability of the SMFQ (Jarbin et al., 2020; see also Thabrew et  
167 al., 2018). We added to these variables official COVID-19 statistics in order to disentangle the role  
168 played by the spatial variability of the pandemic diffusion on individual mood. We used the official  
169 data released every day at 6 PM (UTC +1 h) by the “Dipartimento della Protezione Civile” (the  
170 National Department of Civil Protection of the Presidency of the Council of Ministers) and archived

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<sup>1</sup> Younger individuals would have needed the direct assistance of their parents, making the filling in of the questionnaire very cumbersome.

171 on GitHub (see <https://github.com/pcm-dpc/COVID-19> ). At times, data may just be a proxy of the  
172 actual state variables. In particular, the number of confirmed COVID-19 cases (i.e. new COVID-19  
173 positives and total COVID-19 positives) depends on the effort being devoted to finding new  
174 positive cases. In addition, deaths statistics for Italy include coronavirus victims who died either in  
175 hospital or outside and were tested before or after dying. Regardless of their goodness and accuracy,  
176 these statistics are those that have been most widely disseminated by health institutions and the  
177 news outlets, thus potentially influencing the mood and feelings of Italian citizens.

178

## 179 **Results**

180 The first step was to analyse the distribution of the SMFQ score among Italian population, just after  
181 the lockdown period, i.e., at June 2020 (see Figure 1). As we would expect, the total distribution of  
182 SMFQ score is asymmetric and skewed to the right (also by a skewness test), with mean at 5.2. It  
183 presents a mode near 0, and a slight bump around 12. If we define a cut-off at 12 that may indicate  
184 the presence of depression in the respondent (see Thabrew et al., 2018), then, at June 2020, 14.4%  
185 of the Italian population lied above this threshold. In Figure 2, we compare the score distribution of  
186 the two age groups: young adults (16-24) vs. adults (25+). Both distributions follow a similar  
187 pattern (skew to the right with a mode near 0 and a long tail thereafter), however the scores across  
188 groups age do not have the same distribution function<sup>2</sup>. In particular, the mean score of the two  
189 groups is significantly different (7.04 for young adults and 4.97 for adults), and the probability of  
190 scoring a higher value than the cut-off ( $SMFQ \geq 12$ ) is significantly higher for the youngest  
191 (24.17% vs. 13.33%; Table 2).

192 The second step was to run econometric analysis on the overall population, correlating the SMFQ  
193 score to some major determinants. Following the existing literature (see above), we included socio-  
194 demographic (age and gender), economic (unemployed, lay-off and poor) and context (living alone,  
195 size of the municipality of residence) variables. Their operative description and summary statistics  
196 are reported in Tables 3 and 4. Given the characteristic of the dependent variable (i.e. the SMFQ  
197 score, which is an integer which lies between 0 and 26) a (Poisson) count model with double  
198 censoring (left at 0 and right at 26) has been estimated<sup>3</sup>. Model (1) in Table 5 shows results of the  
199 count model with aforementioned “traditional” explanatory variables. Younger individuals are  
200 confirmed to be more exposed to depressive mood (the coefficient of age is negative and significant  
201 at 99%), as well as women (coefficient .212 and std. dev. .0286). This means that younger adults  
202 and women are more vulnerable when it comes to the onset of depressive symptoms in response to  
203 the pandemic. A negative economic condition significantly affects depression in terms of future  
204 prospect (unemployed: .152 and std. dev. .0497), absolute value (poor: .217 and std. dev. .0394)  
205 and, above all, professional uncertainty (lay-off: .482 and std. dev. .0658)<sup>4</sup>. This result stresses the  
206 importance of considering also economic vulnerability which the pandemic and lockdown affected  
207 impacting people of lower socio-economic status. Loneliness is also significantly correlated with  
208 higher values of SMFQ, both in terms of family nucleus (i.e., living alone: .166 and std. dev. .0398)  
209 and social context (i.e. size of the municipality of residence<sup>5</sup>: -.0235 and std. dev. .0071). The

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<sup>2</sup> Nonparametric statistical tests (i.e. Kolmogorov-Smirnov test, Wilcoxon rank-sum test and Epps-Singleton test) confirm that the two samples are not drawn from the same distribution function. For this reason, the econometric analysis is also run for the two age groups separately (see Table 6).

<sup>3</sup> In the Appendix (Table A.1), we present also results of linear models.

<sup>4</sup> Significantly, uncertainty displays (by t-tests) a significantly higher effect than a negative economic status.

<sup>5</sup> Note that this variable is (negative and) significant in a logarithmic but not in a linear form, meaning that living in small and very small towns mostly influences (positively) the probability of scoring a high value of SMSQ.

210 lockdown aggravated the condition of people living alone removing their opportunities to gather  
211 with closed ones and limiting the moments of social exchange and sharing which resulted in  
212 developing depressive symptoms.

213 We then turned to the core of the analysis, by adding variables related to the pandemic phase into  
214 two stages. First, we added variables concerning the experience of the individual during the  
215 pandemic (see model 2 of Table 5). COVID-19 is a dummy variable which is equal to 1 when the  
216 individual or someone in her/his family tested positive to coronavirus, 0 otherwise<sup>6</sup>. Moreover, we  
217 looked at the effect of lockdown introducing a dummy variable that is equal to 1 whenever the  
218 individual kept on going to the workplace during the lockdown period and is 0 in the opposite  
219 situation of people staying at home<sup>7</sup>. Results of model 2 show that COVID-19 is the variable that  
220 displays the greatest effect on the probability of falling into depression (.733 and std. dev. .0562).  
221 To obtain a more analytical account of this effect, we calculated a probit model of scoring more  
222 than the cut-off (SMQF  $\geq$  12; see Table A.2) and then plot the probability of depression as a  
223 function of age and COVID-19 (Figure 3.a). The effect of this latter variable is huge and mostly  
224 doubles the probability of depression at any age. Having experienced the virus within the family  
225 clearly makes the pandemic more vivid, it increases risk perception, generating worry for the loved  
226 one and for themselves which in turn affects mental health. Also, the fact of having experienced a  
227 complete lockdown shows a clear effect on depressive symptoms (the coefficient of “no lockdown”  
228 is equal to -.123 with std. dev. .0551). However, the amplitude of this effect (and that of other  
229 variables) is of a different (much smaller) order, ranging between 1-3% (see Figure 3b)<sup>8</sup>.

230 In the third step (models 3-6 of Table 5), we introduced variables related to the diffusion of the  
231 COVID-19 pandemic in the local area of residence of Italian citizens (either the county or the  
232 region)<sup>9</sup>. In particular, we used the number of confirmed cases (at county level) and deaths (at a  
233 regional level) in June 2020, in terms of absolute and relative (as a % of local population) values.  
234 Indeed, these statistics were the most used by media outlets and public institutions to inform Italian  
235 citizens about the spread of the pandemic<sup>10</sup>. Results of models 3-6 of Table 5 confirm previous  
236 effects and show, interestingly, that the local diffusion of the pandemic does not affect the  
237 probability of scoring high values of SMFQ. This result is in line with previous results that  
238 investigated the dynamic evolution of TV viewership of Italian national and local news and showed  
239 that the attention of individuals to the pandemic is not related to the local spread but to the national  
240 diffusion (Castriota, Delmastro and Tonin, 2020). In sum, results show that anxiety and depressive

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<sup>6</sup> From our data, 7.6% of Italian population has experienced directly or indirectly negative health effects from coronavirus (see Table 3). This value seems to be coherent with official statistics. In fact, at June 2020, confirmed cases are nearly 0.5% of Italian population. This value must be times a factor of 7.3 if one considers only the close family network (see Istat, 2018). When one takes into account also the largest family network (second- and third-degree family members), one may reach percentages around 7-8% of Italian population.

<sup>7</sup> Of course, by comparing scores of individuals who experienced total lockdown with people that were forced to keep going to their workplace we greatly underestimate the effect of lockdown. Indeed, the second category of individuals suffered severe stress and anxiety from the particular situation and type of job they did (by definition public interest work in hospitals, supermarkets, pharmacies,...), so that are not able to compare lockdown with a “normal” situation.

<sup>8</sup> However, as mentioned (see previous footnote), the coefficient of the variable “no lockdown” underestimates the effect of lockdown. Indeed, this result tells us that individuals who were forced to go to the workplace during this period and, presumably, suffered from stress and anxiety due to the situation and type of work they did, score significantly lower values of SMFQ than people under lockdown. Therefore, the effect of lockdown on depression may be significantly higher than that detected.

<sup>9</sup> At county level, the only available official statistics related to the number of COVID-19 confirmed cases. At regional level, there are other statistics such as the number of deaths and recovered individuals.

<sup>10</sup> In any case, the use of other local variables on the pandemic (recovered, intensive care, ...) confirms results of Table 5.

241 symptoms are not connected with the local spread of the virus (but only with family cases), since  
242 they are widespread nationwide (and this may also be the effect of a national lockdown).

243 As a final step, we split the sample into two age groups (young adults and adults) and we ran count  
244 statistical models for the two groups, separately (see the Appendix for linear models, Table A.3).  
245 Results are reported in Table 6<sup>11</sup> (in column 1 we report results for all individuals – as in model 2 of  
246 Table 5 -, in column 2 those of young adults and in column 3 those of adults) and confirm previous  
247 outcomes for both age groups, in particular with regard to the significance and size of the effect of  
248 COVID-19 (whose coefficient is equal to .485 – std. dev. .087 – for young adults and to .77 – std.  
249 dev. .0619). There are, however, three interesting and significative differences regarding younger  
250 individuals: 1) family wealth does not significantly affect depressive mood of the youngest people,  
251 2) the social context in terms of the size of the municipality where individuals live comes out to be  
252 less important for the youngest, and 3) age seems to display a U-inverted relation with depression  
253 score. Indeed, this relation is positive for young people (.101 and std. dev. .0143) and negative for  
254 older individuals (-.00954 and std. dev. .0013).

255

## 256 **Discussion**

257 To our knowledge, this is the first study exploring the effects of COVID-19 on mental health in a  
258 large and representative sample of the Italian population. Our results show higher scores of  
259 depressive symptoms in females, younger adults, people reporting professional uncertainty and  
260 lower socio-economic status. A positive correlation was also found for individuals living alone,  
261 those who could not leave home for going to work, and people with a case of COVID-19 in the  
262 family. Interestingly, the region of residence was not a significant predictor of depressive  
263 symptoms.

264 Our findings highlight that the effect on mental health is related more broadly to the lockdown  
265 condition rather than the actual number of reported cases of deaths and infected (which were higher  
266 in the northern regions). The Short Mood and Feelings Questionnaire proved to be a reliable  
267 measure of depressive symptoms for both young and older adults, as shown by the separate analyses  
268 for age ranges 16-24 and 25+. The strength of the questionnaire lies in its easiness of administration  
269 and understanding, essential characteristics for detecting mental health's effects during such an  
270 unprecedented situation.

271 Our research provides support to previous studies and extends the understanding of the  
272 psychological impact of the lockdown using a more reliable and scientifically sound method for  
273 sample's selection. In line with our findings, previous studies on the psychological effects of  
274 COVID-19 also found that females are more affected by depression, anxiety, and distress (Rossi et  
275 al., 2020; Casagrande et al., 2020; Mazza et al., 2020). Additionally, a recent review of the literature  
276 (Salk et al., 2017) revealed that females are more likely to report depressive symptoms and to  
277 receive a diagnosis of depression.

278 The higher vulnerability of younger adults was observed in previous research as well in relation to  
279 anxiety and distress (Forte et al., 2020; Mazza et al., 2020). Our results complement this picture and  
280 reveal an association with depressive symptoms. This result is of high importance when thinking

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<sup>11</sup> Some variables (the professional ones - Unemployed, Lay-off and No lockdown – and Living alone) are not introduced in the model of younger individuals because they do not apply to them (or apply only to a very small part of them).

281 about policy and health measures to be adopted to help younger generations to overcome the  
282 individual and social loss that they experienced during the pandemic.

283 Regarding work and financial conditions, our results confirm that professional uncertainty and low  
284 socio-economic status are related to depression, as found by Rossi and colleagues (2020) for people  
285 with working discontinuity and financial struggles.

286 On the topic of household conditions, our findings highlight the role played by living alone in the  
287 experience of depressive symptoms. Despite new technologies aided in feeling closer to significant  
288 ones even from distance, the lack of social relations and daily gatherings significantly affected  
289 people's mood. It is also worth noting that older individuals living by themselves could have been  
290 less familiar with the potential of new technologies, therefore limiting their chance to engage in  
291 virtual exchanges with loved ones.

292 Importantly, while previous studies revealed higher anxiety for individuals leaving their home to go  
293 to work (Rossi et al., 2020; Mazza et al., 2020), our research found lower depression in those people  
294 who kept going physically to the workplace. This finding shows that, even if going out triggered  
295 anxiety and fear of getting infected, keeping a working routine helped to feel less depressed and  
296 lonely.

297 Lastly, as previous research has shown (Rossi et al., 2020; Forte et al., 2020; Mazza et al., 2020),  
298 having a case of COVID-19 in the family had an impact on reported depression. This negative  
299 experience could amplify the feelings of fear, anxiety, stress and enhance the perceived risk on the  
300 probability of infection and the potentially fatal consequences derived from catching the virus.

301 It is crucial to remark that, other things being equal (in particular, the eventual presence of a  
302 COVID-19 case in the family), no differences were found in relation to the region of residence,  
303 while Forte et al. (2020) and Casagrande et al. (2020) found more sleep disturbances and state of  
304 anxiety in Northern Italy. Our study, which is statistically grounded, reveals that feelings of anxiety  
305 and depression were spread in the whole country<sup>12</sup>.

306 As highlighted by Holmes et al. (2020), it is likely that the prevalence of clinically relevant numbers  
307 of people with anxiety, depression, and engaging in harmful behaviours (such as suicide and self-  
308 harm) will increase. The potential consequences of an economic recession on mental health may be  
309 acute on people directly affected by COVID-19 and their caregivers. Data on the severe acute  
310 respiratory syndrome epidemic in 2003 reported a 30% increase in suicide in those aged 65 years  
311 and older; around 50% of recovered patients remained anxious; and 29% of health-care workers  
312 experienced probable emotional distress. Post-traumatic stress disorder and depression were also  
313 reported among patients who survived severe and life-threatening illness (Holmes et al., 2020).

314

## 315 **Conclusions and Future Work**

316 The present research stresses the need to take into account the psychological consequences of the  
317 COVID-19 pandemic and lockdown, aiming at the implementation of a holistic approach that  
318 considers both physical and mental health and well-being. The society as a whole, and in particular  
319 vulnerable groups such as children, older adults, people with existing mental health disorders, and

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<sup>12</sup> This effect is clearly linked to the very nature of the phenomenon under investigation (i.e. a pandemic) that can potentially spread everywhere and is therefore likely to generate anxiety and depression even in places where it has not yet arrived (or will never arrive).

320 front-line health-care workers, call for support to overcome this difficult time. Next months will be  
321 characterised by uncertainty, financial insecurity and worry, therefore it is pivotal to provide help  
322 through mental health care which could also make use of the Telemedicine, e.g., telehealth and app  
323 tools (see Kontoangelos et al., 2020). Indeed, online interactions can promote a sense of connection  
324 and improve psychological well-being, as highlighted by Van Bavel and colleagues (2020).

325 Future studies should consider the long-term effects of the pandemic on mental health, adopting a  
326 longitudinal design to measure change over time. Additional work should aim at comparing the  
327 experiences of the different countries affected by the pandemic in order to understand the size of the  
328 psychological impact and the potential risk and protective factors. Importantly, the data on people  
329 who seek for mental health assistance should closely monitored to prevent a second pandemic of  
330 psychological distress.

331

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400 **Tables**

401

402 **Table 1: Population: sample (weighted and not weighted) vs. Italian population**

	Sample population		Italian population
	N.	% (weighted)	%
Total (16+)	6,692	100.0%	100.0%
Young adults (16-24)	666	10.0% (10.3%)	10.2%
Adults (25+)	6,026	90.0% (89.7%)	89.8%

403

404 **Table 2: (S)MFQ score for sample population, and by age groups (weighted and not weighted)**

Population	Average (weighted)	% ≥ 12 (cut-off) (weighted)	Minimum	Maximum
Total	5.18 (5.21)	14.41 (14.83)	0	26
Young adults (16-24)	7.04 (7.08)	24.17 (24.91)	0	26
Adults (25+)	4.97 (5.00)	13.33 (13.68)	0	26

405

406 **Table 3: Summary statistics of independent variables (weighted and not weighted)**

Variable	Description	N.	Avg. (weighted)	Std. dv.	Minimum	Maximum
Gender (female)	1 if female; 0 otherwise	6,692	.524 (.517)	.499	0	1
Age	Age (number of years)	6,692	50.489 (50.323)	17.928	16	96
Unemployed	1 if unemployed; 0 oth.	6,692	.066 (.076)	.249	0	1
Lay-off	1 if a lay-off; 0 otherwise	6,692	.025 (.029)	.155	0	1
Poor	1 if poor <sup>(*)</sup> ; 0 otherwise	6,692	.110 (.123)	.313	0	1
Living alone	1 if she/he lives alone; 0 otherwise	6,692	.154 (.149)	.360	0	1
COVID-19	1 if a COVID-19 case in her/his family; 0 otherwise	6,643	.076 (.076)	.265	0	1
No lockdown	1 if he/she has kept working from workplace (during lockdown); 0 if she/he experienced home lockdown	6,643	.102 (.109)	.302	0	1

407 <sup>(\*)</sup> “Poor” is defined from a 5-point Likert scale as the worst economic condition, in which the individual experiences severe  
 408 economic difficulties, lacking sufficient money to live at a normal standard (in 2019, the Italian Statistical Office has estimated that  
 409 7.7% of Italian individuals could be regarded as poor; however, this values has sharply increased in 2020 due to the economic crisis  
 410 related to the COVID-19 pandemic).

411

412 **Table 4: Summary statistics of geographical variables (at the 31<sup>st</sup> of May 2020)**

Variable	N.	Average	Minimum	Maximum
Population of the municipality of residence <sup>(*)</sup>	2,172	19,715	100	2,761,477
Population of the county of residence	110	550,048	56,938	4,300,000
Population of the region of residence	20	3,013,808	125,666	1.00e+07
Number of COVID-19 cases (county)	110	2,088	22	23,076
Number of COVID-19 deaths (region)	20	1,671	22	16,112

413 <sup>(\*)</sup> In Italy there are 7,982 municipalities; sample individuals live in 2,172 of them.

414 Sources: Italian Statistical Office (ISTAT) and Italian Ministry of Health

415

416 **Table 5: Result of econometric models on the (S)MFQ score**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	regr_1 mfq	regr_2 mfq	regr_3 mfq	regr_4 mfq	regr_5 mfq	regr_6 Mfq
Gender (female)	0.212*** (0.0286)	0.238*** (0.0302)	0.238*** (0.0303)	0.240*** (0.0297)	0.239*** (0.0299)	0.240*** (0.0298)
Age	-0.0108*** (0.000828)	-0.00985*** (0.000838)	-0.00986*** (0.000839)	-0.00984*** (0.000839)	-0.00985*** (0.000839)	-0.00983*** (0.000839)
Unemployed	0.152*** (0.0497)	0.133*** (0.0503)	0.133*** (0.0505)	0.126** (0.0496)	0.128** (0.0500)	0.127** (0.0498)
Lay-off	0.481*** (0.0658)	0.316*** (0.0802)	0.316*** (0.0805)	0.321*** (0.0845)	0.315*** (0.0823)	0.319*** (0.0844)
Poor	0.217*** (0.0394)	0.219*** (0.0425)	0.218*** (0.0426)	0.213*** (0.0431)	0.216*** (0.0427)	0.215*** (0.0430)
Living alone	0.166*** (0.0398)	0.192*** (0.0409)	0.192*** (0.0408)	0.195*** (0.0410)	0.194*** (0.0409)	0.195*** (0.0410)
Pop. municipality (log)	-0.0235*** (0.00712)	-0.0203*** (0.00718)	-0.0200*** (0.00745)	-0.0217*** (0.00723)	-0.0206*** (0.00720)	-0.0209*** (0.00721)
COVID-19		0.733*** (0.0562)	0.734*** (0.0570)	0.748*** (0.0531)	0.741*** (0.0544)	0.744*** (0.0537)
No lockdown		-0.123** (0.0551)	-0.123** (0.0549)	-0.122** (0.0540)	-0.123** (0.0542)	-0.122** (0.0543)
# COVID-19 cases (county)			-4.18e-07 (2.46e-06)			
% COVID-19 cases pop. county				-7.638 (4.297)		
# COVID-19 deaths (region)					-3.24e-06 (2.60e-06)	
% COVID-19 deaths pop region						-40.10 (26.51)
Constant	2.199*** (0.0872)	2.054*** (0.0904)	2.052*** (0.0910)	2.095*** (0.0931)	2.067*** (0.0909)	2.080*** (0.0920)
Observations	6,692	6,643	6,643	6,643	6,643	6,643

417 (\*) Note: The estimates in the table refer to Poisson count models with double censoring (left at 0, right at 26), sample weights and  
418 robust standard errors. The dependent variable is the SMFQ score. For each variable, the coefficient, the standard error (in  
419 parentheses), and the level of significance are reported as follows: \*\*\* significant at 99%; \*\* significant at 95%.

420

421

422 **Table 6: Result of econometric models on the (S)MFQ score: young adults vs. adults**

VARIABLES	(1)	(2)	(3)
	ALL mfq	16-24 mfq	25+ mfq
Gender (female)	0.238*** (0.0302)	0.267*** (0.0791)	0.241*** (0.0328)
Age	-0.00985*** (0.000838)	0.101*** (0.0143)	-0.00954*** (0.00113)
Unemployed	0.133*** (0.0503)		0.125** (0.0565)
Lay-off	0.316*** (0.0802)		0.338*** (0.0933)
Poor	0.219*** (0.0425)	0.143 (0.187)	0.227*** (0.0458)
Living alone	0.192*** (0.0409)		0.192*** (0.0432)
Pop. municipality (log)	-0.0203*** (0.00718)	-0.0191 (0.0193)	-0.0188** (0.00788)
COVID-19	0.733*** (0.0562)	0.485*** (0.0870)	0.770*** (0.0619)
No lockdown	-0.123** (0.0551)		-0.113** (0.0565)
Constant	2.054*** (0.0904)	-0.147 (0.361)	2.008*** (0.107)
Observations	6,643	661	5,982

423 (\*) Note: The estimates in the table refer to Poisson count models with double censoring (left at 0, right at 26), sample weights and  
424 robust standard errors. The dependent variable is the SMFQ score. For each variable, the coefficient, the standard error (in  
425 parentheses), and the level of significance are reported as follows: \*\*\* significant at 99%; \*\* significant at 95%.

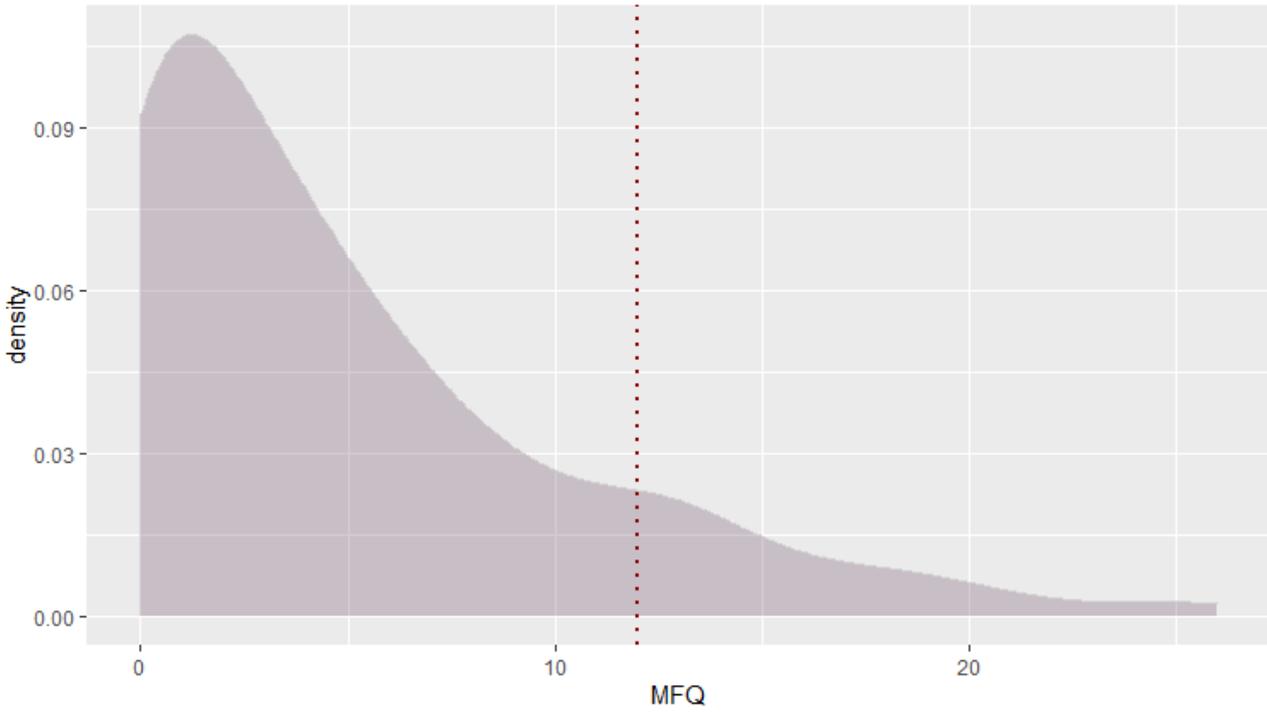
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428 **Figures**

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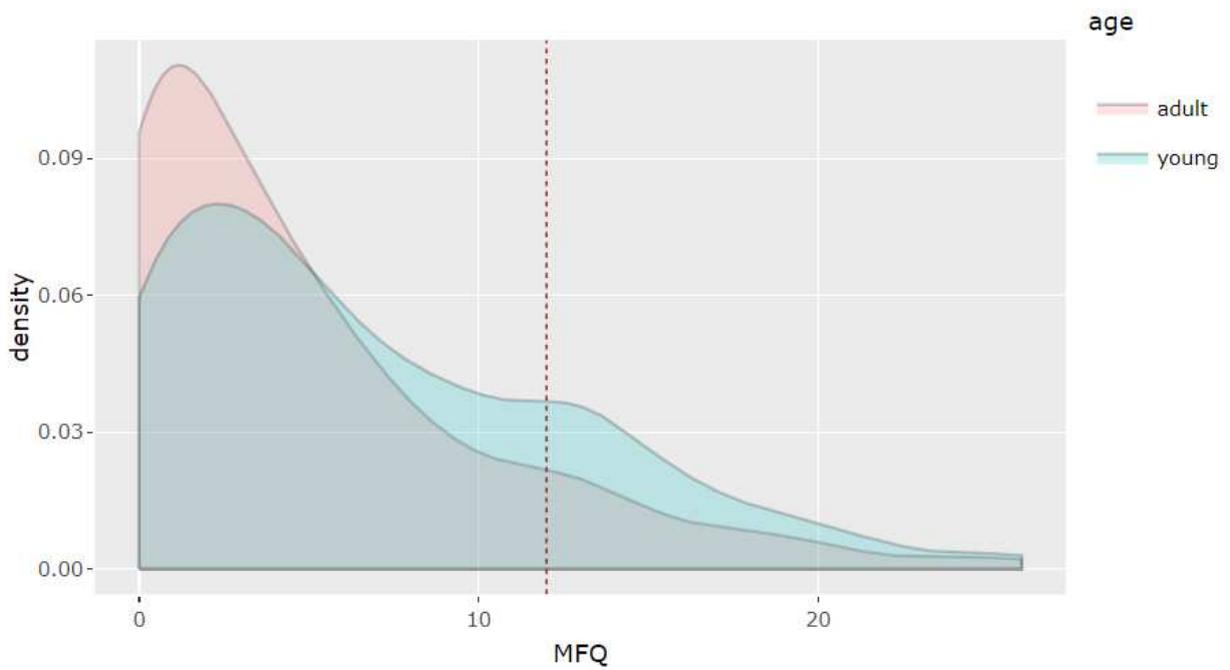
430 **Figure 1: Distribution of (S)MFQ Scores on total population**



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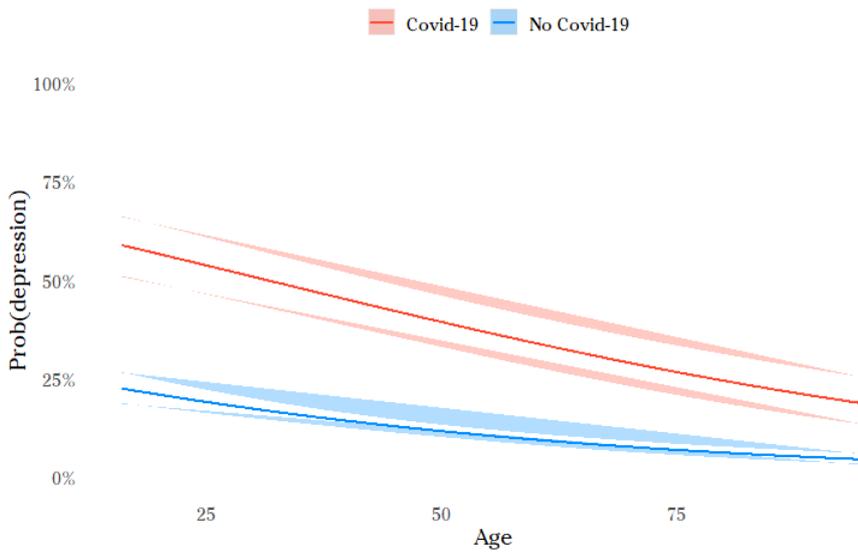
433 **Figure 2: Distribution of (S)MFQ Scores on young adult (16-24) and adult (25+) groups**



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435

436 **Figure 3a: The effect of COVID-19 on the probability of depression (cut-off  $\geq 12$ )**

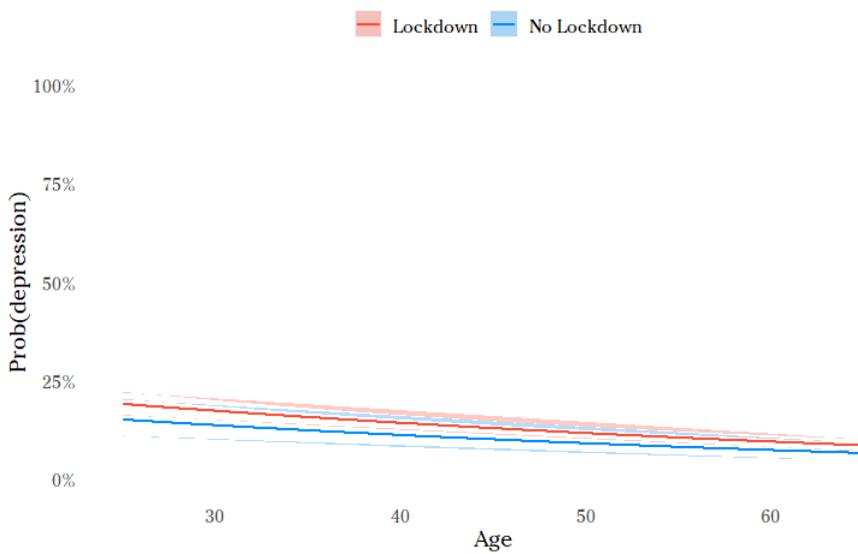


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438 (\*) Note: effects calculated on the basis of the probit model of Table A.2 (age interval: 16-95). Confidence interval at 99%.

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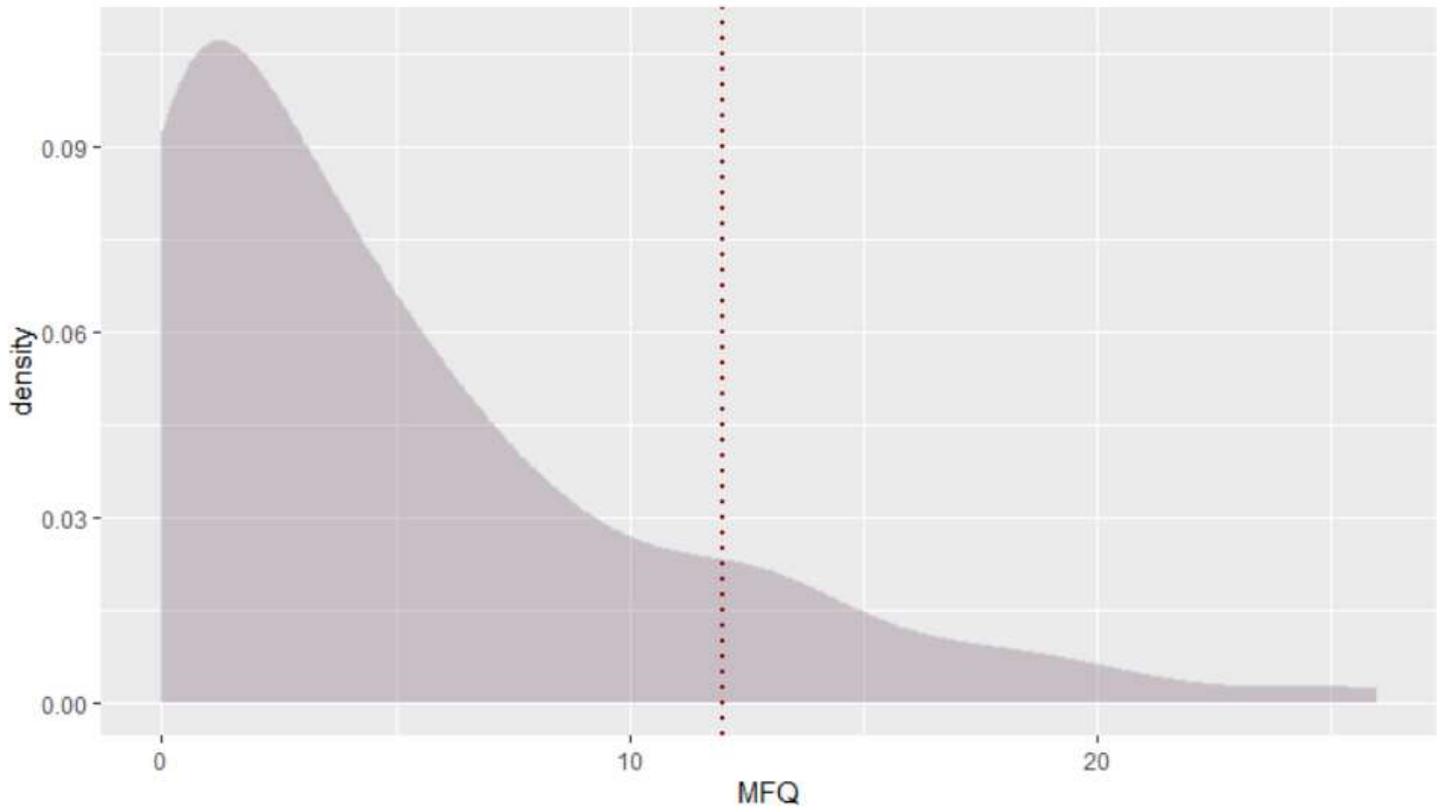
440 **Figure 3b: The effect of lockdown on the probability of depression (cut-off  $\geq 12$ )**



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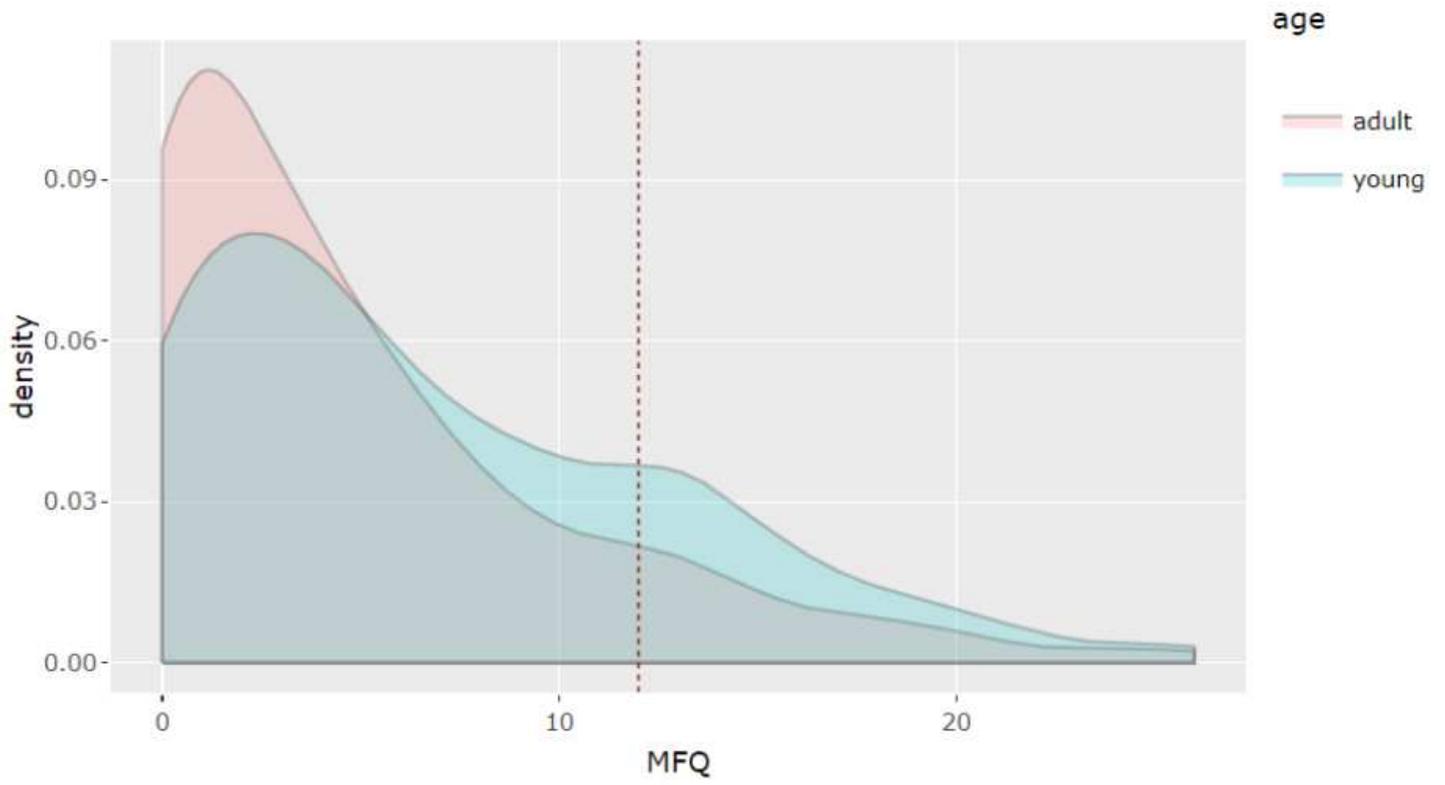
442 (\*) Note: effects calculated on the basis of the probit model of Table A.2 (age interval: 25-65). Confidence interval at 99%.

# Figures



**Figure 1**

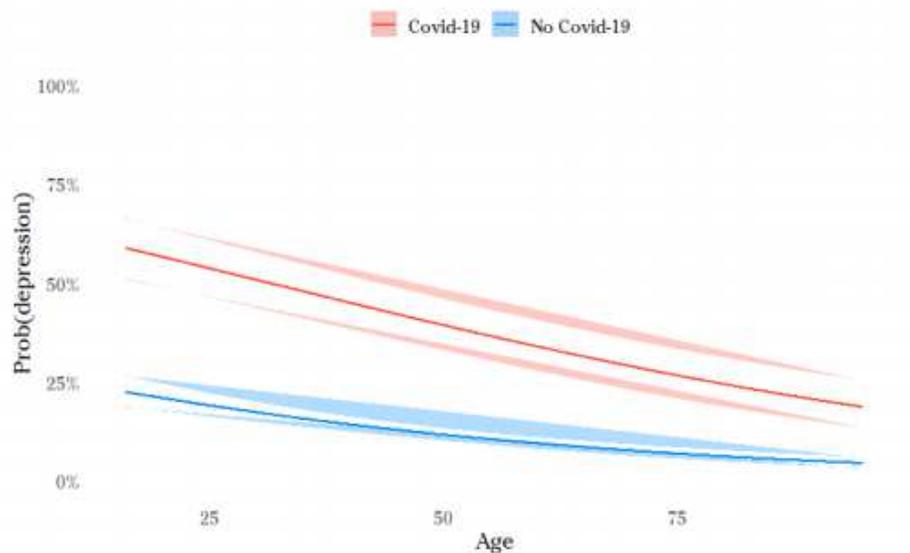
Distribution of (S)MFQ Scores on total population



**Figure 2**

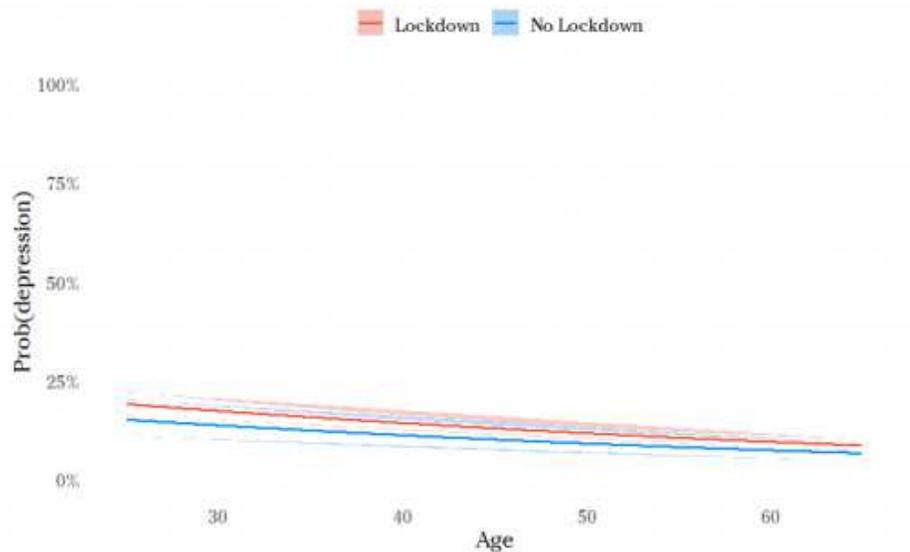
Distribution of (S)MFQ Scores on young adult (16-24) and adult (25+) groups

**Figure 3a: The effect of COVID-19 on the probability of depression (cut-off  $\geq 12$ )**



(\*) Note: effects calculated on the basis of the probit model of Table A.2 (age interval: 16-95). Confidence interval at 99%.

**Figure 3b: The effect of lockdown on the probability of depression (cut-off  $\geq 12$ )**



(\*) Note: effects calculated on the basis of the probit model of Table A.2 (age interval: 25-65). Confidence interval at 99%.

### Figure 3

a: The effect of COVID-19 on the probability of depression (cut-off  $\geq 12$ ). b: The effect of lockdown on the probability of depression (cut-off  $\geq 12$ )

## Supplementary Files

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- [SupplementaryfileDelmastroZamariolaSR.pdf](#)