

# BMJ Open Impact of the COVID-19 lockdown on psychological health and nutritional habits in Italy: results from the #PRESTOinsieme study

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## ABSTRACT

**Objectives** The present work aims to present the results of the ‘PRESTOinsieme’ (which is ‘we will be together soon’ in English). The web-based survey ([www.prestoinsieme.com](http://www.prestoinsieme.com)) describes changes in lifestyle habits and symptoms of psychological discomfort in the Italian population during the COVID-19 lockdown.

**Design** Cross-sectional online survey disseminated by messaging apps (ie, WhatsApp and Telegram) and social networks (ie, Instagram, Facebook and LinkedIn).

**Setting** Italy.

**Participants** Italian population older than 16 years of age.

**Exposure** COVID-19 lockdown.

**Main outcomes and measures** Survey respondents filled out a set of validated questionnaires aimed at assessing lifestyle habits and psychological health, that is, the General Health Questionnaire (GHQ-12) to screen for psychological distress, the Impact of Event Scale-Revised (IES-R) to screen for post-traumatic stress and the Center for Epidemiologic Studies Depression Scale (CES-D).

**Results** Survey respondents totalled 5008. Moderate or severe psychological distress was reported in 25.5% and 22% of survey respondents, respectively. Lower age, female gender, being unemployed (OR 1.57, 95% CI 1.22 to 2.02) or being a student (OR 1.73, 95% CI 1.31 to 2.28) were predictors of more severe depressive symptoms.

**Conclusions** The present study is one of the largest population-based surveys conducted in Italy during the first COVID-19 lockdown, providing valuable data about the Italian population’s psychological health. Further studies should be conducted to understand whether psychological distress persists after the end of the lockdown.

## INTRODUCTION

Containment measures (eg, social distancing and a national lockdown) are crucial public health strategies in the fight against COVID-19.<sup>1</sup> Even though such actions are essential to contain the COVID-19 pandemic, it is worth noting that they might adversely affect physical<sup>2</sup> and psychological<sup>3</sup> health and seem to be associated with an increased risk of domestic accidents.<sup>4</sup>

## Strengths and limitations of this study

- The study is a web-based survey consisting of a set of validated questionnaires to assess the Italian population’s psychological well-being and lifestyle habits during the COVID-19 lockdown.
- The survey involved 5008 participants over age 16, and it represents one of the largest surveys conducted during the first COVID-19 lockdown in Italy, the European country most severely affected by the first wave of the COVID-19 outbreak.
- The survey identifies predictors of psychological distress during the lockdown, helping identify individuals most vulnerable to the psychological effects of lockdown.
- Further studies should be conducted to understand the long-term consequences of the COVID-19 lockdown affecting psychological health and lifestyle habits.

Mental health changes during the lockdown have been detected by studies conducted in the USA and Italy, showing an increased prevalence/severity of anxiety and depressive symptoms together with an impairment of psychological functions involving memory and attention.<sup>5–7</sup> Furthermore, changes in lifestyle habits in response to COVID-19 and the lockdown have been reported. Italian studies have found a decrease in physical activity frequency, an impairment of sleep habits and unhealthy eating habits.<sup>8–9</sup> It appears to be of extreme importance to take appropriate public health actions to mitigate the adverse effects of lockdowns<sup>10</sup> and to identify groups more vulnerable to the potential side effects of lockdowns to develop public health actions explicitly meant for these vulnerable populations.<sup>10</sup>

Italy is the first European country where the COVID-19 outbreak occurred,<sup>11</sup> causing

**Table 1** Respondents' characteristics and habits according to General Health Questionnaire score; 0–13 (no psychological distress), 14–36 (psychological distress)

	N	0–13 (n=507)	14–36 (n=3931)	Combined (n=4438)	P value
Age	4438	26/34/48	26/38/53	26/37/53	<0.001
Gender					
Female	4438	59% (300)	64% (2502)	63% (2802)	0.049
Male		41% (207)	36% (1429)	37% (1636)	
Nationality					
Other	4438	2% (8)	1% (53)	1% (61)	0.676
Italian		98% (499)	99% (3878)	99% (4377)	
Region					
High COVID-19 incidence	4427	48% (242)	45% (1780)	46% (2022)	0.282
Low COVID-19 incidence		52% (263)	55% (2142)	54% (2405)	
Educational level					
Secondary education	4438	49% (249)	47% (1831)	47% (2080)	0.493
University education		50% (256)	53% (2089)	53% (2345)	
Primary education		0% (2)	0% (11)	0% (13)	
Working status					
Active employee	4438	71% (360)	67% (2630)	67% (2990)	0.001
Unemployed/Retired/Homemaker		8% (42)	14% (568)	14% (610)	
Student		21% (105)	19% (733)	19% (838)	
House type					
Multifamily house	4438	64% (325)	66% (2589)	66% (2914)	0.221
Single room apartment		3% (16)	2% (79)	2% (95)	
Single-family house		33% (166)	32% (1263)	32% (1429)	
Garden					
No	4438	39% (198)	42% (1658)	42% (1856)	0.180
Yes		61% (309)	58% (2273)	58% (2582)	
Nasopharyngeal swab					
No	2873	96% (278)	93% (2391)	93% (2669)	0.038
Yes		4% (12)	7% (192)	7% (204)	
Recent loss					
No	2858	91% (266)	89% (2289)	89% (2555)	0.240
Yes		9% (25)	11% (278)	11% (303)	
Living alone					
No	4438	88% (448)	88% (3469)	88% (3917)	0.939
Yes		12% (59)	12% (462)	12% (521)	
Pet					
No	4438	54% (274)	54% (2112)	54% (2386)	0.893
Yes		46% (233)	46% (1819)	46% (2052)	
Physical activity					
No	3991	44% (203)	57% (2024)	56% (2227)	<0.001
Yes		56% (259)	43% (1505)	44% (1764)	
Dietary habits (weekly consumption)					
Pasta, rice, cereals	3987	5/7/10	5/7/10	5/7/10	0.705
Cereal-based products	3984	3/7/7	4/7/7	3/7/7	0.214
Raw meat	3985	2/3/4	2/3/4	2/3/4	0.299

Continued

Table 1 Continued

	N	0–13 (n=507)	14–36 (n=3931)	Combined (n=4438)	P value
Cured meat	3981	1/2/3	1/2/3	1/2/3	0.050
Fish	3985	1/2/2	1/2/2	1/2/2	0.864
Milk and yoghurt	3982	2/7/7	2/7/7	2/7/7	0.971
Milk-based products	3984	2/3/5	2/3/5	2/3/5	0.675
Fruit	3985	4/7/10	4/7/10	4/7/10	0.699
Dried fruit	3981	0/2/5	0/2/5	0/2/5	0.249
Vegetables	3984	6/7/14	6/7/14	6/7/14	0.003
Legumes	3982	1/2/5	1/2/4	1/2/4	0.002
Eggs	3984	1/2/3	1/2/2	1/2/2	0.100
Foods high in fat and sugar	3980	1/3/6	2/4/7	2/3/7	0.158
Soft drinks	3979	0/0/1	0/0/1	0/0/1	0.478
Alcoholic drinks (eg, wine, beer, spirits)	3981	0/1/3	0/1/4	0/1/4	0.080

Data are percentages (absolute numbers) for categorical variables and I quartile/median/III quartile for continuous variables.

an excess of mortality with severe overloads for the healthcare system.<sup>12</sup> The first containment measures were introduced on 23 February 2020 in the two Italian regions where the COVID-19 first spread (Veneto and Lombardia).<sup>13</sup> However, over a short time, the disease also spread to other Italian regions, so the Italian government introduced new containment measures at the national level on 11 March 2020. Finally, on 22 March 2020, a nationwide full lockdown was implemented. Data on the Italian population during the lockdown show impaired emotional well-being and unhealthy lifestyle changes.<sup>14</sup>

The present work aims to present the results of the ‘PRESTOinsieme’ (imPact of quaRantine mEasures againST COVID-19, which is known as ‘we will be together soon’ in English) project, a web-based survey conducted in Italy. The study aims to describe changes in lifestyle habits and the prevalence of psychological discomfort symptoms in the Italian population during the COVID-19 lockdown. The reason for analysing and presenting data on both psychological well-being and lifestyle habits is the strict relationship documented between these two dimensions. An example of such a relationship is represented by emotional eating. Individuals experiencing anxiety and depressive symptoms are prone to emotional eating habits, that is, eating to relieve stress instead of physical hunger, and this phenomenon was reported during the lockdown.<sup>15 16</sup>

Several studies have been conducted so far with the aim of describing the relationship between the COVID-19 lockdown and psychological well-being in China, European countries and the USA. The value added by the present study refers to the fact that it was conducted in Italy, one of the countries most severely affected by the pandemic, at the very beginning of the first COVID-19 lockdown, when only little information was available about the prevention and treatment of the infection and

the only previous experience in the management of the outbreak was that of the city of Wuhan, in China.

## METHODS

The *PRESTOinsieme* project is a cross-sectional web-based survey open to volunteers older than 16 years of age (www.prestoinsieme.com). The project began in Italy on 20 March 2020 to assess the effects of the national lockdown on the population’s psychological health and lifestyle habits.

### Sampling strategy

The survey was web-based via Lime Survey<sup>17</sup> and disseminated by messaging apps (ie, WhatsApp and Telegram) and social networks (ie, Instagram, Facebook and LinkedIn). Survey respondents were encouraged to spread the survey to their contacts, that is, virtual snowball sampling. Five-thousand nine hundred thirty survey accesses were registered during the study period (from 20 March to 24 August 2020); 5008 responded, that is, 84.5%. The response rate, calculated as the proportion of survey responses over the number of accesses to the survey website, ranged between 70% and 95% during the study period (online supplemental figure S1, panel A). The analysis included all survey responses collected until 24 August 2020; however, 73% of survey responses were recorded until the end of the full lockdown, that is, 3 May 2020 (online supplemental figure S1, panels B and C). The regions most affected by the outbreak (ie, Lombardia, Veneto, Piemonte and Emilia-Romagna) provided the highest number of responses, except for Campania and Friuli Venezia Giulia (online supplemental figure S1, panel D). Online supplemental figure S2 reports the proportion of responses with missing data

**Table 2** Respondents' characteristics and habits according to Center for Epidemiologic Studies Depression Scale score; 0–15 (no/mild depressive symptoms), 16–23 (moderate depressive symptoms) and 24–60 (severe depressive symptoms)

	N	0–15 (n=2179)	16–23 (n=1057)	24–60 (n=909)	Combined (n=4145)	P value
Age	4145	29/43/57	25/34/50	23/29/44	26/37/53	<0.001
Gender						
Female	4145	53% (1165)	70% (740)	80% (729)	64% (2634)	<0.001
Male		47% (1014)	30% (317)	20% (180)	36% (1511)	
Nationality						
Other	4145	1% (27)	2% (17)	1% (9)	1% (53)	0.464
Italian		99% (2152)	98% (1040)	99% (900)	99% (4092)	
Region						
High COVID-19 incidence	4135	45% (976)	44% (464)	48% (431)	45% (1871)	0.258
Low COVID-19 incidence		55% (1200)	56% (589)	52% (475)	55% (2264)	
Educational level						
Secondary education	4145	45% (976)	44% (464)	52% (476)	46% (1916)	<0.001
University education		55% (1196)	56% (593)	47% (431)	54% (2220)	
Primary education		0% (7)	0% (0)	0% (2)	0% (9)	
Working status						
Active employee	4145	73% (1583)	67% (709)	57% (521)	68% (2813)	<0.001
Unemployed/Retired/Homemaker		16% (338)	12% (130)	12% (111)	14% (579)	
Student		12% (258)	21% (218)	30% (277)	18% (753)	
House type						
Multifamily house	4145	63% (1369)	68% (715)	69% (628)	65% (2712)	0.001
Single room apartment		2% (40)	2% (23)	3% (25)	2% (88)	
Single-family house		35% (770)	30% (319)	28% (256)	32% (1345)	
Garden						
No	4145	36% (781)	44% (467)	52% (475)	42% (1723)	<0.001
Yes		64% (1398)	56% (590)	48% (434)	58% (2422)	
Nasopharyngeal swab						
No	2684	92% (1223)	92% (612)	95% (660)	93% (2495)	0.023
Yes		8% (106)	8% (50)	5% (33)	7% (189)	
Recent loss						
No	2665	90% (1194)	89% (584)	88% (606)	89% (2384)	0.277
Yes		10% (127)	11% (73)	12% (81)	11% (281)	
Living alone						
No	4145	89% (1937)	89% (937)	86% (778)	88% (3652)	0.029
Yes		11% (242)	11% (120)	14% (131)	12% (493)	
Pet						
No	4145	54% (1179)	53% (565)	52% (470)	53% (2214)	0.475
Yes		46% (1000)	47% (492)	48% (439)	47% (1931)	
Physical activity						
No	3991	53% (1123)	56% (573)	61% (531)	56% (2227)	0.001
Yes		47% (981)	44% (445)	39% (338)	44% (1764)	
Dietary habits (weekly consumption)						
Pasta, rice, cereals	3987	5/7/10	5/7/10	5/7/10	5/7/10	0.182
Cereal-based products	3984	3/7/7	4/7/7	4/7/7	3/7/7	0.135
Raw meat	3985	2/3/4	2/3/4	2/3/4	2/3/4	0.418

Continued

Table 2 Continued

	N	0–15 (n=2179)	16–23 (n=1057)	24–60 (n=909)	Combined (n=4145)	P value
Cured meat	3981	1/2/3	1/2/3	1/2/3	1/2/3	0.243
Fish	3985	1/2/2	1/2/2	1/2/2	1/2/2	0.003
Milk and yoghurt	3982	1/7/7	2/7/7	2/7/7	2/7/7	0.309
Milk-based products	3984	2/3/5.25	2/3/5	1/3/5	2/3/5	<0.001
Fruit	3985	5/7/12	3/7/10	3/7/10	4/7/10	<0.001
Dried fruit	3981	0/2/5	0/2/5	0/1/4	0/2/5	<0.001
Vegetables	3984	6/7/14	5/7/14	5/7/14	6/7/14	0.013
Legumes	3982	1/3/4	2/3/4	1/2/4	1/3/4	0.059
Eggs	3984	1/2/2	1/2/2	1/2/2	1/2/2	0.442
Foods high in fat and sugar	3980	1/3/6	2/4/7	2/4/7	2/3/7	0.008
Soft drinks	3979	0/0/1	0/0/1	0/0/1	0/0/1	0.002
Alcoholic drinks (eg, wine, beer, spirits)	3981	0/2/5	0/1/4	0/1/3	0/1/4	<0.001

Data are percentages (absolute numbers) for categorical variables and I quartile/median/III quartile for continuous variables.

for each region, ranging from 36.6% to 21.1%, with an average of 29.9%.

### Questionnaires

The survey consisted of validated questionnaires examining participants' personal and household characteristics, psychological health and lifestyle habits. Regarding psychological health, three validated screening instruments for psychological distress, depression and post-traumatic stress were administered. The General Health Questionnaire (GHQ-12) was used to screen for psychological distress. The GHQ-12 was scored using the 4-point Likert method (0-1-2-3), with a threshold of 14 points to indicate psychological distress.<sup>18</sup> The Center for Epidemiologic Studies Depression Scale (CES-D) was used to screen for depression, considering three classes of symptom severity: 0–15 (no/mild depressive symptoms), 16–23 (moderate depressive symptoms) and 24–60 (severe depressive symptoms). Finally, the Impact of Event Scale-Revised (IES-R) was used to screen for post-traumatic stress. According to a recent publication in the field,<sup>19</sup> the total score of the IES-R was classified as follows: 0–23 (normal), 24–32 (mild psychological impact), 33–36 (moderate psychological impact) and ≥37 (severe psychological impact). All the instruments were validated in the Italian language and showed good psychometric properties.<sup>20–22</sup>

Finally, lifestyle habits were assessed using a routine, validated questionnaire that is used in the Italian Food Consumption Survey (INRAN),<sup>23</sup> which inquiries about weekly food intake and physical activity frequency.

### Patient and public involvement

Not applicable.

### Statistical analysis

Continuous data are reported as medians (quartiles I and III); categorical data are summarised as percentages and absolute frequencies. Wilcoxon-type tests were performed for continuous variables, and the Pearson's  $\chi^2$  test or Fisher's exact test was performed for categorical variables. The Pearson's  $\chi^2$  test was performed when the number of observations per cell was above five; otherwise, Fisher's exact test was performed.

Multivariable regression models were estimated to identify predictors of psychological distress, depression and post-traumatic stress. The categorised version of the three instruments' scores was used in the analyses. A proportional odds model was estimated for ordinal responses with more than two categories (CES-D and IES-R). A logistic regression model was estimated for the binary response variable (GHQ-12). The variables included in the model were selected via the backward elimination method and Akaike information criterion (AIC). All the models were adjusted by time from the start of the survey, which was computed as the difference between the start date of the survey and each participant response date. The time was entered in the models to account for potential confounding since the COVID-19 restrictions changed over the survey timespan, that is, the full lockdown ended on 3 May 2020, but restrictions' removal was progressive. The non-linear effects on the study outcome (ie, respondents' age and time effect) were included in the model using restricted cubic splines. The model estimated ORs together with the 95% CI, and p values were reported.

The computations were performed using the software R V.4.0.2<sup>24</sup> with the rms<sup>25</sup> package.

**Table 3** Respondents' characteristics and habits according to Impact of Event Scale-Revised score; 0–23 (normal), 24–32 (mild psychological impact), 33–36 (moderate psychological impact) and ≥37 (severe psychological impact)

	N	0–23 (n=2463)	24–32 (n=827)	33–36 (n=242)	≥37 (n=762)	Combined (n=4294)	P value
Age	4294	27/40/55	26/37/53	25/33/49	25/33/47	26/37/53	<0.001
Gender							
Female	4294	52% (1279)	73% (600)	85% (205)	83% (633)	63% (2717)	<0.001
Male		48% (1184)	27% (227)	15% (37)	17% (129)	37% (1577)	
Nationality							
Other	4294	1% (30)	1% (12)	1% (3)	1% (10)	1% (55)	0.965
Italian		99% (2433)	99% (815)	99% (239)	99% (752)	99% (4239)	
Region							
High COVID-19 incidence	4284	44% (1090)	47% (385)	48% (115)	47% (357)	45% (1947)	0.377
Low COVID-19 incidence		56% (1370)	53% (440)	52% (127)	53% (400)	55% (2337)	
Educational level							
Secondary education	4294	44% (1087)	48% (397)	50% (121)	51% (390)	46% (1995)	0.009
University education		56% (1368)	52% (430)	50% (120)	48% (369)	53% (2287)	
Primary education		0% (8)	0% (0)	0% (1)	0% (3)	0% (12)	
Working status							
Active employee	4294	70% (1720)	66% (543)	62% (151)	65% (494)	68% (2908)	0.001
Unemployed/Retired/Homemaker		14% (349)	14% (115)	14% (34)	13% (100)	14% (598)	
Student		16% (394)	20% (169)	24% (57)	22% (168)	18% (788)	
House type							
Multifamily house	4294	64% (1586)	65% (538)	76% (183)	67% (512)	66% (2819)	0.003
Single room apartment		2% (49)	2% (19)	1% (2)	3% (25)	2% (95)	
Single-family house		34% (828)	33% (270)	24% (57)	30% (225)	32% (1380)	
Garden							
No	4294	38% (935)	43% (355)	52% (126)	49% (375)	42% (1791)	<0.001
Yes		62% (1528)	57% (472)	48% (116)	51% (387)	58% (2503)	
Nasopharyngeal swab							
No	2774	93% (1482)	92% (454)	93% (151)	95% (491)	93% (2578)	0.418
Yes		7% (120)	8% (37)	7% (11)	5% (28)	7% (196)	
Recent loss							
No	2759	91% (1458)	87% (423)	88% (139)	87% (452)	90% (2472)	0.004
Yes		9% (137)	13% (64)	12% (19)	13% (67)	10% (287)	
Living alone							
No	4294	88% (2170)	89% (737)	88% (214)	87% (663)	88% (3784)	0.635
Yes		12% (293)	11% (90)	12% (28)	13% (99)	12% (510)	
Pet							
No	4294	54% (1332)	52% (426)	63% (152)	52% (397)	54% (2307)	0.014
Yes		46% (1131)	48% (401)	37% (90)	48% (365)	46% (1987)	
Physical activity							
No	3991	53% (1220)	58% (443)	59% (132)	61% (432)	56% (2227)	<0.001
Yes		47% (1081)	42% (317)	41% (93)	39% (273)	44% (1764)	
Dietary habits (weekly consumption)							
Pasta, rice, cereals	3987	5/7/10	6/7/10	5/7/10	5/7/10	5/7/10	0.560
Cereal-based products	3984	3/7/7	4/7/7	4/7/7	4/7/7	3/7/7	0.018
Raw meat	3985	2/3/4	2/3/4	2/3/4	2/3/4	2/3/4	0.150

Continued

Table 3 Continued

	N	0–23 (n=2463)	24–32 (n=827)	33–36 (n=242)	≥37 (n=762)	Combined (n=4294)	P value
Cured meat	3981	1/2/3	1/2/3	1/2/3	1/2/3	1/2/3	0.404
Fish	3985	1/2/2	1/2/2	1/1/2	1/2/2	1/2/2	0.443
Milk and yoghurt	3982	2/7/7	2/6/7	2/7/7	2/6/7	2/7/7	0.398
Milk-based products	3984	2/3/5	2/3/5	1/3/5	2/3/5	2/3/5	0.002
Fruit	3985	4/7/10	4/7/10	3/7/14	3/7/8.75	4/7/10	0.003
Dried fruit	3981	0/2/5	0/2/5	0/1/5	0/2/4	0/2/5	0.061
Vegetables	3984	6/7/14	6/7/14	6/7/14	5/7/14	6/7/14	0.043
Legumes	3982	1/3/4	1/2/4	1/2/4	1/2/4	1/3/4	0.710
Eggs	3984	1/2/2	1/2/2	1/2/2	1/2/3	1/2/2	0.836
Foods high in fat and sugar	3980	1/3/6	2/3/6	2/4/7	2/4/7	2/3/7	0.012
Soft drinks	3979	0/0/1	0/0/1	0/0/1	0/0/2	0/0/1	<0.001
Alcoholic drinks (eg, wine, beer, spirits)	3981	0/2/4	0/1/3	0/1/3	0/1/3	0/1/4	<0.001

Data are percentages (absolute numbers) for categorical variables and I quartile/median/III quartile for continuous variables.

## RESULTS

There were 5008 survey respondents. The median age was 38 years, and the proportion of females was 63%. Concerning socioeconomic status, approximately half of the sample has attained a secondary education (48%), and two-thirds were actively employed (67%).

Online supplemental table S1 reports the analysis of respondents' sociodemographic characteristics according to the place where they lived. Participants living in areas with high numbers of COVID-19 infections were significantly older and had a higher socioeconomic status than residents of regions with low rates of COVID-19. Furthermore, most participants from high COVID-19 incidence areas were found to have university educations, and they were more likely to have a job and to live in a single-family house with a garden.

Tables 1–3 present respondents' characteristics according to the scores obtained at the screening tools for psychological distress, depression and post-traumatic stress.

### Psychological distress

Most of the survey respondents (88.6%) suffered from psychological distress (GHQ score  $\geq 14$ ). The prevalence of psychological distress was significantly higher in females ( $p=0.049$ ), unemployed individuals ( $p=0.001$ ) and those who did not engage in physical activity ( $p<0.001$ ) (table 1). The results were confirmed by multivariable analysis (table 4). Unemployed/Retired/Homemakers were found to be at significantly higher risk for psychological distress than active employees (OR 1.99, 95% CI 1.4 to 2.85), together with females (OR 0.77, 95% CI 0.63 to 0.94, male vs female).

### Depression

Half of the sample suffered from moderate (25.5%, 1057 participants) or severe (22%, 909 participants) depressive

symptoms. In the univariable analysis (table 2), young women (median age of 29 years) were significantly more likely to report severe depressive symptoms, while participants with no or moderate depressive symptoms had median ages of 43 and 34 years, respectively ( $p<0.001$ ). In addition, participants living in multifamily houses/single-room apartments without a garden were significantly more likely to exhibit frequent moderate to severe symptoms of depression. In line with univariable analysis, lower age (OR 0.39 for IQR 26–53, 95% CI 0.32 to 0.48), female gender, being unemployed/retired/homemaker (OR 1.57, 95% CI 1.22 to 2.02) or being students (OR 1.73, 95% CI 1.31 to 2.28) were found to be significant predictors of more severe depressive symptoms (table 4). Additionally, participants who lived alone (OR 1.50, 95% CI 1.17 to 1.91) and experienced a loss (OR 1.35, 95% CI 1.05 to 1.72) were found to be significantly more likely to suffer from depressive symptoms. Conversely, engaging in physical activity was found to be protective against the worst depressive symptoms (OR 0.64, 95% CI 0.55 to 0.75).

### Post-traumatic stress

The prevalence of moderate and severe psychological effects was 5.6% and 17.7%, respectively. For moderate/severe depressive symptoms, the impact was significantly higher in females, young respondents and participants living in multifamily houses (table 3). The multivariable analysis confirmed these results (table 4).

### Dietary habits

Overall, participants reported eating pasta/rice/cereals and cereal-based products a median of 7 times per week. Meat was reported more frequently than fish (median of 3 times per week vs median of 2 times per week), while the consumption of legumes was reported to be a median



**Table 4** Results of the multivariable models (proportional odds model for the ordinal responses with more than two categories, ie, CES-D and IES-R, logistic regression model for the binary response variable, ie, GHQ-12)

	OR	Lower 0.95	Upper 0.95
<b>GHQ</b>			
Days from the start of the survey	1.19	0.95	1.49
Gender: male versus female	0.77	0.63	0.94
Region: low incidence versus high incidence	0.87	0.72	1.06
Working status: unemployed/retired/homemaker versus active employee	1.99	1.4	2.85
Working status: student versus active employee	1.10	0.85	1.43
Physical activity: yes versus no	0.56	0.46	0.69
<b>CES-D</b>			
Days from the start of the survey	1.38	1.00	1.89
Age	0.39	0.32	0.48
Gender: male versus female	0.46	0.39	0.55
Working status: unemployed/retired/homemaker versus active employee	1.57	1.22	2.02
Working status: student versus active employee	1.73	1.31	2.28
Garden: no versus yes	1.72	1.46	2.01
Recent loss: yes versus no	1.35	1.05	1.72
Living alone: yes versus no	1.50	1.17	1.91
Physical activity: yes versus no	0.64	0.55	0.75
<b>IES-R</b>			
Days from the start of the survey	1.03	0.75	1.42
Age	0.67	0.58	0.78
Gender: male versus female	0.30	0.25	0.37
Educational level: secondary versus university	1.29	1.10	1.52
Educational level: primary versus university	0.48	0.05	4.55
Garden: no versus yes	1.55	1.33	1.82
Recent loss: yes versus no	1.63	1.28	2.09
Physical activity: yes versus no	0.72	0.61	0.84

For continuous variables, the effect is reported on the IQR, that is, 26–53 for age and 3–20 for days from the start of the survey. Results are reported as ORs (logistic regression) or proportional odds (proportional odds model), 95% CIs, p value (see online supplemental material).

CES-D, Center for Epidemiologic Studies Depression Scale; GHQ, General Health Questionnaire; IES-R, Impact of Event Scale-Revised.

of 3 times per week. The consumption of fruits and vegetables was a median of 7 times per week each.

The analysis of the distribution of weekly food frequency according to the categorised scores of the psychological health screening tools (tables 1–3) shows no statistically significant differences for GHQ scores, except

for consumption of vegetables and legumes (significantly lower for participants with psychological distress,  $p=0.003$  and  $p=0.002$ ). Participants with moderate/severe depressive symptoms were found to consume milk-based products less frequently ( $p<0.001$ ), fruit ( $p<0.001$ ), dried fruit ( $p<0.001$ ) and vegetables ( $p=0.013$ ). Conversely, they were significantly more likely to eat foods high in fat and sugar more frequently ( $p=0.008$ ). Similarly, participants with moderate/severe psychological impact showed a lower consumption of fruit ( $p=0.003$ ). At the same time, they were more likely to frequently eat foods high in fat and sugar ( $p=0.012$ ).

## DISCUSSION

The present findings show a high prevalence of moderate to severe depressive symptoms during the lockdown. The analysis of predictors of psychological distress among survey respondents identified a significant association with female gender, being student or unemployed/retired/homemaker and living in a multifamily house without a garden. Conversely, only a small proportion of participants reported moderate to severe psychological impact, and, again, young females and unemployed/retired/homemaker individuals were the most affected. For what concerns sample characteristics, they were found to be representative of national trends. Respondents from high COVID-19 incidence regions were found to have higher socioeconomic status compared with those from other regions. High COVID-19 incidence regions were mainly located in Northern Italy, which is characterised by higher socioeconomic level than Southern Italy, according to the official data of the Italian National Institute of Health.

A recent review in the field has shown that over a short-term period, quarantine is associated with an increased prevalence of anxiety, depression and post-traumatic stress symptoms.<sup>26</sup> Such findings are confirmed by surveys conducted in the most affected countries during the COVID-19 lockdown, showing that the population presented with increased feelings of anxiety and depression.<sup>14 19</sup> Furthermore, emotional eating has been frequently reported,<sup>15</sup> highlighting the strong and direct association between psychological well-being and lifestyle habits, which have been recently documented in college students during lockdown.<sup>27</sup> Surveyed individuals have reported doing less physical activity and snacking more frequently during the lockdown, with consequent weight gain.<sup>28 29</sup> Disturbingly, such changes have also been shown to affect children,<sup>30</sup> with potentially detrimental long-term consequences for their health since such lifestyle changes could result in an increased risk for non-communicable diseases over the life course.

A recent meta-analysis showed a 33.7% prevalence of depression,<sup>3</sup> while in the present study, the proportion of subjects reporting moderate to severe depressive symptoms was 47.5%. However, when only severe depressive symptoms are considered, the prevalence is

consistent with previous studies in the field.<sup>3</sup> Conversely, the prevalence of moderate to severe symptoms of post-traumatic stress was not consistent with reports in the literature,<sup>19 31</sup> especially when only severe psychological impact was considered. In discussing such data, it is worth noting that studies in the field have employed different tools to ascertain the prevalence of depression, anxiety and post-traumatic stress, making it difficult to compare results across studies.

Regarding the characterisation of depressed participants, in line with the literature, female gender, low socioeconomic status,<sup>5</sup> younger age and being a student<sup>32</sup> were found to be significant predictors of depression.

### Dietary habits

The study of dietary habits during the lockdown showed that participants were not compliant with the Mediterranean pyramid targets.<sup>33</sup> Half of the sample reported eating fruits and vegetables only twice a day, even though their recommended consumption is 5 times a day. In addition, participants reported eating foods high in fat and sugars (eg, cakes) a median of 3 times a week (IQR 2–7), meaning that 25% of the sample ate such foods once a day, even though their consumption is recommended to be occasional. Such findings are in line with the literature, demonstrating that participants tended to snack more frequently during lockdown.<sup>28</sup> Fish consumption is recommended 3 times per week, but participants report eating fish a median of 2 times per week. We cannot rule out that lockdown might pose difficulties in the purchase of fish.

Interestingly, dietary patterns were found to be even worse among participants with symptoms of depression and psychological impact. They reported frequently eating foods high in fat and sugar and fruits and vegetables less frequently than participants without symptoms of depression and psychological impact. Such a finding could be interpreted as emotional eating, which has been reported during lockdown.<sup>15</sup> However, we can also hypothesise that participants with psychological discomfort had worse eating habits because of a worse socioeconomic status since they were more likely not to have a job and to live in a smaller house without a garden. However, we cannot clarify the issue because we did not investigate eating habits before lockdown.

The fact that no data about participants' habits before lockdown were available represents a study limitation. Since no measures were taken before the lockdown started, the present study results can only provide a characterisation of survey respondents during the lockdown, without making reference to changes in psychological distress symptoms as a result of COVID-19 restrictions. Another limitation is the non-negligible proportion of survey responses presenting with missing data and the higher proportion of responses from high-incidence COVID-19 regions compared with those from regions with a low incidence of COVID-19. Furthermore, the analysis of missing data showed that the proportion varied

across regions, with the lowest proportion in regions with a high COVID-19 incidence. We cannot rule out that such limits might lead to an overestimation of psychological distress prevalence; however, when only the proportion of severe depressive symptoms was considered, it was similar to that reported in the literature. More responses came from high-incidence COVID-19 regions because residents of those regions were more prone to respond to the survey. Furthermore, that fact is related to the sampling technique employed, that is, snowball sampling. The technique may result in a selection bias by including individuals who belong to a specific social network and excluding individuals not in that social network, since it was based on personal social networks. However, snowball sampling is a well-known and widely used sampling technique in the social sciences.

The present work presents several strengths. First, it is one of the largest population-based surveys conducted in Italy during the first COVID-19 lockdown, providing valuable data about the Italian population's psychological health. Furthermore, the results provide an analysis of predictors of psychological distress, depression and post-traumatic stress, helping identify individuals most vulnerable to the psychological effects of lockdown.

These results have relevant implications for future research and public health. First, they provide insight into the need to understand the long-term consequences of lockdowns on psychological health and lifestyle habits, which need to be investigated further since data in the field are lacking. As an example, did depression symptoms persist after the end of the full lockdown? If yes, did they worsen? Furthermore, for what concerns the public health perspective, if the long-term effects of lockdowns are confirmed, the present results help identify vulnerable populations that potentially benefit from follow-up programmes of psychological support in the case of persistent psychological distress.

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#### REFERENCES

- Anderson RM, Heesterbeek H, Klinkenberg D, *et al*. How will country-based mitigation measures influence the course of the COVID-19 epidemic? *Lancet* 2020;395:931–4.
- Tona F, Plebani M, Gregori D. “Stay home stay safe?” Systemic inflammation in subjects undergoing routine hematology tests during the lockdown period of COVID-19. *Clin Chem Lab Med CCLM* 2020;1.
- Salari N, Hosseini-Far A, Jalali R, *et al*. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Global Health* 2020;16:1–11.
- Bressan S, Gallo E, Tirelli F, *et al*. Lockdown: more domestic accidents than COVID-19 in children. *Arch Dis Child* 2021;106:e3.
- Ettman CK, Abdalla SM, Cohen GH, *et al*. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Netw Open* 2020;3:e2019686.
- Fiorenzato E, Zabberoni S, Costa A, *et al*. Cognitive and mental health changes and their vulnerability factors related to COVID-19 lockdown in Italy. *PLoS One* 2021;16:e0246204.
- Fiorillo A, Sampogna G, Giallonardo V, *et al*. Effects of the lockdown on the mental health of the general population during the COVID-19 pandemic in Italy: results from the COMET collaborative network. *Eur Psychiatry* 2020;63:e87.
- Cellini N, Canale N, Mioni G, *et al*. Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy. *J Sleep Res* 2020;29:e13074.
- Cancello R, Soranna D, Zambra G, *et al*. Determinants of the lifestyle changes during COVID-19 pandemic in the residents of Northern Italy. *Int J Environ Res Public Health* 2020;17:6287.
- Bavli I, Sutton B, Galea S. Harms of public health interventions against covid-19 must not be ignored. *BMJ* 2020;371:m4074.
- Gregori D, Azzolina D, Lanera C, *et al*. A first estimation of the impact of public health actions against COVID-19 in Veneto (Italy). *J Epidemiol Community Health* 2020;74:jech-2020-214209.
- Magnani C, Azzolina D, Gallo E, *et al*. How large was the mortality increase directly and indirectly caused by the COVID-19 epidemic? An analysis on all-causes mortality data in Italy. *Int J Environ Res Public Health* 2020;17:3452.
- Lorenzoni G, Lanera C, Azzolina D, *et al*. Is a more aggressive COVID-19 case detection approach mitigating the burden on ICUs? Some reflections from Italy. *Crit Care* 2020;24:175.
- Di Renzo L, Gualtieri P, Cinelli G, *et al*. Psychological aspects and eating habits during COVID-19 home confinement: results of EHLIC-2020-19 Italian online survey. *Nutrients* 2020;12:2152.
- Cherikh F, Frey S, Bel C, *et al*. Behavioral food addiction during lockdown: time for awareness, time to prepare the aftermath. *Obes Surg* 2020;30:3585–7.
- Cecchetto C, Aiello M, Gentili C, *et al*. Increased emotional eating during COVID-19 associated with lockdown, psychological and social distress. *Appetite* 2021;160:105122.
- Schmitz C. LimeSurvey: an open source survey tool. *Lime Survey Proj Hambg Ger* 2012.
- Giorgi G, Perez JML, D’Antonio AC. The general health questionnaire (GHQ-12) in a sample of Italian workers: mental health at individual and organizational level. *World J Med Sci* 2014;11:47–56.
- Wang C, Pan R, Wan X. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 1729;2020:17.
- Craparo G, Faraci P, Rotondo G, *et al*. The impact of event scale-revised: psychometric properties of the Italian version in a sample of flood victims. *Neuropsychiatr Dis Treat* 2013;9:1427.
- Fava GA. Assessing depressive symptoms across cultures: Italian validation of the CES-D self-rating scale. *J Clin Psychol* 1983;39:249–51.
- Piccinelli M, Bisoffi G, Bon MG, *et al*. Validity and test-retest reliability of the Italian version of the 12-item general health questionnaire in general practice: a comparison between three scoring methods. *Compr Psychiatry* 1993;34:198–205.
- Sette S, Le Donne C, Piccinelli R, *et al*. The third national food consumption survey, INRAN-SCAI 2005-06: major dietary sources of nutrients in Italy. *Int J Food Sci Nutr* 2013;64:1014–21.
- R Core Team. *R: a language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing, 2019. <https://www.R-project.org>
- Harrell FEJ. rms: regression modeling strategies. R package version 4.1-3, 2014. Available: <http://CRAN.R-project.org/package=rms>
- Brooks SK, Webster RK, Smith LE, *et al*. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 2020;395:912–20.
- Amatori S, Donati Zeppa S, Preti A, *et al*. Dietary habits and psychological states during COVID-19 home isolation in Italian college students: the role of physical exercise. *Nutrients* 2020;12:3660.
- Sidor A, Rzymiski P. Dietary choices and habits during COVID-19 Lockdown: experience from Poland. *Nutrients* 2020;12:1657.
- Scarmozzino F, Visioli F. Covid-19 and the subsequent Lockdown modified dietary habits of almost half the population in an Italian sample. *Foods* 2020;9:675.
- Pietrobelli A, Pecoraro L, Ferruzzi A, *et al*. Effects of COVID-19 lockdown on lifestyle behaviors in children with obesity living in Verona, Italy: a longitudinal study. *Obesity* 2020;28:1382–5.
- Karatzias T, Shevlin M, Murphy J, *et al*. Posttraumatic stress symptoms and associated comorbidity during the COVID-19 pandemic in Ireland: a population-based study. *J Trauma Stress* 2020;33:365–70.
- Solomou I, Constantinidou F. Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: age and sex matter. *Int J Environ Res Public Health* 2020;17:4924.
- CREA, Centro di ricerca alimenti e nutrizione. Dietary guidelines for healthy eating – Revisione 2018 (Italian: Linee Guida per una sana alimentazione - Revisione 2018), 2018. Available: [https://www.crea.gov.it/documents/59764/0/LINEE-GUIDA+DEFINITIVO+\(1\).pdf/3c13ff3d-74dc-88d7-0985-4678aec18537?t=1579191262173](https://www.crea.gov.it/documents/59764/0/LINEE-GUIDA+DEFINITIVO+(1).pdf/3c13ff3d-74dc-88d7-0985-4678aec18537?t=1579191262173) [Accessed 6 Apr 2020].