Differences in mental health and health-related quality of life between the Israeli and Italian population during a COVID-19 quarantine

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Abstract

Purpose Severe restrictions related to COVID-19 were implemented almost simultaneously in Italy and Israel in early March 2020, although the epidemic situation in both countries was significantly different. Therefore, the purpose of this study was to examine how and to what extent the severe restrictions affected the mental health and health-related quality of life of non-infected people, in a comparison between Israel and Italy.

Methods A cross-sectional study was conducted during the first week of May 2020 among 510 Israeli and 505 Italian participants. Anxiety and depression levels were measured using the Patient Health Questionnaire-4 (PHQ-4), and the short form-8 health survey (SF-8) questionnaire measured health-related quality of life. Linear hierarchic regression forced steps analysis was performed to measure the unique contribution of each variable to predicting health-related quality of life.

Results After adjusting for socioeconomic variables, the results showed a significantly higher anxiety level and lower health-related quality of life in the Italian participants. The anxiety and depression variables predicted lower health-related quality of life. Physical activity was found to be a protective factor.

Conclusion The results suggest that early monitoring of anxiety and depression in situations such as quarantine may detect the risk for decline in health-related quality of life. Establishment of professional interventions is needed in order to prevent the negative health consequences of the pandemic-related policy.

Keywords Depression · Anxiety · Health-related quality of life · COVID-19

Introduction

The 2019 outbreak of the coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2), emerged in Wuhan, China and spread to the entire country by the end of December 2019 [1]. In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic; it encouraged the world's population to collaborate and to radically change their lifestyle in order to fight the spread of the virus [2].

Italy, and the Lombardy region in particular, was severely affected by COVID-19 shortly after China was infected, making it the first European country to face a pandemic crisis [3–5]. On March 10, 2020, Lombardy was quarantined and the government instituted stronger containment measures, including strict self-isolation measures. [5–7] At that time, 3420 of Lombardy's 10,060,574 residents tested positive for COVID-19 [6]. Israel, on the other hand, is one of the countries that was initially affected by COVID-19 to a much lesser extent and that responded to the crisis relatively early. On March 17, 2020, the same restrictions were put into place by the Israeli government, although the number of positive patients at the time was 712 for a population of 9,136,000 [8, 9]. Interestingly, both regions have a similar number of inhabitants and a similar geographical area. Both regions have characteristics of developed countries and a very intense and active social life. The two similar populations were put into lockdown facing a completely different reality outside the home. During this new pandemic, it is

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extremely important to better understand how the population has been coping with such a major disaster [10].

The psychosocial and health-related quality of life (HRQoL) response to an adverse event of this magnitude is complex; it involves considering many biological, psychological, social, and economic factors [11]. Different studies show that in an early phase of the severe acute respiratory syndrome (SARS) outbreak, a range of psychiatric morbidities may occurred, including depression, anxiety, panic attacks, and even suicide [10]. During the SARS outbreak, many studies investigated the psychological impact on the non-infected community, revealing significant psychiatric morbidities [12]. During one influenza outbreak, around 10% to 30% of the general public experienced severe stress [13]. With the closure of schools and businesses, negative emotions experienced by individuals are further compounded [14]. Strong fundamental evidence suggests that the reduction of social interactions is associated with higher depression symptoms and a higher risk of mortality [15]. Furthermore, some evidence suggests that the psychological impact of quarantine is wide ranging and long lasting [16]. Through this mechanism, the quarantine and social distancing related to COVID-19 has the potential of impacting the population's health-related quality of life. To date, only limited studies have investigated the severe impact of strict self-isolation on mental health and quality of life [11, 17].

Therefore, the aims of this study were to examine how the quarantine and social distancing during the COVID-19 pandemic affected the self-reported incidence of depression and anxiety and to evaluate its effect on HRQoL, among the adult population in Israel and Lombardy (Italy). Conducting the study in two similar populations to which the same restrictions were applied, though facing significantly different infection rates and mortality rates, provides a unique opportunity to perform comparative multivariate analysis and to identify major factors affecting public health.

Materials and methods

Data source

A cross-sectional study was carried out using the online internet polling service. The Israeli sample used the *i-panel* source, the largest panel survey in Israel, with more than 100,000 participants; the *i-panel* matched the population in Israel [18]. The *i-panel* adheres to the high-quality research code of the European Society for Opinion and Marketing Research (ESOMAR). The Italian sample used the *CINT* source. This is one of the largest panel surveys in Italy; the target area was Lombardy and quotas were used to match the composition of the local population. The Italian *CINT* adheres to the ESOMAR

research code and was managed by an ASTRARICERCHE research company located in Milan. During the data collection, both Israel and Italy were in the end stage of the quarantine and had reopened local businesses with social distancing guidelines. Internet surveys such as *i-panel* and the *CINT* panel allowed the researchers to quickly collect data [19] while capturing similar end-stage quarantine circumstances in Israel and Italy. Brandon et al. reported that participants recruited to studies by internet panels generate data as valid as those provided by traditionally recruited participants [20].

The sample included adult participants from Israel and the Lombardy region in Italy. We used the G*Power program to calculate sample size for linear multiple regression [21], and considered a small effect size of 0.02, $\alpha = 0.05$, and a power of 80%. Thus, the sample comprised 550 participants from each country. The final Israeli sample comprised 510 participants and the Italian sample comprised 505 participants (with 7.2% and 8.1% withdrawal, respectively). The questionnaire was distributed randomly via e-mail or a mobile phone application. The study used quota sampling to ensure the representative variables of gender, age, and SED status [22]. The study was conducted for one week beginning from May 7, 2020, two months after both countries were placed under lockdown.

Measures of variables

The study used three self-report questionnaires to measure anxiety and depression, HRQoL, and socioeconomic variables.

Anxiety and depression

Anxiety and depression were measured by the Patient Health Questionnaire-4 (PHQ-4) consisting of 4 items. The first 2 items assessed depression and the last 2 items anxiety. This tool was validated among the general population by Löwe et al. with an original Cronbach's alpha value of 0.78 for the depression scale and 0.75 for the anxiety scale [23]. The questionnaire is shown in Appendix 1 (Supplementary material). Replies were ranked on a scale ranging from 0 to 3. The total score for the depression scale and for the anxiety scale was between 0 and 6 points each. A score of ≥ 3 was suggested as a cut-off distinction point between a normal range and probably indicated initial symptoms of depression or anxiety. In the current study, the Cronbach's alpha values of the depression scales were 0.70 and 0.79 for the Israeli and Italian populations, respectively. The Cronbach's alpha values of the anxiety scales were 0.82 and 0.83 for the Israeli and Italian populations, respectively.

Health-related quality of life (HRQoL)

HRQoL was measured by the short form-8 health survey questionnaire (SF-8) tool. The SF-8 questionnaire is a shorter form of the SF-36 health survey tool. Both tools were found to be efficient and practical tools for assessing HRQoL [24]. The SF-8 is a short but comprehensive tool for measuring multiple dimensions of health status among various populations regardless of ages and health status. This tool assesses eight health concepts, including restrictions in various aspects of life due to physical, mental, emotional, and subjective health. The SF-8 included eight questions: one for each health domain. Four items assessed physical health, termed the physical component summary (PCS), and four items assessed mental health, termed the mental component summary (MCS) [25]. The SF-8 tool was validated in several studies, with good agreement of its internal consistency [26]. The current study found Cronbach's alpha values of 0.80 and 0.81 for the PCS among the Israeli and Italian groups, respectively, and 0.85 for the MCS for both the Israeli and Italian groups. The scoring method consisted of Norm-Based T-Scoring, which means that each item and the component summary have the same mean ($M = 50$) and standard deviation (SD = 10), normalized to the general US population. This normalized scoring method allows comparison of the research sample with the reference population (US general population) [25]. The calibrated scoring was conducted under license number QM053998.

Both the SF-8 and the PHQ-4 questionnaires were translated into Hebrew and Italian and then back-translated into English [27].

Socioeconomic variables

Socioeconomic variables included gender, age, marital status, education (years), living with children, health status (options: yes/no chronic disease), owning an apartment, employment status before the COVID-19 outbreak, and employment status during the outbreak (options: as usual, part time, full time at home, part time at work, unpaid vacation, and layoff), average income before the COVID-19 outbreak, and status during the outbreak (options: no change; reduced; and sharply reduced), and physical exercise during the last 4 weeks (options: on a regular basis, sometimes, do not exercise).

Data analysis

Descriptive statistics were conducted to describe the research sample. Mean and SD were calculated for depression, anxiety, and the SF-8 questionnaires, comparing between the Israeli and Italian samples. The differences between the Israeli and Italian samples were quantified using Cohen's d effect size measure.

Linear multiple hierarchic regression forced steps analysis was performed to measure the unique contribution of each variable to predicting the dependent variable [28] in the PCS and the MCS. All the categorical variables were computed to a dummy variable, for example: "Israeli group = 0 and Italian group = 1" or "no change in income status during the quarantine = 0 and reduced income = 1". Three steps were conducted: The first step included socioeconomic variables and health status. The second step included variables related to the COVID-19 quarantine: employment status, income level, and physical exercise. The third step included depression, anxiety, and groups (Israel/Italy). The explained variance (R^2) and the statistically significant value of F that changed were calculated for each of the models. The diagnostics parameter for multicollinearity was correlation, variance inflation factor (VIF), and tolerance. There was no correlation higher than 0.8 between the variables; the VIF range was 1.01–2.31, and the tolerance range was 0.43–0.98. This diagnosis suggests that each of the variables had a unique contribution to the dependent variable of PCS or MCS, with no multicollinearity interface [28]. Values of $p < 0.05$ were considered significant. All analyses were performed using SPSS version 25.

The study was approved by the University Ethics Committee (number 0001366–1). The participants were asked to sign an informed consent form before beginning completion of the survey.

Results

Table 1 presents the samples' characteristics. The Israeli and Italian cohorts differed significantly in the following socioeconomic characteristics: age, owning an apartment/house, the number of children living at home, employment status, family income before and during the COVID-19 outbreak, and the level of physical exercise. In addition, the probability of the Italians having a ≥ 3 score of anxiety (severe anxiety) was significantly higher than that of the Israelis (50.2% vs. 42.2%, $p = 0.02$) (Table 2).

Table 3 presents the mean scores for depression, anxiety, the SF-8 health survey for each of the eight items separately, as well as PCS and MCS, in comparison between the Israeli and Italian cohorts. The anxiety level reported by the Israeli participants was significantly lower than that of their Italian counterparts ($M = 0.97$, SD = 0.86; $M = 1.17$, SD = 0.86, $p = 0.0001$, respectively), with a moderate size effect ($d = -0.23$). No significant differences in depression were found between the Israeli and Italian participants. In addition, the Israeli participants reported significantly

Table 1 Sample characteristics: Israeli and Italian cohorts

Variable	Israel (n=510)		Italy (n=505)		P
	n (%)	M (SD)	n (%)	M (SD)	
Gender					0.47
Male	250 (49.0)		259 (51.3)		
Female	260 (51.0)		246 (48.7)		
Age groups					0.0001
18–24	91 (17.8)		48 (9.5)		
25–34	114 (22.4)		79 (15.6)		
34–44	103 (20.2)		106 (21.0)		
45–54	108 (21.2)		124 (24.6)		
55–70	94 (18.4)		148 (29.3)		
Marital status					0.90
Married	372 (72.9)		370 (73.3)		
Unmarried	138 (27.1)		135 (26.7)		
Health status					0.86
No chronic disease	364 (71.4)		363 (71.9)		
With chronic disease	146 (28.6)		142 (28.1)		
Owning an apartment/house					0.001
Yes	280 (54.9)		336 (66.5)		
No, rental	127 (24.9)		96 (19.0)		
No, living with parents	103 (20.2)		73 (14.5)		
Education (years)		14.03 (2.52)		14.23 (3.73)	0.31
Number of children living at home		2.4 (1.6)		1.3 (0.9)	0.0001
Employment status before COVID-19					0.0001
Unemployed	63 (12.4)		141 (27.9)		
Public sector employment	153 (30.0)		64 (12.7)		
Private sector employment	214 (42.0)		208 (41.2)		
Self-employed	29 (5.7)		58 (11.5)		
Student/Military service	51 (10.0)		34 (6.7)		
Scope of employment before COVID-19*					0.62
Full time	312 (78.8)		250 (75.8)		
Part time	56 (14.1)		56 (16.1)		
Per diem	28 (7.1)		27 (8.2)		
Workplace before COVID-19*					0.11
Outside home	357 (90.2)		283 (85.8)		
At home	11 (2.8)		18 (5.5)		
Both	28 (7.1)		29 (8.8)		
Family income before COVID-19					0.0001
Below average	277 (54.3)		184 (36.4)		
Average	149 (29.2)		226 (44.8)		
Above average	84 (16.5)		95 (18.8)		
Employment during the COVID-19 quarantine*					0.0001
As usual	82 (20.7)		53 (16.1)		
Part time	80 (20.2)		49 (14.8)		
Full time at home	49 (12.4)		79 (23.9)		
Part time at work	39 (9.8)		43 (13.0)		
Unpaid leave	122 (30.8)		74 (22.4)		
Layoff	24 (6.1)		32 (9.7)		
Income status during the COVID-19 quarantine					
Unchanged	169 (33.1)		212 (42.0)		0.004

Table 1 (continued)

Variable	Israel (n=510)		Italy (n=505)		P
	n (%)	M (SD)	n (%)	M (SD)	
Reduced	228 (44.7)		213 (42.4)		
Sharply reduced	113 (22.2)		80 (15.8)		
Physical exercise during the past 4 weeks					0.01
As usual	113 (22.2)		110 (21.8)		
Sometimes	245 (48.0)		204 (40.4)		
Never	152 (29.8)		191 (37.8)		

The table shows the results of a Chi-square test for categorical variables and Mean (SD) for continuous variables. *Excluded: did not work; student; soldier

Table 2 The four-item patient health questionnaire (PHQ-4) for anxiety and depression, a comparison between Israeli (n=510) and Italian participants (n=505)

Variable	Israel (n=510)	Italy (n=505)	p
	n (%)	n (%)	
Depression score*			0.78
Score < 3	223 (52.5)	228 (53.4)	
Score ≥ 3	202 (47.5)	199 (46.6)	
Anxiety score*			0.02
Score < 3	216 (57.8)	208 (49.8)	
Score ≥ 3	158 (42.2)	210 (50.2)	

*Score ≥ 3 indicates patients suspected of having depression/anxiety symptoms

higher PCS and MCS mean scores compared with the Italians (PCS: $M = 52.47$, SD = 7.88; $M = 50.35$, SD = 7.90, $p < 0.0001$, MCS: $M = 46.13$ SD = 10.78; $M = 43.46$,

SD = 10.03, $p < 0.0001$, respectively). The Cohen's d value was 0.27 for the PCS difference and 0.26 for the MCS difference. These findings suggest that the HRQoL reported by the Israeli participants was higher than that of the Italian participants, and that it had a moderate sized effect. The correlation matrix of the variables can be seen in Appendix A1.

Table 4 presents a summary of hierarchical multiple linear regressions forced steps used to predict PCS and MCS among the Israeli and Italian cohorts. The table presents the final and third step of the regression, controlling for socioeconomic variables, health status, and quarantine-related variables (for example, employment during the quarantine).

PCS explanation (Table 4, model A): In the first step, the socioeconomic variables and health status were added. In step two, variables related to the quarantine, i.e., working, income status, and physical exercise, were added. In the final step, the depression, anxiety, and cohorts (Israel/Italy) variables were added. After the socioeconomic,

Table 3 Comparisons between Israeli and Italian participants regarding depression, anxiety, PCS, and MCS levels (independent *t-test* and Cohen's *d* for the effect size)

Variable	Israel	Italy	p	t	Cohen's d^a
	M (SD)	M (SD)			
Depression	1.12 (0.82)	1.15 (0.81)	0.52	− 0.64	− 0.03
Anxiety	0.97 (0.86)	1.17 (0.86)	0.0001	− 3.73	− 0.23
Health survey*					
General health	51.72 (7.14)	47.18 (7.38)	< 0.0001	9.89	0.62
Physical functioning	50.10 (7.00)	48.12 (5.75)	< 0.0001	4.29	0.30
Role—physical	49.17 (7.77)	47.87 (7.82)	0.009	2.63	0.16
Bodily pain	53.43 (7.61)	53.38 (7.40)	0.91	0.11	0.00
Vitality	50.70 (7.40)	45.66 (8.08)	< 0.0001	10.29	0.65
Social functioning	47.22 (9.36)	46.97 (8.29)	0.66	0.44	0.02
Role—emotional	46.65 (8.75)	44.60 (8.70)	< 0.0001	3.70	0.23
Mental health	45.02 (8.19)	44.34 (7.41)	0.16	1.38	0.08
PCS	52.47 (7.88)	50.35 (7.90)	< 0.0001	4.26	0.27
MCS	46.13 (10.78)	43.46 (10.03)	< 0.0001	4.05	0.26

*Health survey = eight items of the SF-8 health survey as tool used for measuring health-related quality of life *PCS* Physical Component summary, *MCS* mental component summary.

[a]Cohen's d is the effect size of the differences

Table 4 Summary of hierarchical regression analysis for variables predicting PCS and MCS among Israeli and Italian participants

Variable[a]	PCS Model A B (CI)	MCS Model B B (CI)
Gender	0.23 (− 0.99 to 1.46)	− 0.48 (− 1.74 to 0.77)
Age	− 0.21 (− 2.63 to 2.20)	− 1.58 (− 4.06 to 0.89)
Marital status	− 1.85 (− 3.41 to − 0.29)*	− 0.40 (− 2.00 to 1.19)
Education	0.19 (0.001 to 0.38)*	− 0.18 (− 0.37 to 0.02)
Owning an apartment	0.13 (− 1.26 to 1.76)	0.05 (− 1.38 to 1.49)
Living with children	0.25 (− 1.26 to 1.54)	0.15 (− 1.39 to 1.70)
Health status	− 6.12 (− 7.50 to − 4.73)***	− 2.17 (− 4.78 to − 1.24)*
Employment during the quarantine	− 0.36 (− 1.72 to 0.99)	0.84 (− 0.55 to 2.23)
Income status during the quarantine	0.16 (− 1.19 to 1.52)	− 0.82 (− 2.17 to 0.57)
Physical exercise during the quarantine	1.44 (0.004 to 2.88)*	2.68 (1.20 to 4.16)***
Depression	0.09 (− 1.02 to 1.21)	− 4.56 (− 5.71 to − 3.41)***
Anxiety	− 4.19 (− 6.44 to − 1.79)*	− 6.33 (− 7.40 to − 5.26)***
Group: Israel/Italy	− 3.31 (− 4.58 to − 2.04)***	− 1.23 (− 2.51 to − 0.09)*
R^2	14.6	53.5
F change	< 0.0001	< 0.0001

The table presents the final and third step of the regression, controlling for socioeconomic variables, health status, and quarantine-related variables (for example, employment during the quarantine)

PCS Physical component summary, *MCS* mental component summary

[a]Category variables recoded to dummy variables, as described: Gender—male = 0 and female = 1; age—youngest group 18–24 = 0 and other groups—1; marital status—not married = 0 and married = 1; owning an apartment—no = 0 and yes = 1; health status—no chronic disease = 0 and having a chronic disease = 1; working during the quarantine—continued to work (as usual or part time) = 1 and did not continue to work (unpaid vacation or layoff) = 0; income status during the quarantine—no change = 0 and reduced income = 1; physical exercise—not exercising = 0 and exercising as usual = 1; group—Israel = 0 and Italy = 1

*p < 0.05 ** p < 0.01 ***p < 0.001

health status, and variables related to the quarantine were adjusted, the regression revealed that physical exercise ($B = 1.44$, $p < 0.05$), anxiety level ($B = − 4.19$, $p < 0.05$), and group ($B = − 3.31$, $p < 0.001$) may explain the PCS. The R^2 value was 14.6% and the model was significant ($p < 0.0001$). This finding suggests that not being physically active during the quarantine, a higher level of anxiety, and being Italian may explain the lower PCS.

MCS explanation (Table 4, model B): The variables were added to the regression as in model A. In the final step, after the socioeconomic, health status, and variables related to the quarantine were adjusted, the regression revealed that physical exercise ($B = 2.68$, $p < 0.001$), depression ($B = − 4.56$, $p < 0.001$), anxiety level ($B = − 6.33$, $p < 0.001$), and group ($B = − 1.23$, $p < 0.05$) explained the MCS. The R^2 value was 53.5% and the model was significant ($p < 0.0001$). These findings suggest that not being physically active during the quarantine, having a higher level of depression and anxiety, and being Italian explained the lower MCS.

Discussion

Unlike previous global disasters such as Ebola and SARS as well as the experience gained, the COVID-19 pandemic has a unique characteristic: strict social isolation and the restriction of movement for millions of people, with a few justified exceptions. This situation drastically changed the life of the population, which can have a potentially wide range of health impacts. The majority of the research conducted on COVID-19 relates to its clinical manifestations, how it is transmitted, the genomic characterization of the virus, and therapeutic options.

The current study aimed to explore the health consequences of quarantine and social distancing during the COVID-19 pandemic, focusing on depression, anxiety, and HRQoL in the Israeli versus the Italian community. These two developed countries with advanced health services and a similar national health service model [4] followed

the same restrictions, but experienced the COVID-19 pandemic at different intensities.

Our results show higher levels of anxiety and depression during the COVID-19 pandemic in both samples compared to the reported prevalence in the general population in previous years. The data from the Italian National Statistical Institute indicate a severe anxiety prevalence of 4.2% and a depressive symptoms prevalence of 5.4% several years before the pandemic [29]. According to the Israeli Central Bureau of Statistics, in the last decade the prevalence of anxiety in Israel's general population was 3.6% while the prevalence of depression was about 10.5–12% [30]. In April 2020, one-third of the adult Israeli population reported feeling anxiety and depression [31]. In Italy, 29.7% reported depression symptoms and 23.2% reported anxiety in a study conducted in the first 14 days of the quarantine [32]. This suggests that the depression and anxiety symptoms were worse both in the Israeli and in the Italian population during the quarantine. On the other hand, the level of HRQoL among the Israeli sample was similar to that found by Baron Epel et al. in Israel, as measured by the SF-12 instrument [33]. In the current study, the Italian participants had a higher level of anxiety symptoms and lower HRQoL (represented by PCS and MCS), compared with their Israeli counterparts. Similar results were reported among the general population during the COVID-19 quarantine in a study conducted in China, which reported higher prevalence of anxiety and depression during the lockdown: 35.1% prevalence of anxiety and 20% prevalence of depression symptoms [34].

At the time the current study was conducted, the number of positive COVID-19 cases in Lombardy was 82,028, which represents an infection rate of 8154 cases per one million citizens, with 14,294 deaths [35]. In contrast, the number of positive COVID-19 cases in Israel was 16,348, which represents an infection rate of 1793 cases per one million citizens, with 239 deaths [36]. The literature describes increases in anxiety disorders among people who are exposed to a disaster event [37, 38]. Similar findings were demonstrated among non-infected students regarding the COVID-19 pandemic [39] and the general population [40]. Previous outbreaks such as Ebola, swine flu, and MERS revealed that such disasters cause a deep and wide range of negative mental and health impacts [13, 14, 41]. Thus, the mere exposure to a larger number of COVID-19 cases and deaths led to an elevated level of stress and anxiety among the Italians. This may explain the higher level of anxiety among Italians compared with Israelis, since the severity and the period of restrictions were similar.

Moreover, previous studies found that exposure to natural disasters causes a drop in quality of life, and that the decrease in HRQoL may continue some years after the event [42]. Cui and Han reported that the perceived risk of disaster mediated the association between disaster and impaired quality of life [43]. If so, then the exposure to higher levels of COVID-19 as well as the higher death rates in Italy compared to Israel might have led to higher perceived risk, explaining the lower HRQoL among Italian participants. In addition, the current study found that having a chronic disease may predict lower HRQoL. This finding was consistent regardless of the variables of quarantine and social distancing related to COVID-19. These results support previous studies, which found a low HRQoL among chronically ill patients [24, 44]. However, after adjusting for the health condition, physical exercise during the quarantine and social distancing, and the level of depression and anxiety explained the lower PCS and MCS. Surprisingly, none of the socioeconomic variables explained the HRQoL, except for marital status and only for PCS. Indeed, the correlation matrix found very low significant correlations (if any) between the groups and socioeconomic variables suggesting that the significance was found due to the large sample size [45].

The results of the current study reveal significantly higher HRQoL levels for the Israeli participants, in comparison to the Italian participants. Interestingly, HRQoL levels for both Israelis and Italians are as the average score with the reference population (US general population) in PCS but lower in MCS [25, 26], meaning that there was no dramatic decrease in HRQOL both for the Israeli and for the Italian sample. This can be explained by the fact that by the time of the study, when the quarantine policy was nearing its end, the public felt more optimistic about the near reopening, which in turn improved HRQoL, as optimistic perceptions and hope were found to be associated with improved HRQoL [46–48]. A longer quarantine may have had a higher impact manifested in a dramatic drop in HRQoL. This issue is beyond the scope of the current study. However, the findings of the current study provide evidence for the importance of early detection of signs of decline in HRQOL in order to prevent the dramatic decline in HRQoL over time as much as possible in circumstances of pandemic and quarantine, for the benefit of public health.

Notably, employment status and income status during the quarantine and social distancing do not predict HRQoL. In Italy, many small family businesses suffered due to the quarantine [5], with an 11.1% rate of unemployment [35]. In Israel, the unemployment rate reached as much as 20%, with a 3% decrease in the standard of living [49]. Previous studies investigating unemployment and lack of income found long-term consequences for depression and quality of life [50, 51]. In the case of COVID-19, it was often clear that changes in employment status were temporary and that there was hope for a return to work. In some cases the state partially covered the unpaid leave, which has greatly eased the economic hardship [49].

Finally, being physically active during the quarantine is a protective factor for both PCS and MCS, corroborating

previous studies that found that exercise is a protective factor for depression and HRQoL [52, 53]. This finding suggests that even in circumstances of pandemic-related quarantine, health policymakers should encourage the public to engage in physical activity as an indispensable tool for coping with the pandemic in order to promote mental and physical health.

This study has several limitations. It was an internet-based survey with volunteer participants who had a computer or smart mobile phone; this might impair the sample's representativeness. Although the literature indicates that an internet-based sample provides validated data [20], it may hamper possible generalization of the findings. In addition, this was a cross-sectional study with limitations in determining causal associations. Moreover, the basic data on depression, anxiety, and HRQoL were drawn from previous studies conducted among the general Israeli and Italian population. We recommend further longitudinal research in order to compare the results to our findings.

Conclusions

The current study was conducted among the general population in specific circumstances of a quarantine and social distancing during the COVID-19 pandemic. The main results of our study showed that anxiety and depression levels were higher during the COVID-19 pandemic in both Italy and Israel, but the anxiety level was significantly higher among Italians. Moreover, anxiety and depression were the main variables predicting HRQoL. These findings suggest that among the general non-infected population under quarantine and social distancing, anxiety and depression are potential health problems that lead to lower HRQoL. It is important that these findings on the health implications of quarantine and social distancing receive the attention needed among health policymakers. Anxiety and depression are initial signs that may predict a decline in physical and mental health.

We believe that there is an urgent need to deepen our knowledge about the mental and physical health of non-infected populations as a first step for developing effective, professional interventions, so that the negative health consequences of COVID-19 pandemic-related policy can be reduced. The WHO determined that HRQoL is an important health outcome [54]. Therefore, in the context of COVID-19, early monitoring of anxiety and depression may promote HRQoL for the long-term benefit of public health, help return the economy to its former strength, and improve citizens' lives.

A few months after the end of the study, Israel and a month later Italy were placed in a second lockdown, with the same severe restrictions as in the first round. However, one important exception was that the population in both countries was now allowed to engage in outdoor physical activities at any distance from their home. This governmental decision supported our research finding concerning the meaningful protective effect of physical activity for the mental health and quality of life of the general population.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The study was approved by the University Ethics Committee (Number 0001366–1).

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