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The effects of mandatory home quarantine on mental health in a community sample during the COVID-19 pandemic

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ABSTRACT

Objective: Major public and scientific interest exists on, whether quarantine as a containment measure, could have adverse effects on individual's mental health. We investigated psychic well-being and distress, symptoms of depression and anxiety among individuals imposed to home quarantine.

Methods: By total population sampling in a Finnish suburban city, a total of 57 quarantined cases (participation rate 97%) were identified and followed up for two weeks until expiration of the quarantine. A randomized control group ($n = 53$) was formed of people seeking laboratory testing for suspected Sars-CoV-2 infection. Primary outcome was the psychic well-being and distress experienced during quarantine measured by the Clinical Outcomes in Routine Evaluation – Outcome Measure (CORE-OM). The cases were followed up by the Clinical Outcomes in Routine Evaluation-10 (CORE-10), Patient Health Questionnaire-9 (PHQ-9), and by the Overall Anxiety Severity and Impairment Scale (OASIS).

Results: The median CORE-OM score for the cases was 3.53 (95% CI: 2.23–4.66), and for the controls 3.24 (1.76–3.82), being mostly in the nonclinical to mild range. The difference between the groups was statistically nonsignificant ($p = .19$). Higher levels of psychic distress were explained by previous psychiatric disorders and living alone, but not having been quarantined. In comparison to controls, the quarantined participants experienced significantly, but slightly lower level of life functioning. At the follow-up, the quarantined participants rated further low on the CORE-10 (median 2.00; 95% CI: 1.00–3.00), the PHQ-9 (1.50; 0.00–3.00), and the OASIS (0.00; 0.00–0.00).

Conclusions: The distress associated with short-term home quarantine may not be to the degree of a mental disorder.

Introduction

Quarantine of those exposed, isolation of infected and contact tracing has been core public health strategies to prevent the spread of the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) during the pandemic. Consequently, the COVID-19 pandemic has led to quarantine measures of unprecedented scale in our time concerning millions of people worldwide. Recently, the increased availability of vaccines has enabled reduction of many restrictive measures, but the virus will likely remain circulating for the time being and novel variants will appear [1–3].

Major and widespread public and scientific concerns have been raised on the possible harmful effects of quarantine and isolation on an individual's mental health during the pandemic. In the early stages of the first global outbreak of the COVID-19, a rapid review of the evidence derived from previous epidemics was published in the *Lancet* [4]. The conclusions of the review suggested substantial negative psychological impact among those who have been quarantined and possible long-lasting effects. Major limitations were also

identified in the available evidence base. The authors were able to identify only five studies with control groups, all conducted in selected populations (three among health care workers, one among horse owners, and one among parents). In addition, the measures of outcome were found to be variable and only one study, without a control group, had followed subjects over time.

A recent meta-analysis [5] of studies conducted during the current COVID-19 pandemic likewise suggested that quarantine is associated with increased burden of mental health problems. Altogether five studies investigating the effects of quarantine were identified. Of these, we were able to retrieve one study based on a small ($n = 50$) nonprobability sample, published as correspondence and probably not peer-reviewed [6]. Of the remaining four studies, based also on small sample sizes, three were available through a website only in Chinese (two likely with hospitalized samples), and one study was not retrievable.

Several other studies not included in the meta-analysis [5] have investigated the effect of quarantine status as a covariate in community-based samples [7–16], or in selected

populations such as college or university students [17,18] or those hospitalized [19] by using web- or social media-based convenience sampling methods. However, even large-scale data gathered by nonprobability sampling methods could contain considerable source of bias restricting inferences based on such data to the exploration of potential associations [20]. We were able to identify only one study published as correspondence stating to have used random and stratified sampling through an online panel [21]. Community-based studies missing control groups or conditions [7,16,22], retrospective assessment of the effects of quarantine [11], or including individuals with their acquaintances having been quarantined as positive cases [14] restrict also possible inferences based on these studies. It is noteworthy that a recent meta-analysis of the effects of governmental mitigation strategies on depression and anxiety reported that only 5.9% of included studies were based on representative samples [23]. In cross-sectional studies, also the severity of pandemic or personal losses could introduce residual confounding to previous findings. The outcome of having been quarantined may vary across cultures and geographically, but also between having been in centralized quarantine or home-quarantine. The hypothesis of adverse effects of quarantine on mental health has become widely accepted and popular, despite these considerable methodological limitations, including lack of representative samples with control groups and longitudinal design.

To test the hypothesis of adverse effects of having been quarantined on mental health, we directly investigate psychological distress and well-being, symptoms of depression and anxiety among individuals who had received an official order to be home-quarantined or home-isolated. We implemented total population sampling in a Finnish suburban city to obtain representativeness of all cases. This cohort was interviewed while quarantined and followed up to two weeks, after the end of the quarantine. The outcomes were compared with a control group consisting of a random sample of symptomatic but nonquarantined individuals, first suspected of having Sars-CoV-2 infection but proved negative afterwards.

Materials and methods

The study was designed as a cohort study with total population sampling, a 2-week follow-up and to include a control group. The sampling of quarantined participants was based on receiving an official individual quarantine decision during the study period. The baseline interviews were made at 1 week since the onset of the quarantine of each participant, and the outcomes were compared with controls. The subsample of quarantined participants was followed up until expiration of the quarantine, for 2 weeks since the onset.

All cases who were imposed to home quarantine (for exposure to a person with SARS-CoV-2 infection), or to a home isolation (for laboratory-confirmed SARS-CoV-2 infection) were identified from the register of the infectious diseases control unit in the city of Kerava, a suburban city in the Helsinki Metropolitan area, Finland (36,754 inhabitants).

The register covers information on all inhabitants with a laboratory-test confirmed Sars-CoV-2 infection or a verified exposure to a person with SARS-CoV-2 infection. Based on the Infectious Diseases Act, all individuals with either an infection or exposure are imposed to a mandatory home isolation or home quarantine, respectively, by a communicable disease control physician. All Sars-CoV-2 infected persons are immediately interviewed for contact tracing. A close contact (≥15 min) with an infected person is defined as an exposure. The sampling was conducted between 12 May and 23 June 2020. In practice, sampling began immediately after obtaining the study permit and ended when the first wave of the epidemic subsided.

The controls were randomly selected from people attending to the only Sars-CoV-2 laboratory testing point of the catchment area for suspected infection between 19 May and 25 June 2020. If the test proved positive, the controls were identified as cases.

All ≥18-year-old Finnish-speaking persons were considered eligible. The study participants were fully informed, and a written consent was requested. The study design was approved by The Ethics Committee of Helsinki University Central Hospital (approval number HUS/1709/2020). Data on the exact duration of the quarantine were extracted from participant's electronical medical records afterwards.

Baseline assessment for quarantined participants and controls

The quarantined participants were telephone interviewed about at 1 week (baseline) since the onset of the quarantine and the controls within 10 days since attending the testing point.

Main outcome of the study was reported psychic well-being and distress rated by the Clinical Outcomes in Routine Evaluation – Outcome Measure (CORE-OM) for the last seven days [24]. The CORE-OM is widely used, reliable, valid, and sensitive self-report instrument on a continuum of distress ranging from low to high levels [24–26]. The 34 items of the scale rate from 0 ('not at all') to 4 ('most or all of the time') four subdomains of psychic well-being and distress, including subjective well-being (4 items), problems or symptoms (12 items), life functioning (12 items), and risk or harm (6 items). The CORE-OM provides a total score and subscales for each subdomain. For the total score, the mean of the 34 items was calculated and multiplied by ten. A cut-off score of 10 or more indicates clinically significant symptoms with good sensitivity (0.87) and specificity (0.88) and is recommended for discriminating between the members of clinical and non-clinical (general) population [25,26]. Because experience of social isolation forms the core psychological phenomena of quarantine [4], previous findings indicate high prevalence of insomnia in the community [5,27] and the presence of hopelessness or suicidal ideation indicates extreme psychological distress, we additionally explored these by single-item ratings. Based on the aforementioned cut-off score corresponding to a mean item score of 1.0, we explored by single items (with responses rated two or more) the participants'

experience of social support (item 3, 'I have felt I have some-one to turn to for support when needed'), experience of loneliness (item 1, 'I have felt terribly alone and isolated'), insomnia (item 18, 'I have had difficulty getting to sleep or staying asleep'), hopelessness (item 23, 'I have felt despairing or hopeless'), thoughts of death (item 24, 'I have thought it would be better if I were dead'), and planning for suicide (item 16, 'I made plans to end my life').

Baseline interviews included ten questions (yes/no) about the presence of symptoms of infection during the last day, three about sociodemographic information, four about physical and mental health, three about COVID-19 related concerns, and one about satisfaction with the services. The detailed information about the phrasing of these questions (Finnish) are available from the authors upon request.

Two-week follow-up for quarantined participants

The quarantined participants were telephone interviewed at 2 weeks since the onset of the quarantine on their psychic well-being and distress, and symptoms of depression and anxiety.

The past week psychic well-being and distress was rated by the short version of the Clinical Outcomes in Routine Evaluation (CORE-10) [28], a brief measure developed from the CORE-OM intended for short-term monitoring and producing comparable outcomes (correlation 0.92–0.94) [28].

Past two weeks depressive symptoms were rated by the Patient Health Questionnaire-9 (PHQ-9) [29]. A cut-off score of ten or more has a 0.88 sensitivity and 0.85 specificity for screening of major depressive disorder (MDD) [30]. Past 2-week suicidal ideation was explored by the PHQ-9 item 9 ('Thoughts that you would be better off dead or of hurting yourself in some way'), with response options from 'not at all', 'several days', 'more than half the days' to 'nearly every day'. Positive responses 'more than half the days' and 'nearly every day' indicate higher risk for a suicide attempt or death [31].

Past week anxiety symptoms were rated by the Overall Anxiety Severity and Impairment Scale (OASIS) [32]. The five items of the OASIS rate (from zero to four) frequency and severity of anxiety symptoms, avoidance behavior, and impaired functioning with recommended cut-off score of eight or more for screening of anxiety disorders.

Data analyses

Psychic well-being and distress (CORE-OM), pandemic-related concerns and contentment with the services at baseline between quarantined individuals and controls were compared with Chi-square test for categorical variables and Kruskal–Wallis test for continuous variables (with α threshold set at ≤ 0.05). Psychic well-being and distress (CORE-10), depressive symptoms (PHQ-9), and anxiety symptoms (OASIS) at two-week follow-up between SARS-CoV-2-exposed and -infected individuals were compared using the Kruskal–Wallis test. In addition, linear regression analysis was performed to further examine the relationship between

quarantine status and psychic well-being and distress (CORE-OM), with adjustments for age, gender, employment status, habitation, chronic diseases, and lifetime diagnosis of a psychiatric disorder. The selection of variables to the multivariable model was made by a priori hypothesis of effects of these factors on the distress perceived. The variance inflation factor was calculated for the variables in the final regression analysis and did not show significant multicollinearity. Due to the skewed nature of the distribution, a natural logarithmic transformation was made for CORE-OM score prior to regression analysis. Stata version 13.1 was used for all analyses.

Results

Of the 59 identified persons, two declined, leaving 57 home-quarantined participants forming the cases of interest of the study (participation rate 97%; 43 with exposure and 14 with Sars-CoV-2 infection). Three quarantined participants declined participation at the follow-up. A total of 53 controls were recruited. The sociodemographic and clinical characteristics of the sample are presented in Table 1. The mean duration of the quarantine for the quarantined sample was 10.8 days (SD 3.4).

Psychic well-being and distress during quarantine (baseline)

The quarantined participants were interviewed mean 8.2 days (SD 2.2) since the onset of the quarantine. Majority of the participants reported low levels of psychic distress or symptoms (Table 2). The CORE-OM total scores were not statistically different neither between the quarantined participants and controls, nor between quarantined infected and exposed participants. Based on the CORE-OM subscales the quarantined participants reported statistically significantly, but in clinical terms slightly lower levels of life functioning than the controls. Based on CORE-OM single-item responses, 12.3% ($n = 7$) of the quarantined participants and 5.7% ($n = 3$) controls reported poor social support (p-value for the difference .23), 24.6% ($n = 14$) quarantined participants and 11.3% ($n = 6$) controls reported loneliness ($p = .07$), 24.6% ($n = 14$) quarantined participants and 26.4% ($n = 14$) controls reported sleeping problems ($p = .82$), 8.9% ($n = 5$) quarantined participants and 7.6% ($n = 4$) controls reported hopelessness ($p = 0.82$), 3.5% ($n = 2$) quarantined participants and 0% ($n = 0$) controls reported thoughts of death ($p = 0.17$), and neither quarantined participants nor controls reported any planning for suicide.

The quarantined participants reported having infrequently or not at all concerns related to the pandemic (Table 3). No significant differences between quarantined participants and controls emerged, except controls were statistically significantly more often concerned about infecting a close person.

Table 1. The characteristics of 57 quarantined cases and 53 controls at the baseline.

	Mean (SD)		
	Sars-CoV-2 exposure (n = 43)	Sars-CoV-2 infection (n = 14)	Controls (n = 53)
Age, years	40.9 (12.1)	36.1 (11.2)	43.5 (14.0)
Duration of quarantine, days	11.3 (3.0)	9.2 (4.2)	
	No. (%)		
Men	18 (42)	5 (36)	22 (42)
Education level			
Basic	2 (5)	1 (7)	5 (9)
Upper secondary or vocational	32 (74)	10 (71)	34 (64)
Tertiary	9 (21)	3 (21)	14 (26)
Employment status			
Unemployed or suspended[a]	4 (9)	0 (0)	5 (9)
Sick leave	1 (2)	2 (14)	1 (2)
Working or studying	36 (84)	12 (86)	42 (79)
Retried	2 (5)	0 (0)	5 (9)
Habitation			
Living alone	13 (30)	5 (36)	15 (28)
Living with parents	2 (5)	1 (7)	3 (6)
Living in own family or intimate relationship	28 (65)	8 (57)	35 (66)
Smoking	11 (26)	3 (21)	13 (25)
Alcohol use twice a month or more	18 (42)	4 (29)	23 (45)
Any chronic disease	13 (30)	4 (29)	22 (42)
Lifetime diagnosis of a psychiatric disorder	13 (30)	7 (50)	16 (30)
Symptoms of infection, last day			
Fever $\geq 38\,^{\circ}\mathrm{C}$	0 (0)	0 (0)	0 (0)
Dyspnea	0 (0)	3 (21)	2 (4)
Cough	3 (7)	7 (50)	13 (25)
Muscle pain	0 (0)	3 (21)	3 (6)
Fatigue	9 (21)	7 (50)	7 (13)
Rhinitis	8 (19)	8 (57)	10 (19)
Nausea	0 (0)	2 (14)	0 (0)
Diarrheal	0 (0)	2 (14)	1 (2)
Ageusia	1 (2)	6 (43)	0 (0)
Anosmia	0 (0)	7 (50)	1 (2)

[a]Includes persons out of labor force for other reasons.

Table 2. The psychic well-being and distress, symptoms of depression and anxiety among cases and controls of the study.

	All quarantined (n = 57)	Sars-CoV-2 exposure (n = 43)	Sars-CoV-2 infection (n = 14)	Controls (n = 53)	p Value*	p Value**
	Median (95% confidence interval)					
CORE-OM – Total score	3.53 (2.23–4.66)	3.53 (1.92–5.29)	3.38 (2.06–5.53)	3.24 (1.76–3.82)	.89[a]	.19[a]
CORE-OM – Subjective well-being	2.50 (2.50–5.00)	2.50 (1.34–5.00)	2.50 (2.09–7.91)	5.00 (2.17–5.00)	.98[a]	.87[a]
CORE-OM – Problems/symptoms	4.17 (3.33–5.36)	4.17 (2.95–5.83)	4.58 (2.50–6.52)	3.33 (2.50–5.83)	.75[a]	.55[a]
CORE-OM – Life functioning	4.17 (3.33–7.50)	4.17 (2.95–7.89)	3.75 (2.36–8.47)	3.33 (0.83–5.00)	.77[a]	.04[a]
CORE-OM – Risk/harm	0.00 (0.00–0.00)	0.00 (0.00–0.00)	0.00 (0.00–0.00)	0.00 (0.00–0.00)	.64[a]	.56[a]
	No. (%)					
CORE-OM					.64[b]	.37[b]
Healthy or low level of distress (score <10)	46 (81)	35 (81)	11 (79)	48 (91)		
Mild distress (score 10 to <15)	8 (14)	5 (12)	3 (21)	3 (6)		
Moderate distress (score 15 to <20)	2 (4)	2 (5)	0 (0)	2 (4)		
Moderately severe distress (score 20 to <25)	1 (2)	1 (2)	0 (0)	0 (0)		
Severe distress (score >25)	0 (0)	0 (0)	0 (0)	0 (0)		

[a]Kruskal–Wallis test.
[b]Chi-square test.
*p Value for the difference between exposed and infected cases.
**p Value for the difference between quarantined and controls.
CORE-OM: clinical outcomes routine evaluation – outcome measure.

Explanatory factors for reported psychic well-being and distress measured by CORE-OM during quarantine

The unadjusted and adjusted effects of baseline factors and quarantine status on the CORE-OM score in the whole sample are presented in Table 4. In the unadjusted analyses, living alone, lifetime diagnosis of a psychiatric disorder, and being unemployed or on sick-leave predicted higher CORE-OM scores. In the adjusted analyses, living alone and lifetime diagnosis of a previous psychiatric disorder were independent predictors for higher CORE-OM scores. The quarantine status was not a statistically significant explanatory factor for CORE-OM scores neither in the unadjusted nor adjusted analyses. Analyses were additionally repeated in the subsample of quarantined participants as a sensitivity analysis. Both living alone and lifetime diagnosis of a psychiatric disorder were similarly independent (age- and gender adjusted) predictors for higher CORE-OM scores.

Table 3. The pandemic related concerns among 57 quarantined cases and 53 controls.

	No. (%)		
	Cases (n = 57)	Controls (n = 53)	p Value
Economical concerns due to pandemic			.67[a]
Not at all	43 (72)	40 (74)	
Infrequent	7 (12)	5 (9)	
Occasional	7 (12)	4 (7)	
Frequent	1 (2)	2 (4)	
Constant	1 (2)	3 (6)	
Concerns about infecting a close person			.02[a]
Not at all	26 (46)	21 (40)	
Infrequent	9 (16)	16 (30)	
Occasional	17 (30)	5 (9)	
Frequent	4 (7)	8 (15)	
Constant	1 (2)	3 (6)	
Concerns for the health of a close person due to pandemic			.57[a]
Not at all	13 (23)	18 (34)	
Infrequent	12 (21)	12 (23)	
Occasional	22 (39)	14 (26)	
Frequent	8 (14)	6 (11)	
Constant	2 (4)	3 (6)	
Contentment with the services of the health care center			.52[a]
Very contented	29 (51)	19 (36)	
Contented	21 (37)	24 (45)	
Neutral	5 (9)	7 (13)	
Discontented	2 (4)	3 (6)	
Very discontented	0 (0)	0 (0)	

[a]Chi-square test.

Table 4. Linear regression analysis of baseline factors and being quarantined for psychic well-being and distress measured by Clinical Outcomes Routine Evaluation – Outcome Measure[a] (N = 110).

	Unadjusted estimate			Adjusted estimate		
	Coef.	95% CI	p Value	Coef.	95% CI	p Value
Age	−0.00	−0.02–0.01	.60	−0.01	−0.02–0.01	.38
Men	−0.15	−0.55–0.24	.45	−0.02	−0.43–0.39	.91
Living alone	0.67	0.26–1.07	**.00**	0.51	0.10–0.93	**.02**
Lifetime diagnosis of a psychiatric disorder	0.65	0.25–1.05	**.00**	0.48	0.04–0.92	**.03**
Any chronic disease	0.19	−0.22–0.60	.35	0.16	−0.27–0.60	.46
Unemployed or sick leave	0.81	0.17–1.46	**.01**	0.43	−0.23–1.09	.20
Being quarantined	0.10	−0.29–0.49	.62	0.03	−0.34–0.40	.88

Statistically significant p values (p < .05) are bolded.
[a]Logarithmic transformation of raw data.

Follow-up after the end of the quarantine period

The quarantined participants were followed up to 2 weeks until expiration of the quarantine (interviews were conducted mean 15.6 [SD 2.4] days since the onset of quarantine and mean 4.9 [SD 3.5] days since the expiration). Of the quarantined participants, three (5.6%) were still in quarantine. The quarantined participants reported again low levels of psychic distress and symptoms of depression or anxiety (Table 5). About 3.7% screened positive for an MDD and 5.6% for an anxiety disorder. PHQ-9 scores were modestly, but statistically significantly, higher among quarantined participants with Sars-CoV-2 infection than among exposed quarantined participants. Two (3.7%) participants reported to the ninth question of the PHQ-9 ('Thoughts that you would be better off dead or of hurting yourself in some way') with response option 'several days', but none 'more than half the days' or 'nearly every day'.

Discussion

This study investigated whether involuntary home quarantine based on contact tracing or verified Sars-CoV-2 infection has

adverse effects on an individual's mental health. We followed the study participants recruited by total population sampling throughout their whole quarantine period and compared the outcomes with a random control group. The main outcome of the study is that we found low levels of psychic distress, symptoms of depression or anxiety among quarantined individuals. No major differences in comparison with controls emerged. In the sample, higher level of psychic distress was explained by living alone and a lifetime diagnosis of a psychiatric disorder, but not having been quarantined. The quarantined participants reported significantly but modestly lower level of every-day life functioning, and a trend for experiencing more loneliness. The latter findings are in alignment with the restrictiveness of the containment. Overall, the burden caused by short-term home quarantine on an individual's mental health appeared limited.

The findings should be interpreted considering the study context, strengths, and limitations. In Finland, a state of emergency was declared between 18 March and 16 June to address the COVID-19 outbreak [33]. Measures taken included closures of schools and public facilities, restriction of public gatherings, recommendations for working remotely,

Table 5. The psychic well-being and distress, symptoms of depression and anxiety among quarantined cases at the 2-week follow-up.

	Median (95% confidence interval)			
	All quarantined (n = 54)	Sars-CoV-2 exposure (n = 41)	Sars-CoV-2 infection (n = 13)	p Value*
CORE-10	2.00 (1.00–3.00)	2.00 (0.00–3.00)	2.00 (0.00–5.61)	.69[a]
PHQ-9	1.50 (0.00–3.00)	1.00 (0.00–2.00)	3.00 (2.39–6.61)	.02[a]
OASIS	0.00 (0.00–0.00)	0.00 (0.00–0.00)	0.00 (0.00–0.00)	.48[a]
	No. (%)			
CORE-10				.43[a]
Healthy or low level of distress (score < 10)	46 (85)	35 (85)	11 (85)	
Mild distress (score 10 to <15)	5 (9)	4 (10)	1 (8)	
Moderate distress (score 15 to <20)	1 (2)	0 (0)	1 (8)	
Moderately severe distress (score 20 to <25)	1 (2)	1 (2)	0 (0)	
Severe distress (score > 25)	1 (2)	1 (2)	0 (0)	
PHQ −9				
None or subthreshold symptoms (score < 10)	52 (96)	39 (95)	13 (100)	.72[a]
Mild depression (score 10–14)	1 (2)	1 (2)	0 (0)	
Moderate depression (score 15–19)	1 (2)	1 (2)	0 (0)	
Severe depression (score ≥ 20)	0 (0)	0 (0)	0 (0)	
OASIS				
None or subthreshold symptoms (score < 8)	51 (94)	40 (98)	11 (85)	.08[a]
Probable anxiety disorder (score ≥ 8)	3 (6)	1 (2)	2 (15)	

[a]Chi-square test.
*p Value for the difference between exposed and infected cases.
CORE-10: clinical outcomes routine evaluation-10;　overall anxiety severity and impairment scale; PHQ-9: patient health questionnaire-9.

and maintaining quarantine-like conditions for persons over 70 years of age. A *cordon sanitaire* was established around the most populous region of Finland (*Uusimaa*), also containing the study area, between 27 March and 15 April. It is assumed that because of early responses, this first outbreak was relatively restricted, and overloading of healthcare resources was avoided. Even though the outcome of the first outbreak turned out to be favorable, at that time, were these measures exceptional and the nature and course of the epidemic mostly unknown.

The study strengths include a complete coverage of quarantined individuals in a city of about 37,000 inhabitants during a given period. The quarantined individuals were followed up during the quarantine and shortly after its expiration. A random sample of symptomatic, but nonquarantined individuals was recruited as controls. Common to most individuals with COVID-19, the symptoms of the participants were mild. Therefore, the findings can be generalizable to those who are quarantined for an exposure or can recover from the COVID-19 at home. Methodological strengths include high participation but low attrition rate and lack of missing data. The main outcome measure (CORE-OM) is sensitive to lower levels of distress commonly found in the general population.

Among the limitations is the sample size, which was a result from a controlled first outbreak and sampling occurring during declining incidence rates. This may have limited our chance to statistically demonstrate group differences, which however, were in absolute and clinical terms negligible. Nevertheless, the sample size of this study compares with those previously published [5], and the significance of the study results being otherwise supported by valid study methodologies. Due to the limited sample size, the results of the multivariate model should be assessed with caution. To

what extent there were unidentified COVID-19 cases and exposures in the community remains undetermined. Albeit the study used total population sampling, the final sample may not be representative of the whole population because sociodemographic factors may have had an influence on the spread of the epidemic and thus on the risk of having been quarantined. Generalization of the results to other regions and countries should also be made with caution.

The main finding of this study shows low levels of psychic distress among individuals who were officially home quarantined to prevent the spread of the Sars-CoV-2. The overall level of psychic distress measured by the CORE-OM among those home quarantined corresponds to the levels of 'nondistressed' general population [26]. The estimated prevalence of MDD or anxiety disorder in the sample is slightly lower, but broadly consistent with the findings of pervious national general population surveys [34,35]. In addition, the findings of the study are in alignment with similar modest findings of a recent meta-analytic study of the psychological impact of lockdowns in geographical areas [36]. However, several possible explanations for the differences in the outcomes of this and some other previous studies can be considered. Different geographical areas have been hit by the pandemic to a varying degree of severity, and the regional characteristics of the pandemic and stringency of containment measures may influence the outcomes. More severe the local pandemic is, more likely is the burden of interpersonal and economic losses among those quarantined, which itself may have an influence on the distress perceived. Secondly, some countries have used centralized quarantine as a containment measure, during which the psychic distress experienced may considerably differ from that experienced while quarantined at home. In comparison to universal and community-wide containment measures or lockdowns, those

ordered individually to quarantine oneself based on infection or exposure, could consider this task important to protect others and close ones. This experience of meaningfulness could sustain motivation and be protective for potential harmful effects of isolation. Lastly, methodological choices of studies have an influence on outcomes. Widely used online sampling methods during the pandemic benefit from rapid and cost-effective data collection, including the majority (91%) of studies investigating the effects of mitigation measures on mental health for example [23]. However, regardless of the scale of the data, discerning commentaries caution against drawing firm conclusions based on such data with potential selection effects and bias [20]. For example, individuals who experience more distress have been found to spend more time focusing on pandemic-related information [37], therefore being potentially more likely to participate in online surveys based on nonprobability sampling. Other methodological issues may include sensitivity and specificity of screening cases, and likelihood of negative studies being not published.

Worth noticing is that the symptoms of infection among quarantined participants within this study were mild. This is in contrast with another study of hospitalized COVID-19 patients which reported a positive correlation between the PHQ-9 scores and the levels of C-reactive protein, a peripheral inflammatory marker [19]. In that study, the scores decreased also with a decline in the levels of this marker. Relatedly, the cytokine-induced symptoms of *sickness behavior* (fatigue, lack of interest, altered sleep patterns, loss of appetite, and failure to concentrate) as part of an adaptive response facilitating recovery during acute infections [38] also overlap with the criteria of the MDD. Accordingly, among the quarantined participants of this study, the PHQ-9 scores were modestly but statistically significantly higher among those with COVID-19 when compared with those quarantined for an exposure. Therefore, the severity of the infection itself, and the overlap of symptoms of sickness behavior and self-report symptoms of depression could potentially have an influence on the outcomes of various studies.

The several individual and societal perspectives on the effects of the sustained pandemic on mental health remain complex. The effects of interpersonal or economic losses on mental health following outbreaks of an infectious agent need to be weighed with the effects of restrictions to prevent community transmission. Studies from other geographical areas, often heavily affected by the COVID-19 pandemic, suggest high levels of stress, depression, or anxiety in the community [5,23]. Conclusions on the suggested harmful effects of quarantine should be made cautiously and avoiding potentially harmful catastrophizing, which could lead into a self-fulfilling prophecy. An exaggeratedly negative public perception of the effects of quarantine on mental health could also negatively influence the level of adherence of the public on these measures. Consistent with our data, most individuals were capable to show resilience in response to adversity [39]. In our study, living alone and having a history of psychiatric disorder, but not quarantine, were

explanatory factors for higher level of psychic distress. This is in alignment with the findings of several other studies that have found individuals with a pre-existing mental disorder to constitute a high-risk group for the adverse effects of the pandemic [40–42]. According to our data, however, the inconveniences caused by quarantine included decreased everyday life functioning and possibly loneliness, but not distress to the extent of clinically significant mental health disturbance.

Conclusions

Individual orders to quarantine or isolate at home to prevent the spread of an infectious agent may not cause clinically significant burden on an individual's mental health, at least in terms of a mental disorder. While the findings here require replication in larger samples and other settings, the results complement the existing knowledge based on the impact of quarantine and its acceptability. For the ongoing or any future pandemics that might threaten the population, the findings support resilience-oriented approach and communication on the effects of home quarantine on mental health to the public.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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