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Original Article

Two Years after the Beginning of COVID-19: Comparing Families Who Had or Did not Have Patients with COVID-19 on Health Beliefs and Obsessive-Compulsive Symptoms

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Abstract

Objective: This study aimed to compare health beliefs and obsessive-compulsive symptoms (OCS) in families with (FIM+) or without an infected member (FIM–) two years after the beginning of COVID-19. Additionally, this research intended to predict a decrease in OCS from baseline (T1) to 40 days later (T2) based on health beliefs.
Method: In a longitudinal survey, 227 participants in two groups, including FIM+ (n = 98; M = 30.44; SD = 5.39) and FIM– (n = 129; M = 29.24; SD = 4.93), were selected through purposive sampling. They responded to measurements consisting of demographic characteristics, the Obsessive-Compulsive Inventory-Revised (OCI-R), Patient Health Questionnaire (PHQ-9), Impact of Event Scale-Revised (IES-R), and COVID-19 Health Belief Questionnaire (COVID-19-HBQ) at the final assessment phase (T2). To investigate differences between the two groups and predict OCS changes from T1 to T2, data were analyzed using Chi-squared, t-tests, U-Mann-Whitney, Kruskal-Wallis, Pearson correlations, and linear regression analyses.
Results: At T1, FIM+ demonstrated significantly greater OCS, health beliefs, posttraumatic stress symptoms (PTS), and depressive symptoms than FIM–. Furthermore, FIM+ showed a decrease in OCS from T1 to T2 after its infected member recovered from COVID-19 ($P < 0.001$). A decrease in OCS was correlated with a decrease in perceived susceptibility, severity, and barriers. Lack of a vulnerable family member, lower educational attainment, and being a primary caregiver were associated with a greater decrease in OCS. Changes in perceived severity and self-efficacy accounted for 17% of variation in OCS.
Conclusion: Even two years after the onset of the pandemic, COVID-19 not only impacts the life of patients with COVID-19 but family members who care for such patients respond to the disease by engaging in excessive health behaviors in the form of OCS.
Key words: *COVID-19; Demographic Factors; Family; Health Belief Model; Obsessive-Compulsive Disorder*

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As the coronavirus disease 2019 (COVID-19) spreads throughout the world, people are experiencing both physical and psychological consequences of the pandemic due to pandemic-related lifestyle changes (1, 2). These consequences have influenced individuals with or without a history of psychiatric disorders (3, 4). To control the spread of COVID-19, the World Health Organization (WHO) offers some advice, including frequent hand washing and the use of disinfectants (5). Despite their critical role in slowing the spread of COVID-19, research indicates that these behaviors have led to an increase in obsessive-compulsive symptoms (OCS) in clinical and nonclinical samples (6-8).

With the goal of elucidating the reason why some individuals experienced increased OCS during the pandemic, some research (9) suggests that OCS may be an adjustable response to a fear of contamination. Research has consistently documented an increase in OCS (10, 11). Furthermore, during the pandemic, studies confirmed a significant relationship between health beliefs and OCS in people with or without psychiatric disorders (12-15). Although the literature has indicated that factors other than COVID-19 infection such as receiving treatment and sociodemographic factors could alter OCS in specific or mental health in general (10, 13), given the abovementioned findings, it is assumed that health beliefs play a significant role in explaining why some people had higher OCS during the pandemic. One example of such health beliefs is the perception of the likelihood of contacting COVID-19 for a person compared to someone of the same age, sex, residency, and health status. Nevertheless, these results were obtained when some COVID-19-related demographic characteristics such as having vulnerable conditions (e.g., hypertension) were not considered, given the association between perceived vulnerability to COVID-19 and OCS (16).

On the other hand, research indicates that psychiatric symptoms may stem in part from fear of transmitting infection (17). For example, healthcare workers and members of the general population who came into contact with COVID-19-infected patients demonstrated increased distress, anxiety, and depressive symptoms (18-21). In addition, previous research has established the association between health beliefs and preventive behaviors in healthcare workers who routinely confront infected patients (22). Similarly, Wong *et al*. (23) demonstrated a relationship between certain health beliefs, such as perceived severity or perceived benefits, and the intention to obtain the COVID-19 vaccine. Thus, in addition to health beliefs, confronting COVID-19 infected patients may increase psychopathology. However, it is unknown whether exposing COVID-19-infected patients increased OCS in a nonclinical sample.

OCS may be better explained as an excessive type of preventive behavior in the nonclinical sample during the pandemic (6, 8). Given the relationship between preventive behaviors and health beliefs on the one hand, and the association between the fear of transmitting COVID-19 to relatives and psychiatric symptoms on the other, there is an unexpectedly small number of studies focusing on the effects of encountering infected people in changing health beliefs and OCS in relatives, and tracking these changes until infected people recover. Additionally, prior research overlooked some critical COVID-19-related factors, such as the percentage of lung infections. As a reliable indicator of the severity of COVID-19, the percentage of infection in the lung affects psychological outcomes, particularly OCS (24).

The aim of the study is twofold. Firstly, this study examines the impact of infection with COVID-19, as well as recovery from the disease in a family member, in changing OCS, health beliefs, posttraumatic stress symptoms (PTS), and depressive symptoms in other family members. Depressive symptoms and PTS are regarded as general psychopathology, and prior research indicated that recent pandemics were associated with elevated PTS and depressive symptoms (4, 25). Even two years after the beginning of the pandemic, authors assumed that the impact of COVID-19 infection on a family's mental health is noticeable. In connection with the first aim, the authors are interested in the effect of demographic characteristics on changes in OCS, specifically the decrease in OCS from immediately after the confirmation of COVID-19 (T1) to 40 days later (T2). Following the first aim, the authors tried to compare families with (FIM+) and without COVID-19 infected members (FIM–) on OCS, health beliefs, PTS, and depressive symptoms. After forty days, when both patients and family members of FIM+ were confident that the disease had been adequately treated, the authors conducted a T2 assessment (26, 27). Based on previous studies (e.g., 28), the authors hypothesized that when a family member is confirmed to have COVID-19, other family members respond by engaging in excessive COVID-19 preventive behaviors (e.g., hand washing), which reinforces and strengthens their health beliefs and OCS. Recent studies (e.g., 10, 14) postulate that COVID-19 infection will result in higher health belief scores (e.g., perceived susceptibility and perceived severity) and OCS in the FIM+ group compared to the FIM– group.

Second, concerning essential associations between demographic characteristics (e.g., working from home, and having a vulnerable family member) and COVID-19-related health behaviors (29), the current study attempted to predict OCS changes using these demographic characteristics and health beliefs, while controlling for PTS and depressive symptoms. After reviewing several studies, the authors selected the most important demographic characteristics in the recent pandemic (19, 30) (see demographic characteristics in Table 1). The authors anticipate that COVID-19-related demographic characteristics (e.g., having a vulnerable family member) (16) and certain health beliefs (e.g., perceived susceptibility and perceived severity) (14) will predict

OCS changes more accurately than other variables. In other words, the present research pursues two goals: (a) examining the impact of having or not having COVID-19 patients in the family on OCS and health beliefs, and (b) predicting changes in outcomes through the health belief model.

Materials and Methods

Participants

By purposive sampling, 253 individuals (aged 18–49 years) were recruited from an online survey via social media platforms (e.g., LinkedIn and Instagram; for FIM–) and two healthcare centers (for FIM+). For FIM–, the file of measurements was sent to individuals who agreed to cooperate, and for FIM+, measurements were completed in person. There are no significant differences between FIM+ and FIM– in terms of age at T1 (n = 104, M = 30.57, SD = 5.70; FIM–: n = 149, M = 29.21, SD = 5.03; t = 2.00; df = 251; P = 0.46). The following criteria were used to determine eligibility: 1) being over 18 years old, 2) having educational background equal to or greater than 12 years, 3) signing the written form of informed consent, 4) agreeing to participate in both assessment phases (i.e., T1 and T2), and 5) having a family member who contracted COVID-19 during the sampling period (for the FIM+ group). Three participants did not complete all measures at T1; additionally, 23 participants did not participate at T2, resulting in a final sample size of 227 participants at T2 (response rate at T2 = 89.7%). At T1, 104 participants (41.6%) reported having a family member infected with COVID-19. The FIM+ group reported not being infected with COVID-19 during the sampling period. The study was approved by Kharazmi University's ethical committee (IR.KHU.REC.1400.034). Informed consent was obtained from all individual participants included in the study. Table 1 contains detailed demographic information.

Measurements

1. Demographic Characteristics Questionnaire

A 13-item questionnaire was developed to assess the demographic characteristics. Gender, educational attainment, age, marital status, having/not having an infected family member, being/not being the primary caregiver of the infected person (only in the FIM+), lung infection percentage (only in the FIM+), and having/not having a history of psychiatric disorders were all considered in the questions (see Table 1). Given that healthcare workers reported more psychological symptoms (e.g., 18), the questionnaire also inquired about whether participants' occupations were related to COVID-19 (e.g., healthcare workers) or not. Additionally, three questions assessed vulnerable conditions associated with COVID-19 in FIM+ (e.g., above 65-year-old, pregnancy, history of underlying conditions such as hypertension). Finally, one question assessed participants' ability to continue working from home. The final question was included in the questionnaire because research confirmed the psychological impact of working from home during the pandemic (31).

2. Obsessive-Compulsive Inventory-Revised (OCI-R)

Foa *et al*. (32) developed OCI-R, a six-subscale measure of OCS over a 30-day period that includes washing, checking, ordering, neutralizing, obsessing, and hoarding. This 18-item inventory is scored on a 5-point Likert scale ranging from 0 ("not at all") to 4 ("extremely"). Earlier research established that the OCI-R has a high degree of convergent validity (e.g., 33). Spearman's rank correlation coefficients between the OCI-R and Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) and Maudsley Obsessive-Compulsive Inventory (MOCI) were 0.53 and 0.85, respectively. Moreover, Cronbach's alphas for six subscales were reported to be higher than 0.65 except for neutralizing subscales in the control group which was 0.35 (32). Other research also has emphasized the OCI-R's psychometric properties (34). The six-factor structure of the OCI-R in the original study was confirmed in the Persian version of the OCI-R (35). Furthermore, Cronbach's alphas of six subscales were 0.50 to 0.72 for the Persian version of the OCI-R and 0.52 to 0.70 for the present study.

3. COVID-19-Related Health Beliefs Questionnaire (COVID-19-HBQ)

Shahnazi *et al*. (36) developed a COVID-19-related health beliefs questionnaire based on the Health Belief Model (HBM) (37) to assess health beliefs. These beliefs contain perceived susceptibility, severity, benefits, barriers, self-efficacy, and cues to action. All items were rated on a 5-point Likert scale ranging from 1 ("completely disagree") to 5 ("completely agree"). According to Shahnaz *et al*. (36), the validity of the questionnaire was established by experts using confirmatory factor analysis, and all Comparative Fit Indexes (CFIs) ranged from 0.91 to 0.94. Cronbach's alphas for six beliefs were 0.53 to 0.65 in the present study.

4. Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 is a nine-item questionnaire designed to assess depressive symptoms in accordance with the criteria for major depression disorder (MDD). The items were scored on a scale of 0 ("not at all") to 3 ("almost every day"), yielding a total score of 0-27. The questionnaire's construct validity was determined using a brief general health survey, self-reported illness days, and symptoms-related problems (38). The test-retest reliability and internal consistency of the questionnaire were acceptable. Cronbach's alphas were 0.86 and 0.89 for two studies (38). This scale was also used to diagnose and quantify MDD and depressive symptoms (39). Moreover, Farrahi *et al*. (40) confirmed the test-retest reliability (interclass correlation coefficient = 0.86) and internal consistency (Cronbach's alpha = 0.85) of the Persian version of the PHQ-9. One-factor structure of the questionnaire was established in the Iranian sample (40).

Furthermore, the Persian form demonstrated good convergent validity, as it has a significant relationship with other depression scales (correlation coefficients extended from 0.50 to 0.76). Finally, Cronbach's alpha of the PHQ-9 in the current research was equal to 0.79.

5. Impact of Events Scale-Revised (IES-R)

Weiss and Marmar (41) developed a 22-item scale to assess post-traumatic stress disorder (PTSD) symptoms within the preceding week (42). The IES-R total score ranges from 0-88 when all items are rated on a five-point Likert scale from 0 ("not at all") to 4 ("significantly"). This scale has three subscales including intrusion, avoidance, and hyperarousal (42). Bienvenu *et al*. (43) demonstrated that the instrument is a valid and reliable scale. The IES-R showed suitable test-retest reliability (0.89-0.94 for a six-month interval) and internal consistency (Cronbach's alpha ranged from 0.79-0.94 for all subscales). The concurrent validity of the IES-R and related constructs was reported as acceptable as all correlation coefficients were above 0.48 (42). According to Panaghi *et al*. (44), the Persian version of the IES-R had acceptable internal consistency (Cronbach's alpha = 0.67-0.87) and could thus be considered a reliable instrument for assessing PTSD symptoms. In the present study, Cronbach's alpha for IES-R was 0.75 for the total scale.

Procedure

Data were collected from December 5, 2021, to February 15, 2022. To collect information on FIM–, notices were distributed via social media platforms (LinkedIn and Instagram). The notices requested participation in "research into the relationship between COVID-19 and hygiene behaviors*."* The authors used a broad term such as *"*hygiene behaviors" rather than a more specific term such as "OCS" because research has demonstrated that OCS may be interpreted negatively (45). Further, participants underwent a five-minute interview to verify and remove fake social media accounts. Then, those who met the eligibility criteria were provided with measurements. FIM+ data were gathered by connecting to two healthcare centers in Tehran and Kashan, Iran. These facilities are primarily used to diagnose COVID-19. All FIM+ participants reported having only one family member with this condition. All participants from both groups were asked to respond as honestly as possible.

Considering the 19-day interval between the onset of COVID-19 symptoms and the negative test result (27) and a prescribed 14-day interval for isolating after the last exposure to infected people (26), the authors carefully conducted a second assessment 40 days later (T2). At this time the likelihood of a significant reduction in the fear of COVID-19 in FIM+ was high. If the COVID-19 infection was prolonged, no T2 assessment was performed. Afterward, participants in both groups (FIM+ and FIM–) were notified via telephone 40 days later (T2) to complete the instruments for the second time. If a member of the FIM– contracted COVID-19 during the sampling period, they were classified as a member of the FIM+. Between T1 and T2, only one participant reported that his family member contracted COVID-19. Moreover, if a family member who cared for an infected member contracted the infection while caring (as indicated and verified by health centers), their responses were omitted to account for confounding variables (n = 1).

Statistical Analysis

IBM SPSS software (version 26.0) was used to analyze the data. Prior to analyses, all assumptions were obtained. The primary dependent variable was the change in OCS from T1 to T2 for the two groups. The authors used the chi-squared test to compare the two groups' demographic characteristics. Furthermore, we used a t-test to compare the two groups on the PHQ-9, IES-R, health beliefs, and OCS at T1 and T2. Following that, the U-Mann-Whitney and Kruskal-Wallis tests were used to determine differences in OCS changes in terms of demographic characteristics between the two groups. It should be noted that age was considered a categorical variable. The analyses were done on participants in both groups (FIM+ and FIM–) who had completed measurements at T1 and T2. Mixed-design MANOVAs were used to compare T1 vs. T2 in both groups. T1 and T2 were considered the within-subject factor; group (FIM+ and FIM–) was considered the between-subjects factor; and the PHQ-9, IES-R, health beliefs, and, OCS were considered the dependent variables in all mixed-design MANOVAs. Moreover, Pearson correlations were used to examine the relationship between study variables and changes in OCS. Finally, linear regression analyses were used to forecast changes in OCS. COVID-19 has been shown to increase depressive symptoms and PTS in several studies (e.g., 4); thus, the PHQ-9 and IES-R were planned as covariates. To predict OCS only based on health beliefs, the authors intended to include demographic characteristics that were significantly associated with OCS changes as covariates. Then, we performed linear multiple regression analyses to examine the predictive validity of health beliefs for OCS. Before conducting these analyses, we examined the assumptions of linear regression. Examination of scatter plots showed that study variables were linearly related and were normally distributed. In addition, other assumptions such as multicollinearity and homoscedasticity were obtained. For all analyses, P-values less than 5% were considered statistically significant.

Results

1.Differences between the Two Groups in Demographic Characteristics

Generally, the demographic characteristics of individuals who participated in both assessments (n = 227) did not differ from those who only participated at T1. On average, however, participants who completed both assessments were younger than participants who completed the T1 assessment only (M = 29.76; SD = 5.17).

Table 1. Demographic Characteristics of the Families with an Infected Member and Families without an Infected Member

Demographic	Level	FIM+ (n = 98)		FIM– (n = 129)		χ^2 (df)	P
		N	%	N	%		
Gender	Male	26	26.5	46	35.7	2.14 (1)	0.153
	Female	72	73.5	83	64.3		
Age	≤ 25	19	19.4	14	10.9	17.61 (3)	0.001
	26-30	31	31.6	77	59.7		
	31-35	34	34.7	27	20.9		
	> 36	14	14.3	11	8.5		
Marital Status	Married	50	51.0	57	44.2	1.04 (1)	0.348
	Single	48	49.0	72	55.8		
Educational Levels	Diploma	20	20.4	51	39.5	12.90 (2)	0.002
	Bachelor's degree	53	54.1	63	48.8		
	High-level education	25	25.5	15	11.6		
Is your job related to COVID-19?	Yes	15	15.3	26	20.2	0.88 (1)	0.387
	No	83	84.7	103	79.8		
Do you work from home?	Yes	15	15.3	40	31.0	7.48 (1)	0.006
	No	83	84.7	89	69.0		
Having a vulnerable family member in your home?	Yes	66	67.3	46	35.7	22.37 (1)	< 0.001
	No	32	32.7	83	64.3		
Having history of psychiatric disorders?	Yes	3	3.1	2	1.6	0.59 (1)	0.654
	No	95	96.9	127	98.4		
Form of Caring of COVID-19 infected member	Primary	22	22.4				
	Secondary	76	77.6				
Percentage of lung infection at T1	0-10%	0	0.0				
	10-30%	53	54.1				
	30-50%	36	36.7				
	50-70%	9	9.2				
	Over 70%	0	0.0				
Percentage of lung infection at T2	0-10%	92	93.9				
	10-30%	6	6.1				
	30-50%	0	0.0				
	50-70%	0	0.0				
	Over 70%	0	0.0				

Note: FIM+ = Families with an Infected Member; FIM– = Families without an Infected Member; T1 = Immediately after contracting COVID-19 in FIM+; T2 = 40 days after T1.

According to Table 1, participants in the FIM+ group were significantly older, more educated, less likely to work from home, and had more vulnerable family members in their homes than participants in the FIM– group. Out of all the participants, five individuals reported a history of psychiatric disorders (three participants in FIM+: two participants had MDD, and one participant had panic disorder; two participants in FIM–: both had MDD).

2. Differences between Groups in PHQ-9, IES-R, Health Beliefs, and, OCS at T1 and T2

As mentioned above, the mixed-design MANOVAs were applied to investigate total differences in the PHQ-9, IES-R, health beliefs, and, OCS. The results indicated the overall significant main effects of Time and Time*Group interactions in all variables. These results are presented in Table 2.

Table 2. The Results of Mixed-Design MANOVAs for Patient Health Questionnaire-9, Impact of Events Scale-Revised, Health Beliefs, and Obsessive-Compulsive Symptoms

		Wilks λ	F(1, 225)	P-value	η^2
PHQ-9	Time	0.18	78.18	< 0.001	0.85
	Time*Group	0.44	63.50	< 0.001	0.69
IES-R	Time	0.14	305.02	< 0.001	0.94
	Time*Group	0.30	84.11	< 0.001	0.78
Health beliefs	Time	0.09	48.42	< 0.001	0.77
	Time*Group	0.46	62.53	< 0.001	0.74
OCS	Time	0.09	65.45	< 0.001	0.79
	Time*Group	0.43	74.50	< 0.001	0.78

Note: PHQ-9 = Patient Health Questionnaire-9; IES-R = Impact of Events Scale-Revised; OCS = Obsessive-Compulsive Symptoms.

These differences need further examination as they did not specify which group differed from the other group in terms of the PHQ-9, IES-R, health beliefs, and OCS changes. The results are summarized in Table 3.

Table 3. The Means, SD, T, Cohen d, and P-Values for Patient Health Questionnaire-9, Impact of Events Scale-Revised, Health Beliefs, and Obsessive-Compulsive Symptoms Changes of the Families with an Infected Member and Families without an Infected Member Immediately after Contracting COVID-19 in Families with an Infected Member and 40-Days Later

	Variables	FIM+ (n = 98)		FIM– (n = 129)		T	Cohen's d	P
		Mean	SD	Mean	SD			
T1	PHQ-9	10.94	4.45	7.33	3.02	7.27	0.97	< 0.001
	IES-R	39.56	13.27	19.82	1.65	16.73	2.24	< 0.001
	Perceived Susceptibility	11.92	2.17	9.74	0.83	10.44	1.40	< 0.001
	Perceived Severity	11.63	1.48	9.64	0.76	13.15	1.76	< 0.001
	Perceived Barriers	25.56	4.21	24.62	1.87	2.26	0.30	0.025
	Perceived Benefits	5.43	1.38	4.73	0.70	4.96	0.67	< 0.001
	Self-Efficacy	3.92	0.80	3.94	0.60	0.212	- 0.03	0.832
	Cues	5.84	1.92	4.52	0.93	6.82	0.91	< 0.001
	Hoarding	4.83	2.84	2.77	0.62	7.98	1.07	< 0.001
	Checking	3.12	1.82	2.82	0.54	1.77	0.24	0.117
	Ordering	5.28	2.16	4.67	0.86	2.93	0.39	0.004
	Neutralizing	1.06	0.94	0.89	0.82	1.45	0.19	0.149
	Washing	6.87	2.16	2.05	0.30	25.08	3.36	< 0.001
	Obsessing	5.56	2.88	2.61	0.50	11.42	1.53	< 0.001
	OCS Total	25.50	9.41	15.81	1.33	11.54	1.55	< 0.001
	Variables	FIM+ (n = 98)		FIM– (n = 129)		T	Cohen d	**P**
		Mean	SD	Mean	SD			
T2	PHQ-9	6.67	4.24	7.22	2.95	1.14	- 0.15	0.250
	IES-R	21.37	10.66	20.07	1.23	1.37	0.18	0.171
	Perceived Susceptibility	10.10	2.13	10.03	0.66	1.46	0.30	0.162
	Perceived Severity	9.97	2.39	9.59	0.59	1.82	0.31	0.069
	Perceived Barriers	24.98	3.13	24.60	1.64	1.48	0.59	0.155

Perceived Benefits	5.32	1.53	5.21	0.68	1.09	0.59	0.208
Self-Efficacy	3.71	0.98	3.78	0.47	0.616	-0.10	0.538
Cues	5.57	1.82	5.01	0.86	1.87	0.36	0.079
Hoarding	2.54	1.47	2.75	0.43	1.54	- 0.21	0.124
Checking	3.09	1.62	2.77	1.64	1.48	0.20	0.139
Ordering	4.25	1.42	4.16	0.84	1.11	0.45	0.254
Neutralizing	1.01	0.89	0.88	0.79	1.90	0.28	0.059
Washing	3.09	1.64	2.88	0.95	1.47	0.32	0.140
Obsessing	2.71	1.78	2.69	0.50	0.148	0.02	0.882
OCS Total	16.10	4.67	15.81	2.14	0.620	0.08	0.536

Note: FIM+ = Families with an Infected Member; FIM– = Families without an Infected Member; PHQ-9 = Patient Health Questionnaire-9; IES-R = Impact of Events Scale-Revised; OCS = Obsessive-Compulsive Symptoms.

As outlined in Table 3, the groups differ in all components except for self-efficacy, checking, and neutralizing at T1. Although there are no differences in outcomes between the two groups at T2, the results indicate that the FIM+ group's mean OCS changes are significantly greater than the FIM– group's (-9.40 ± 2.2 vs. 0.01 ± 2.17, P < 0.001).

3. Differences between Groups in Demographic Characteristics According to OCS Changes

The means, standard deviations, and P-values for OCS changes in terms of demographical variables for the two groups are represented in Table 4. The table shows that levels of factors such as having a vulnerable family member, educational background, and forms of caring for a COVID-19-infected member significantly differ when OCS changes are considered as outcomes only in the FIM+ group. There are no significant differences in OCS changes between the levels of demographic characteristics in FIM–.

Table 4. The Demographic Characteristics of the Families with an Infected Member and Families without an Infected Member According to Obsessive-Compulsive Symptoms Changes

Demographic	Level	FIM+ (n = 98)		FIM– (n = 129)	
		Mean	SD	Mean	SD
Gender	Female	- 9.35	4.84	0.28	2.86
	Male	- 9.42	10.37	- 0.16	1.66
		T (df)	0.03 (96)	T (df)	1.1 (127)
		P	0.974	P	0.272
Marital Status	Married	- 7.68	10.51	- 0.25	1.58
	Single	- 11.19	7.31	0.19	2.53
		T (df)	1.91 (96)	T (df)	1.15 (127)
		P	0.059	P	0.254
Educational Levels	Diploma	- 13.25	3.68	- 0.02	1.54
	Bachelor's degree	- 11.75	6.86	0.05	2.73
	High-level education	- 1.32	11.72	- 0.13	1.25
		F (df_1, df_2)	17.58 (2,95)	F (df_1, df_2)	0.045 (2,126)
		P	< 0.001	P	0.956
Is your job related to COVID-19?	Related	- 13.00	3.32	0.77	3.34
	Unrelated	- 8.75	9.78	- 0.19	1.73
		T (df)	1.66 (96)	T (df)	1.97 (127)
		P	0.100	P	0.050
Do you work from home?	Yes	- 5.20	8.99	- 0.15	3.10
	No	- 10.16	9.10	0.07	1.60
		T (df)	1.95 (96)	T (df)	0.52 (127)

		P	0.055	P	0.600
Having a vulnerable family member in your home?	Yes	- 7.02	10.22	- 0.30	1.68
	No	- 14.31	3.03	0.17	2.39
		T (df)	3.94 (96)	T (df)	1.19 (127)
		P	< 0.001	P	0.237
Having psychiatric disorders?	Yes	- 9.33	9.34	- 0.02	2.18
	No	- 11.67	1.15	1.50	0.71
		T (df)	0.43 (96)	T (df)	0.99 (127)
		P	0.667	P	0.326
Percentage of lung infection at T1	30-50%	- 9.77	10.33		
	50-70%	- 8.17	8.00		
	Over 70%	- 12.11	6.27		
		F (df1, df2)	0.752 (2,95)		
		P	0.474		
Percentage of lung infection at T2	10-30%	- 9.37	9.38		
	30-50%	- 9.83	6.65		
		T (df)	0.787 (87)		
		P	0.434		
Form of Caring of COVID-19 infected member	Primary	- 10.41	9.14		
	Secondary	- 5.91	8.78		
		T (df)	2.05 (96)		
		P	0.043		

Note: FIM+ = Families with an Infected Member; FIM– = Families without an Infected Member.

Table 4 shows that individuals with lower educational levels experienced more significant OCS changes than those with higher educational backgrounds in FIM+. Moreover, individuals in FIM+ who reported not having a vulnerable family member in their homes exhibited the most significant changes in OCS. Additionally, primary caregivers indicated a significantly more reduction in OCS changes than secondary caregivers at T2.

4. Correlations between Demographic Characteristics, PHQ-9, IES-R, and Health Beliefs with OCS Changes

As shown in Table 5, all T1 scores, except for age, were significantly related to changes in OCS in the FIM+ group. Except for depressive symptoms and perceived barriers which had significant negative relationships with OCS changes, most variables had significant positive relationships with OCS changes in this group. Only self-efficacy demonstrated a significant positive correlation with OCS changes in the FIM– group. When changes in health beliefs are calculated over time (T1-T2), the results indicate that perceived susceptibility and severity changes have significant correlations with OCS changes in the FIM+ group, whereas perceived barriers changes have significant negative correlations with OCS changes. On the other hand, there is a positive, meaningful relationship between perceived benefits changes and OCS changes in FIM– group.

5. Prediction of OCS Changes

Only individuals in the FIM+ group reported significant changes in OCS; thus, health beliefs at T1 were used to predict OCS changes in the group. Our analysis revealed that having vulnerable family members and educational levels are significantly associated with changes in OCS; the authors, therefore, include these variables as covariates in addition to the IES-R and PHQ-9 at T1.

Table 5. Pearson Correlation Coefficients of the Study Variables, and Obsessive-Compulsive Symptoms Changes According to the Families with an Infected Member and Families without an Infected Member

Variables	FIM+ (n = 98)		FIM– (n = 129)	
	r	P-Value	r	P-Value
IES-R	0.20	0.047	- 0.13	0.137
PHQ-9	- 0.30	0.002	0.17	0.060

Age	0.16	0.113	0.06	0.481
Perceived Susceptibility	0.48	< 0.001	- 0.02	0.854
Perceived Severity	0.54	< 0.001	0.04	0.679
Perceived Barriers	- 0.57	< 0.001	- 0.14	0.107
Perceived Benefits	0.36	< 0.001	0.07	0.436
Self-Efficacy	0.28	0.005	0.21	0.015
Cues	0.21	0.042	- 0.11	0.219
Perceived Susceptibility Changes	0.74	< 0.001	0.10	0.281
Perceived Severity Changes	0.64	< 0.001	0.05	0.567
Perceived Barriers Changes	- 0.42	< 0.001	- 0.12	0.163
Perceived Benefits Changes	0.17	0.097	0.34	< 0.001
Self-Efficacy Changes	0.17	0.091	- 0.06	0.503
Cues Changes	- 0.18	0.084	- 0.03	0.719

Note: FIM+ = Families with an Infected Member; FIM– = Families without an Infected Member; PHQ-9 = Patient Health Questionnaire-9; IES-R = Impact of Events Scale-Revised.

Table 6. Predictors of Obsessive-Compulsive Symptoms Changes

Variables	β	Std. Error	B	T-Value	P-Value	R	R^2
Perceived Susceptibility	- 0.60	0.41	- 0.14	- 1.46	0.149		
Perceived Severity	2.20	0.44	0.57	5.01	< 0.001		
Perceived Barriers	- 0.53	0.29	- 0.18	- 1.83	0.071	0.41	0.17
Perceived Benefits	- 0.05	0.53	- 0.01	- 0.10	0.919		
Self-Efficacy	3.16	0.66	0.34	4.79	< 0.001		
Cues	0.14	0.36	0.03	0.40	0.689		

Note: The result presented by controlling IES-R (β ± SE = 0.11 ± 0.07), PHQ-9 (β ± SE = -0.86 ± 0.16), Educational levels (β ± SE = 3.77 ± 0.97), and Vulnerable family member (β ± SE = -0.2 ± 1.4197); Std. Error = Standard Error.

Perceived severity and self-efficacy remained significant predictors in the regression model after controlling for covariates, as shown in Table 6. The greater the severity and self-efficacy perceived at T1, the greater the decline in OCS from T1 to T2. Additionally, these health beliefs were found to be capable of predicting 17% of the variance (R^2) in OCS changes.

Discussion

The primary objective of this study was to determine whether contracting COVID-19 and then recovering from it in a family member changes OCS in other members, and to what extent these changes are dependent on health beliefs and demographic characteristics.

The results demonstrated that a family member's infection with COVID-19 increases the OCS in other members and the perceived severity and self-efficacy predicted a significant reduction in OCS. The findings corroborate recent research on healthcare workers who encountered COVID-19 patients (e.g., 18). Prior research indicated that confronting infected patients increased PTS and depressive symptoms in healthcare workers (19, 46). Thus, our results are promising because the current study controlled PTS, depressive symptoms, and even COVID-19-related demographic characteristics such as percentage of lung infection and form of care. At T1, individuals in the FIM+ group reacted to COVID-19 similarly to healthcare workers.

Previous research has established that during the recent pandemic, individuals with obsessive-compulsive disorder (OCD) experienced an increase in OCS (47). In the current study, individuals without OCD also reported having elevated OCS scores in response to COVID-19 in a family member (96.9% of FIM+ reported having no psychiatric disorders; see Table 1). At T1, the FIM+ group scored significantly higher than the FIM– group in OCI-R and even exceeded the clinical threshold for OCD (32), suggesting a temporary overreaction to exposure to and care for patients with COVID-19 (48). However, the scores remained below the average for OCD patients (32). The present study indicated an increase in specific OCS dimensions such as washing probably as a result of health organizations' promotion of similar behaviors or fear of germs in FIM+ at T1. Furthermore, the uncertain future of this traumatic event and elevated intrusive thoughts may have increased obsessions in FIM+ at T1 (49, 50). Consequently, they had greater scores in hoarding, probably due to the traumatic event that occurred in their families (51).

Furthermore, our results indicated increased scores in the ordering subtype in FIM+ compared to FIM– at T1. Ordering is one of the most prevalent subtypes of OCD in Iranian people (52). Likely individuals in the FIM+ interpreted certain ordering items (e.g., "I get upset if others rearrange my things") as they did the washing items. This probably occurs because they are at risk of a contagious disease, and changing the order of things is equal to touching these objects. Moreover, when the FIM+ group observed adverse impacts of COVID-19, they had a meaningfully raised risk of PTS and depressive symptoms (19), which elevated OCS in FIM+. In addition to PTS and depressive disorders, all subtypes of OCS decreased after family members in FIM+ recovered from COVID-19 at T2, as individuals in FIM+ perceived less risk of COVID-19 transmission in comparison to T1.

In contrast to Lossen *et al*. (53), the authors found that the FIM+ group did not significantly engage in more checking and neutralization than the FIM– group at T1. Cox and Olatunji (54) confirmed that elevating in OCS was only reported in washing and hoarding subtypes rather than checking and neutralizing. It is possible that checking behaviors such as checking out windows and gas faucets had nothing to do with COVID-19 concerns. Furthermore, the FIM+ group did not believe they needed to neutralize negative thoughts through strategies such as counting.

Additionally, the result showed that FIM+ scores at T1 in terms of taking the disease seriously (perceived severity) and believing in their ability to overcome it (self-efficacy) predict a 17% reduction in OCS.

According to the health belief model, when people believe that they are at risk of contracting serious diseases, they are more likely to engage in health behaviors, especially when they face fewer barriers and reap greater benefits from those behaviors (55). Our findings showed that all health beliefs, except for self-efficacy, were higher in FIM+ than in the FIM– group at T1. Confronting an infected family member and hosting vulnerable patients may be sufficient conditions to increase perceived susceptibility in the FIM+ group. As a result, individuals in the FIM+ group are more likely to be concerned about the seriousness of COVID-19 while also perceiving the pandemic's high fatality rate. A growing body of research suggests significant associations between health beliefs and preventive behaviors during COVID-19 (56, 57). Our study generalized these findings to the excessive type of preventive behaviors which appeared in OCS.

At T1, individuals in the FIM+ group also realize more problems and more advantages when performing preventive behaviors, and they would be more likely to attend to COVID-19-related information (i.e., higher cues to action scores) probably because of their distress (more PTS in FIM+) (58). At T2, individuals in FIM+ worry significantly less about being at risk of being infected with COVID-19, and through their experiences, they may not believe that the pandemic is as deadly as they imagined before (lesser scores of FIM+ in perceived susceptibility and severity at T2, respectively; see Table 3).

Additionally, an increase in perceived susceptibility and severity changes and a decrease in perceived barrier changes were found to be significantly associated with an increase in OCS changes. In line with this, recent research emphasized the role of the aforementioned health beliefs in preventive behaviors (14, 56). The findings underscore the need for addressing health beliefs in interventions to reduce OCS in people.

Intriguingly, having a COVID-19 patient in the family did not substantially affect self-efficacy in FIM+. In contrast to our findings, Hsing *et al*. (59) stated that self-efficacy correlated with preventive behaviors for COVID-19. Self-efficacy appears to promote normal preventive behaviors rather than excessive ones. Consistent with this, Gelfand and Radomsky (60) found a significant association between low self-efficacy and a long period of excessive washing. Furthermore, Voderholzer *et al*. (61) concluded that self-efficacy is the primary mediator of the relationship between treatment effects and outcomes in OCD. Following Voderholzer *et al*. (61), the present study showed that self-efficacy scores in FIM+ at T1 were meaningfully associated with reducing OCS at T2. It is unclear to what extent these results could generalize to patients with OCD, and we suggest future studies examine the role of health beliefs on response to treatment in this sample (e.g., 62).

The results also revealed that individuals in the FIM+ are more likely to work out of the home. It seems that the higher risk of COVID-19 infection in FIM+ is partly a result of the violation of some preventive behaviors such as working from home in this group (15) (see Table 1). In addition, as some individuals in FIM+ reported that they could work from home or in an office but preferred to work in an office, they may prefer to work away from a stressful environment in their families (63, 64) (see Table 3 for a comparison of PTS in FIM+ and FIM–). Leaving home to manage stress may increase the risk of transmitting COVID-19 to others which in turn can increase worry and OCS in them and it seems to create a vicious cycle.

Additionally, the FIM+ group was found to be older than FIM–. This may account for the fact that FIM+ reported that they have more family members with vulnerable conditions. However, none of the participants in the current study were over the age of 50. Consequently, a higher number of vulnerable family members may be reported in FIM+ due to other factors such as assistance-seeking (65). Additionally, primary caregivers showed significantly greater OCS changes than secondary caregivers. This is confirmed temporary and high psychological distress in people who frequently confront infected patients (e.g., 20).

Drawing on the work of Mahaffey *et al*. (66), the authors assumed that having a vulnerable family member in one's home and lower educational attainment are associated

with higher OCS changes. In other words, individuals in the FIM+ group who have vulnerable family members and higher educational attainment experienced higher OCS at T1 and fewer changes in OCS from T1 to T2. Bik-Multanowska *et al*. (67) stated that families with chronic illness patients viewed COVID-19 as a risk; thus, individuals in FIM+ who had vulnerable family members exhibited naturally higher OCS at both T1 and T2. In general, these findings shed light on at-risk populations during the pandemic and they underscore the importance of continued support for families with chronic patients long after the pandemic's stressful period has passed.

Limitation

The current study examines multiple demographic characteristics and health beliefs through a longitudinal study; the findings should be interpreted in light of several limitations. Initially, and unexpectedly, only one participant contracted COVID-19 during the assessment period. Particularly in the FIM+ group, the risk of infection was relatively high, but infection may have not been self-reported due to the fear of stigmatization (e.g., 68) or because the disease was asymptomatic, representing a limitation. However, 78 individuals in the FIM– group were located in areas where sampling of FIM+ was performed. Thus, if any of these individuals contact COVID-19, the sampling centers notify us, as patients should be referred to these centers. According to reports of the centers, none of the FIM– groups had referred to these centers during the sampling period. Therefore, it is assumed that most FIM– had not COVID-19 or recovered at the time of sampling. Second, the authors assessed outcomes using self-report measures, introducing social desirability bias into the study. Third, the online assessment made it difficult to control situational factors that could affect completion and responses. Fourth, the two groups lacked pre-pandemic data; thus, no conclusions about both groups' data prior to the pandemic could be drawn. However, the longitudinal study allows for the tracking of changes in outcomes.

Conclusion

The current study that was conducted two years after the beginning of COVID-19 showed that people without OCD are also susceptible to temporarily suffering from high OCS when one of their significant others got infected with COVID-19. In addition, the present research highlights the role of demographic characteristics such as having vulnerable patients at home in response to this traumatic event and recovering from it. The findings emphasized the need for addressing health beliefs like perceived severity and self-efficacy for treating psychopathology during the pandemic.

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Conflict of Interest

None.

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