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Anxiety and Depressive Symptomatology among Iranian Patients Hospitalized for COVID-19 in January 2020

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Abstract

Background: Widespread outbreaks of Coronavirus disease among Iranian people are not only associated with physical illness but also with psychological symptoms which need special attention.
Objectives: This study was an endeavor to examine the relationship between comorbidity and death anxiety with Anxiety and Depressive Symptomatology among those survived after the COVID-19 pandemic in Iran.
Methods: This was a cross-sectional study in which the probands o survivors of COVID-19 participated. By means of convenient smpling method and adhering to selection criteria we chose 300 patients admitted for COVID-19 in a university affiliated hospital in Isfahan-Iran during the January 2020. We collected the data pertaining to their illness history, including information about their comorbidity and demographic background by means of an interview schedule with closed-ended questions. We used the Persian version of Templer's Death Anxiety Scale (TDAS) and Hospital Anxiety and Depression Scale (HADS). Data were computer analyzed using SPSS-19 and running Hierarchical Log-linear analysis symptomatology in a saturated model.
Results: Majority of the participants were female (64%) with the mean (SD) age of 44.8 (12.8) years. Positive comorbidity was accompanied by a higher chance of exhibiting depressive symptoms (OR=34.67, df =1, P=0.000). High death anxiety was accompanied by higher chances of anxiety-depressive symptoms (OR=90.13, df =1, P=0.00).
Conclusion: These observations reinforce the hypothesis proposed on the basis of Hill's (1958) ABC-X model and provided impetus to idea that how absence of comorbidity and positive perception of illness condition protect individuals from psychological hazards of COVID-19.

Keywords: COVID-19; death anxiety; anxiety; depression; Iran

Introduction

It has been nearly three years since the beginning of COVID-19 pandemic. As a result of the outbreak the world has witnessed a high death toll of individuals from different age groups [1-2]. Since then, several attempts have been made to describe, explain, predict and control this pandemic [3]. Also the social impact of COVID-19 on the community inhabitants have been studied. There are also evidences related to the

consequences of “lock down” in people’s life specially in terms of social isolation [4], disruption social role performance [5-6], and impairment of social functions. The last but not least is the stigma attached to this infectious disease which has perpetuated social disintegration [7]. The psychiatric complications of COVID-19 encompasses widely from depression, anxiety, panic attacks, somatic symptoms, and posttraumatic stress disorder symptoms, to delirium, psychosis and even suicidality [8-12]. Coupled with previous studies, there are evidences about devastating role of comorbidity in weakening the immune system, aggravating mental and physical functions and making the conditions of victims of COVID-19 more complicated [13-16]. With the purpose of persuasion mass media has come to the rescue of health professionals which sometimes have worsen the situation. The critics interpret the function of mass media in this realm more of "conspiracy" for broadcasting misleading information among the public. The fear and anxiety of falling sick or dying is partly attributed to the social propaganda and social influence [17-19].

According to thanatology fear of death as an inevitable part of the human life and is as old as humanity. It stems from the belief of disappearance after death and punishment for our sins [20]. As human beings we fear death for various reasons including, unknown loneliness and anxiety from tolerating the death experience; loss of family and friends; the loss of self-control of bodily functions; possibility of suffering; and the failure to achieve one's life goals [21]. Death anxiety is one of the variables related to death results from encountering situations that lead to anticipation or awareness of dying or being harmed. It is a complex phenomenon with emotional, cognitive, motivational, and behavioral dimensions. It is viewed as a predictor for both the existence and severity of mental diseases [22]. Couple of studies have been launched to examine the association between death anxiety and well being of the aged [23], cancer patients [24], multiple sclerosis [25] and the victims of COVID-19 [26,27]. Death anxiety during the pandemic is reported high and associated with the death of a family member from COVID-19, religiosity and cultural norms, perceived level of stress, attitude toward COVID-19, subjective proximity to death, coping strategies, history of close contact with COVID-19 patients, mental illness, alcohol consumption, loneliness, perceived risk, and strategies for coping with stress [28].

Conclusively, previous studies assessed the overall impact of the pandemics on mental health, proposing a general outlook towards psychological impact of COVID-19. Among the most common determinants of mental health of the victims of this affliction, fear of death and comorbidity appeared to be important. Hill's (1958) ABC-X model which explains “the crisis-proneness and freedom from crisis among families” was used as a mental schema to demonstrate the plausible relationships between three variables [29]. In its most basic form, the ABC-X model proposes that the impact of a stressor like COVID-19 (A) on an outcome variable like anxiety-depressive symptom(X) is affected by absence or presence of a comorbidity (B) and the way in which the stressor is perceived ,i.e. if the threat has been fearful enough to cause death anxiety (C). As shown below, for a stressor like COVID-19 to produce anxiety and depressive symptomatology, it has to go through two filters: [1] individual’s perception of the event (fearless versus fearful) and presence or absence of comorbidity (medical or psychiatric).(Figure-1).

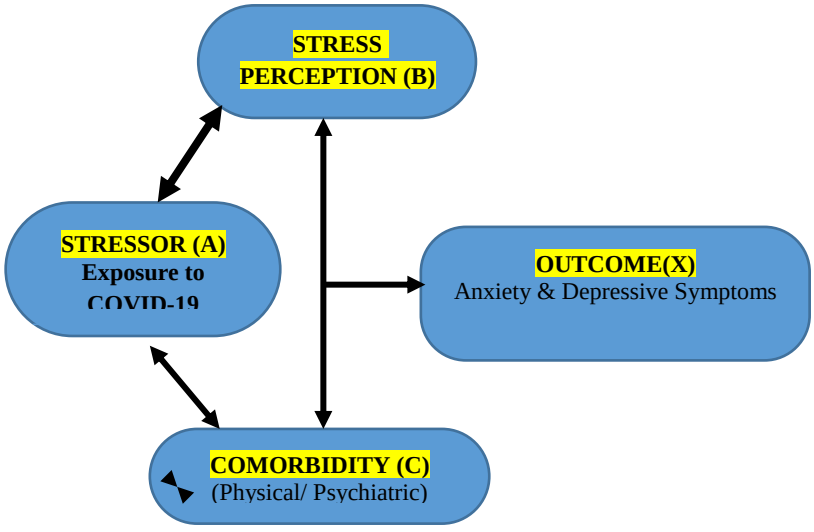

Figure.1: Conceptual Model of ABC-X to Show the Likelihood of Clinically Significant Anxiety & Depressive Symptoms among the Survivors of COVID-19

Despite of influential role of fear of death and comorbidity in the psychological outcome of COVID-19, no appreciable attempt has been made in Iranian context to examine the association between fear of death and anxiety-depressive symptoms. From the previous literature stems two major hypotheses: for the survivors of COVID-19, presence or absence of fear of death and comorbidity determine their chances to develop anxiety and depressive symptoms. To this end, fear of death and comorbidity are viewed as independent variables and anxiety-depressive symptomatology as the dependent variable. In a sense this study has tried to examine whether fear of death and comorbidity operate singly or together in manifestation of anxiety-depressive symptoms in survivors of COVID-19. To test the hypotheses and find answer to the above question we launched a survey among patients admitted for COVID-19 in a university hospital situated in Isfahan-Iran for the year 2021

Methods

This cross-sectional study was conducted on 300 patients hospitalized with the diagnosis of COVID-19 in Khroshid Medical Centre, affiliated to Isfahan University of Medical Sciences, Isfahan-Iran during January 2021. The sampling list of patients was prepared based on the national card and hospital records of the patients, in which all patients with initial diagnosis of Covid-19 were included in the final list. However, we adhered to certain inclusion and exclusion criteria. The participants had to be of Iranian nationality, age range between 18 to 60 years old, the inpatients stay for at least 24 hours and clear COVID-19 diagnosis, admission and discharge date between first to 30th January in 2021,and the respondents had to be literate enough to work with smartphones or computers. They should have been stable enough to be interviewed. Individuals with a history of a previously diagnosed severe psychiatric illness (e.g., schizophrenia, bipolar disorder, anxiety disorder, or depression disorder) and individuals with a chronic illness treated with oral medications (e.g., metoprolol, reserpine, prednisone, and methylprednisolone) that could cause side effects related to anxiety, depression, and insomnia were not included in the study. Also, those with the history of serious mental illness, mental retardation, dependency on drugs, alcohol, and substance were not included in this study. Exclusion criteria included inability to complete or failure to complete the questionnaire. For those with more than one inpatient stay in the period, only the first COVID-19 health-related inpatient stay was used in our analysis. However, due to unavoidable circumstances and quarantine period we did not have face to face contact with patients and out of choice we relied on a web

based panel to administer the paper-pencil measurement tools. We obtained written consent from the participants after explaining the study objectives.

Demographic and Medical History included demographic characteristics including sex, age, education, occupation, and marital status, as well as past and present medical history which comprised of comorbid conditions, length of hospitalization and days spent in the Intensive Care Unit (ICU), was intubated or not.

The computerized hospital records allowed us to detect the patients' comorbidity status. This was feasible by means of a guideline obtained from the Centre for Disease Control and Prevention [**Error! Reference source not found.**]. Accordingly, the physical health comorbidity categories could be any diseases included infectious, endocrine, nutritional, metabolic diseases, immunity system, blood and blood-forming organs, nervous system and sense organs, circulatory systems, respiratory system, digestive system, complications of pregnancy, childbirth and puerperium, skin and subcutaneous tissues, musculoskeletal systems and connective tissues, and congenital anomalies. For psychiatric morbidity we adhered to the DSM-IV classification [**Error! Reference source not found.**]. Individuals with any listed diagnosis from the inpatient record were positively coded for a condition.

We used the Persian version of the Templer's Death Anxiety Scale to assess the respondents' subjective response to the psychological distress at the outbreak of the COVID-19 [**Error! Reference source not found.**]. This self-report index contains 15 items with dichotomous options of "Yes" and "No". The scores for this scale ranged between 0 to 15, with higher scores indicating higher levels of anxiety for death. For the purpose of analysis, the overall scored was classified into low (0–7) and high (8 and above). Factor analysis of this scale in Iran by Soleimani and coworkers (2016) yielded a Cronbach's alpha and construct reliability of greater than 0.70. Goodness of fit indices showed an acceptable fit overall with the full model {$\chi 2$(df) = 262.32 (61), $\chi 2$/df= 2.04 [adjusted goodness of fit index (AGFI) = 0.922, parsimonious comparative fit index (PCFI) = 0.703, normed fit Index (NFI) = 0.912, CMIN/DF = 2.048, root mean square error of approximation (RMSEA) = 0.055]}.[31] To determine the participants' levels of anxiety and depression we used the Persian version of Hospital Anxiety and Depression Scale (HADS) [**Error! Reference source not found.**]. HADS is a self-report instrument designed to detect symptoms related to anxiety and depression in the general medical outpatient population in the past week. Each item had been answered by the patient on a four point (0–3) response category so the possible scores ranged from 0 to 21 for anxiety and 0 to 21 for depression. All items were rated on a 4-point scale, ranging from the absence of a symptom (score of 0) to maximal symptoms (score of 3). A score of 11 was used as the cutoff for all HADS subscales. Items were dummy coded into asymptomatic (0) and symptomatic (1). Reportedly, the Iranian version of the HADS yielded the Cronbach's alpha coefficient in Iranian population is 0.78 for the HADS anxiety sub-scale and 0.86 for the HADS depression sub-scale with satisfactory validity. Both anxiety and depression sub-scales discriminated well between sub-groups of patients differing in clinical status as defined by their disease stage [33].

For the purpose of this study the scale (HADS) was administered on a group of 175 residents of a resident complex which yielded a Cronbach Alpha of 0.81, very close to findings of the previous studies. While the Death Anxiety Scale for the same population yielded a Cronbach Alpha of .92.Statistical Package for Social Sciences (SPSS) software for windows, version 19, was used in performing statistical analysis [**Error! Reference source not found.**34]. At the outset we calculated the frequency distribution of the participants' demographic and health related characteristics. Two-way and three-way frequency tables were analyzed by means of Phi and Pearson Chi-Square (X^2) tests; multi-way frequency tables were examined through log-linear analysis. Log linear modeling was employed to examine the relationships between the variables of comorbidity (absent, present), death anxiety (low, high), and anxiety-depressive symptomatology (symptomatic, asymptomatic) to obtain odds ratios for included effects. The study protocol was approved by Research Committee of Isfahan University of Medical Sciences and the Ethics Committee has confirmed it.

Results

The participants of the study were typically married women who were middle age, with secondary higher education (12th standard) who worked as housewives. On an average they spend less than a week with less than 4 days in the ICU. Reportedly one third of them had physical or psychiatric comorbidities. (Table 1).

Table 1: Frequency & Percentage Distribution of Participants' Demographic Characteristics & Medical History

Character		Frequency (N=300)	%
Gender	Male	108	36.0
	Female	192	64.0
	Age Group	Mean ± SD: 44.78±12.82	
	Young	92	30.7
	Middle	131	43.7
	Elderly	77	25.7
Educational Status	Up to Diploma	113	37.7
	Above Diploma	187	62.3
Occupation	Not Working	190	63.3
	Working	110	36.7
Marital Status	Un Married	68	22.7
	Married	232	77.3
Comorbidity	No	198	66.0
	Yes	102	34.0
	Physical Comorbidity	53	17.7
	Pulmonary comorbidities	10	3.3
	Cancer & Immune Suppressive Conditions	7	2.3
	Chronic Medical Conditions	36	12.0
	Psychiatric Comorbidity	49	16.3
	GAD	20	6.7
	MDD	24	8.0
	Personality Disorder	10	1.7
	Average Hospitalization Days	Mean ± SD : 5.69±4.83	
ICU Admission	No	193	64.3
	Yes	107	35.7
	Average Days in ICU	Mean ± SD : 3.53±2.52	
Intubation	No	225	75.0
	Yes	75	25.0

At the outset we need to examine the hypothesis showing the relationship between comorbidity and symptoms of anxiety-depression in patients admitted for COVID-19. The basic form of variation to be explained in LLM is the cell frequencies. Odds are calculated as the frequency in a given category divided by the frequency not in that category, in this case the ratio of symptomatic to asymptomatic (anxious-depressed). Table 2 presents the cross-tablulation of the dependent variable of anxiety-depressive symptomaology by comorbidity. Comparison of the asymptomatic to symptomatic group shows higher odds for being anxious-depressed in patients with comorbidity. For the total sample, the marginal odds of being anxious-depressed is 0.176 (45.255). Analysis of data shows that the odds of being anxious-depressed increases across the categoris of the independent variable (comorbidity), being high than the marginal odds for those having with comorbdity and lower than the marginal odds for those without comorbdity. In other words, compared to the subject with comorbdity, the odd of being anxious-depressed is increased (multiplied) by a factor of 7.35(0.478/0.065) for those with comorbdity. Viewed from the reverse perspective, those without comorbdity0.065 times (0.056/0.478) are

less likely to become anxious-depressed than those with comorbdity. The Likelihood Ratio Chi Squar yielded a value of 34 which shows two odds of being anxious-depressed significantly differ across the categories of absent and present comorbdity ($LRX^2(1)=34$, $P<0.001$) (Table 2).

Table 2: Anxiety-Depression as a Function of Comorbidity

Comorbidity	Anxiety-Depressive Symptoms		Total	Odds of Being Anxious-Depressed	Proportion Anxious-Depressed
	Asymptomatic	Symptomatic			
Absent	186	12	198	0.065	00.061
Present	69	33	102	0.478	0.324
Total	255	45	300	0.176	0.150
Likelihood Ratio= 34; df=1; Sig=0.000					

Fear of death is one of the prominent features of the patients affected by COVID-19. In assessing the stress-buffering role of comorbidity, the basic analytical question is whether absence or presence of comorbidity alter the relationship pattern of fear of death and anxiety- depressive symptomatology? In other words, does presence or absence of comorbidity increase or decrease the impact of death anxiety? Table 3 presents the cross-tablulation of the dependent variable of anxiety-depressive symptomaology by fear of death. Odds are calculated by taking the ratio of symptomatic to asymptomatic (anxious-depressed). For the total sample, the marginal odds of being anxious-depressed is 0.176 (45/255). As can be seen, the odds of being anxious-depressed increases across the categoris of the independent variable (fear of death), being lower than the marginal odds for those having low fear of death and higher than the marginal odds for those with high level of fear of death. Thus, compared to those who have low fear of death, the odd of being anxious-depressed is increased (multiplied) by a factor of 37.04(2/0.054) for those high on fear of death. Viewed from the reverse perspective, those with low fear of death 0.027 times (0.056/2) are less likely to become anxious-depressed than those with high fear of death. The Likelihood Ratio Chi Squar yielded a value of 90 which shows two odds of being anxious-depressed significantly differ across the categories of low and high fear of death ($LRX^2(1)=90$, $P<0.001$) (Table 3).

Table 3: Anxiety-Depression as a Function of Fear of Death

Fear of Death	Anxiety-Depressive Symptoms		Total	Odds of Being Anxious-Depressed	Proportion Anxious-Depressed
	Asymptomatic	Symptomatic			
Low	239	13	252	0.054	0.516
High	16	32	48	2	0.667
Total	255	45	300	0.176	0.15
Likelihood Ratio=90.0, d.f=1					

In assessing the impact of fear of death on anxiety-depression, however, the central interest is in whether fear of death results in a subsequent anxious-depressive symotpomatoloy when we introduce comorbidity. Based on the theortitial framework we are interested to know how fear of death affects the odds of subsequent anxiety-depression after controlling for comorbidity. Is comorbidity related to anxiety-depression within each category (asymptomatic versus symptomatic) of anxiety-depression? To answer this question , LLMs are assessed for a 3-way contingency table formed by the cross-classification of these three variables as shown in Table 4. A three-way analysis of two independent and the outcome variable in Table 4 shows that in the absence of comorbidity despite of low degree of fear of death patients tend to be more asymptomatic. However, with hike in the degree of fear of death the tendency to be more symotpmatic increases. Statistically, in the absence of comorbidity and presence of low fear of death, the odd of being anxious-depressed is increased(multiplied) by a factor of 281.4

(0.016/4.5) for those high on fear of death. Viewed from the reverse perspective, in the absence of comorbidity and presence of low fear of death 0.003 times (0.016/4.5) patients are less likely to become anxious-depressed than those with high fear of death. The same table shows that in presence of comorbidity and low degree of fear of death, the odds of the odd of being anxious-depressed is increased(multiplied) by a factor of 9.03 (1.643/0.182) for those high on fear of death. Viewed from the reverse perspective, in the presence of comorbidity and presence of low fear of death 0.011 times (0.182/1.643) patients are less likely to become anxious-depressed than those with high fear of death. For patients having low degree of fear of death but with and without comorbdity, the odd of being anxious-depressed is increased (multiplied) by a factor of 11.37(1.643/0.016) for those with comorbidity. interestingly, taking patients with high fear of death in both groups (i.e. with and without comorbidity), the odds for patients having no comorbidity but high fear of death is increased (multiplied) by a factor of 2.74 (4.5/1.643) whereas, those with comorbidity and high fear of death are 0.365 (1.643/4.5) times less likely to develop anxiety-depressive sysmptoms. These observations turn out to be statistically significant (Table 4).

Table 4: Models for Odds of being Anxious-Depressed as a Function of Comorbidity and Fear of Death

Comorbidity			Anxiety-Depression Symptoms		odds	d.f	Sig.
			Asymptomatic	Symptomatic			
Absent	Fear of Death	Low	184	3	0.016	1	0.000
		High	2	9	4.5		
Present	Fear of Death	Low	55	10	0.182	1	0.000
		High	14	23	1.64		

The simultaneous interactions between three-factor variables namely, comorbidity, death anxiety, anxiety-depressive symptoms are displayed in Table 5. The total effects (G^2 total) for three factors is shown in the first row (X^2=498.39, df=7, sig.=0.000), the second row shows the results of the first and second order effects combined (X^2=152.76, d.f. =4, sig.=0.000), and the third row indicates the results of the third order effects inclusive of the first two order effects (X^2= 12.07, df=1, sig.=0.001). Since there are only three variables in the model the analysis does not go beyond 3 model. The second layer of the table for the first row shows the results of the first-order-effect alone (X^2=345.62, df=3, sig. = 0.000), the second row shows the results of the second-order-effects alone (X^2=140.70, df=3, sig. =0.000) and finally the last row presents the results of the third-order-effects alone (X^2=12.07, d.f. =1, sig. =0.001) (Table 5).

Table 5: Shows the Analysis for the Simultaneous Interactions Between k-Factors Variables: Comorbidity, Fear of Death and Anxiety-Depression Symptoms

K Factors	Df	Likelihood Ratio		Pearson		Number of Iterations
		Chi-Square	Sig.	Chi-Square	Sig.	
1	7	498.391	.000	708.000	.000	0
2	4	152.775	.000	236.577	.000	2
3	1	12.070	.001	11.618	.001	6
1	3	345.616	.000	471.423	.000	0
2	3	140.704	.000	224.959	.000	0
3	1	12.070	.001	11.618	.001	0

Tables 4 and 5 together are supposed to show a comprehensive picture of the three-factor variables indicating significant association for all variables independent of each other (C, A, D), combined (CA, CD, AD), and three of them together (CAD). By and large, the three models turned out to be significant which confirm the buffering effects of comorbidity and death anxiety in aggravating the mental health condition of the victims of the COVID-19 in this study.

Conclusively, the saturated model presented in Tables 4-5 indicate the significance of all the three order effects. In particular, the hierarchical model determination included the three-way interaction of comorbidity × death anxiety × anxiety-depressive symptoms, yielded G^2 total equal to 498.391(d. f= 1, P= 0.000). generated a saturated model. In LLM our preferences are for a parsimonious model which employs almost all values of each cell for each category while deleting the redundant values. However, with the significance values granted for the three order effects, it become compulsory to run a full or saturated model which contains the interaction of comorbidity by death anxiety by anxiety-depressive symptoms (C*A*D). As anticipated, the saturated or full model resulted in a zero order Chi Square difference.

As mentioned earlier overall there are three variables in the LLM. In order to examine the buffering effects of death anxiety the 3-way contingency table of comorbidity (C), anxiety-depression (A), fear of death (F) was modeled. In the second-order effect the dependent variable anxiety-depressive symptoms paired with each of the independent variables (CD, AD, AC). In the third-order term we testified the interaction between three variables as per our theoretical interest (CAD). This latter term posits that the there is a significant association between comorbidity, death anxiety and anxiety-depressive symptoms. As shown in Table 6, this model provided an excellent fit to the data (LRX^2 (1)= 12.07 P<0.001) (Table 6).

Table 6: Partial Associations tests on Comorbidity, Fear of Death, Anxiety-Depression Symptoms in Survivals of COVID-19

Effect	df	Partial X^2	Sig.
CM	1	31.267	0.000
FD	1	152.086	0.000
ADS	1	162.263	0.000
CM × FD	1	15.909	0.000
CM × ADS	1	5.358	0.021
FD × ADS	1	60.815	0.000
FD× CM×ADS	6	12.070	0.001

CM= Comorbidity; FD=Fear of Death; ADS= Anxiety & Depression Symptoms
Hierarchical model selected: FD × ADS + FD×CM×ADS.
Likelihood Ratio X^2 = 12.070; d.f = 1; *P*=0.001

Discussion

As a global health threat COVID-19 has devastating psychological consequences such as anxiety and depression which come on the way of normal functioning among the afflicted individuals. This study was an endeavor to highlight the psychological problems of a segment of individuals who were hospitalized for COVID-19 at a university hospital in Isfahan-Iran during 2021. Adhering to Hill's ABC-X model we introduced an integrated theoretical framework with three basic elements of comorbidity, illness perception, and current mental status29). It was hypothesized that the impact of a stressor such as COVID-19 leaves a psychological outcome such as depression. However, operation and intensity of the aftermaths of COVID-19 is largely determined by absence and presence of comorbidity and the extent to which the afflicted individual is horrified, assumed death anxiety in oneself. The primary hypothecs stated that clinically significant symptoms of depression will appear more among those with psychiatric or physical comorbidity accompanied by higher levels of death anxiety. The second key hypothesis was that there is an interwoven relationship between comorbidity, fear of death with anxiety and depressive symptoms.

Our observations are on line with couple of studies conducted in various parts of the world including studies done in Egypt [**Error! Reference source not found.**35], Iran [36,37] China [38], South Africa [**Error! Reference source not found.**39] Switzerland [40], Nigeria

[41], Singapore [**Error! Reference source not found.**42], Saudi Arabia [43], India [**Error! Reference source not found.**] and Iraq [**Error! Reference source not found.**45]. There is a great consensus among the scholars around the globe regarding prevalence and incidence of symptoms such as depression, anxiety and fear of death following COVID-19. The mechanism through which these symptoms form and influences various aspects of mental functioning are yet to be known. Previous studies depict a global picture of the psychological consequences of COVID-19 for the affected individuals. Whereas, the present study enjoys supremacy over them for the simple reason that the statistical methods applied here can make better estimates and predictions while eliminating the role of comorbidity and fear of death as determining factors for anxiety and depressive symptoms among the population with COVID-19 experience. This implies that under circumstances which the infectious disease is unavoidable, paying attention to the physical and psychiatric comorbidities at the outbreak of the illness becomes imperative. Psychologically, a sound and strong mind can combat the aftermaths of this illness provided we accept the reality and remain hopeful and optimistic. This in can insure our immune system and overcome the problem despite of the physical complications. In order to understand the importance of sound mental health in better outcome of illness, we need to undertake case studies to have a better judgment about strong personalities who combat the illness like worriers who are fearless and daring.

In view of the convenient sampling method, sample size, means of data collection and illness condition we need to interpret the findings with caution. However, the sample study hails from one particular region and only after few days when they were exposed to COVID-19. Couple of other variables such as age, sex, and belief system should have been incorporate in this study to get a clearer picture of the scene. Due to unavoidable circumstances there was scope for a face-to-face interview with the participants and instead we had to administer the instruments in a web-based environment. The sample design this study was purposive and convenient method which may be viewed as a limitation of the study. We have been deprived of knowing the participants' nonverbal messages. There is every possibility in underestimating of on the contrary exaggerating their symptoms. However, in this study we had to accept the responses on face value which does not show the true picture of the problem at hand. In view of the nature of the problem, it would be advisable to engineer a combined method to strengthen the observations and better estimate the research parameters. The study should have been able to provide comparative picture of the participants' mental health status immediate after the outbreak and a gap of recovery from the illness. The study is restricting to LLM and probably incorporating other statistical methods could show a clearer picture of the moderating and mediating role of comorbidity and fear of death in predicting the participants' mental health condition. The last but not least limitations of the study is that the observations are made on a segment of people who out of choice or helplessness had to surrender themselves at the outbreak to the health system. However, we are ignorant about those who took self-treatment at home. The hospital environment, the attitude of families towards COVID-19 and the nature of their support at the time of crisis compared to those of health providers is another issue which is hidden from our eyes.

Despite of the limitations mentioned above, these observations have been able to estimate the parameters in a population with its specifications. With the increasing mental health burden during the COVID-19 outbreak, there have been increasing calls for enhanced mental health support. The Iranian health system with its institutionalized infrastructure mainly the primary health system (PHC) at urban and rural areas offers psychiatric services at family and community level. Nevertheless, there is an urgency to have a national guideline to specifically support the mental health of the nation during the COVID-19 outbreak. In view of the findings of this study we need to pay special attention to patients with physical or psychiatric comorbidities [**Error! Reference source not found.**]. Reportedly in the first two weeks following the outbreak conducted women and students experience a higher degree of the psychological impact of the outbreak, stress, anxiety, and depression [**Error! Reference source not found.**46]. Therefore, health authorities must identify community and

healthcare groups at a high risk of psychological morbidities for targeted early psychological interventions. It is essential for all physicians, particularly general practitioners (GP) and Emergency Department doctors, to proactively screen for psychological issues in patients who come in for consultations [47]. To this end healthcare professionals can consider using standard psychological instruments to assess the mental state of people who are under quarantine. We need a responsible and vigilant system to provide these patients with resources for psychological support, and if needed, refer to the psychiatrists for further evaluation and management [**Error! Reference source not found.**48]. However, to further meet the demands of the nation in this epidemic, it would be worthwhile to provide online or smartphone-based psych education about the virus outbreak, promote mental wellness and initiate psychological intervention such as cognitive behavior therapy (CBT) and mindfulness-based therapy (MBT) [49]. It is essential to provide a peer-support network for people to share their challenges and resolutions during the outbreak, in turn, fostering comradeship and resilience. It is important to safeguard the morale and mental health of the health worker which in turn can influence the success of healthcare delivery [49].

Conclusion

These observations led us to the conclusion that in the population under study the presence of comorbidity and high death anxiety increases the chance of developing anxiety-depressive symptoms. Analysis of the third-order-effects are significant enough to propose an association and interaction between these three variables. The result of the final analysis was a full or saturated model in which three first-order effects, three second order effects and one third order-effects were incubated in it. The full model provides an excellent fit for the data and there is no scope for any parsimonious model in which we can use lesser number of parameter for estimation. These observations reinforce the hypothesis proposed on the basis of Hill's (1958) ABC-X model which are on line with contemporary stress theories [**Error! Reference source not found.**29]. Our observations are on line with couple of studies around the globe. Health authorities must identify community and healthcare groups at a high risk of psychological morbidities for targeted early psychological interventions. It is essential for all physicians, particularly general practitioners (GP) and Emergency Department doctors, to proactively screen for psychological issues in patients who come in for consultations.

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Conflict of interest

We have conflict of interest in this work.

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