Fouad *et al.*
Egypt J Neurol Psychiatry Neurosurg (2023) 59:124
https://doi.org/10.1186/s41983-023-00724-5

The Egyptian Journal of Neurology, Psychiatry and Neurosurgery

RESEARCH

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Role of personality, health beliefs and fear of COVID-19 in engagement of adaptive and maladaptive behaviors among Egyptians during COVID-19 pandemic: a cross-sectional study

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Abstract

Background Social distancing and hand hygiene were highly recommended by WHO as an effective preventive strategy for the COVID-19 pandemic. However, people differ in their adherence to safety recommendations and may respond in maladaptive ways but the origins of these differences are poorly understood. The objective of this study was to investigate the association between, personality traits, health beliefs, and adaptive or maladaptive behaviors.

Methods The sample consisted of 1002 Egyptian adults who answered an online survey, which included: the health belief model, Big Five Personality Inventory, and Fear of COVID-19 Scale.

Results The results showed that females and workers in the medical field were more adherent to adaptive behaviors, while highly educated, and young adults were more liable to maladaptive behaviors. Conscientiousness as a personality trait was directly proportionate with practicing of adaptive behaviors among Egyptians, while higher openness trait was a risk factor for practicing maladaptive behaviors. High perceived hand hygiene and social distance barriers were significant risk factors that decrease the practicing of adaptive behaviors. There was a significant positive relationship between fear of COVID-19 and practicing adaptive behaviors.

Conclusions Personality traits play an important role in adaptive or maladaptive behavior towards the COVID-19 pandemic. These findings might help in planning prevention programs in the future.

Keywords COVID-19, Adaptive, Maladaptive behaviors, Personality, Health belief model

Introduction

Coronavirus disease (COVID-19) was first identified in Wuhan, China, and then spread globally. It was transmitted primarily by respiratory droplets and close contact [1]. To control the spread of the COVID-19 virus, World Health Organization WHO has recommended for certain precautionary measures and protective behaviors such as maintaining social distancing, washing hands, and using masks and sanitizers [2], which are also strictly recommended by the Egyptian government. Individual behavior has an important role in controlling the spread of COVID-19. It is well-documented that the adoption of protective behaviors by individuals is effective in slowing down the transmission and consequently negative impacts of the virus [3].

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On the other hand, "After WHO declared COVID-19 a global pandemic, several countries, including Egypt, implemented various measures like lockdowns to combat the waves of the pandemic, especially during the first year in 2020. These measures significantly heightened psychological distress and fears among the population. Our study represents one of the early investigations that documented the fears and behaviors of the Egyptian population during that period. The primary sources of fears included the risk of contracting the virus, experiencing complications, the potential for death, the loss of loved ones, and the financial repercussions. These concerns were reasonable given the sudden onset of such a widespread pandemic for which no curative treatment was available at the time [4, 5].

Individual adoption of health-related behaviors is controlled by many different factors [6], which also may be applied in the context of COVID-19. Uncertain novel situations can increase an individual's anxiety level which may lead both healthy and vulnerable individuals to engage in protective behaviors [7]. Engagement in protective behaviors during the COVID-19 pandemic may be affected by self-reported anxiety over the situation [8].

It was also assumed that engagement in protective behaviors in a pandemic may be easier for some people than others and these individual differences may be related to the disposition to engage in these behaviors. An example of how attitude and experienced level of anxiety are variant among the subjects and highly influenced by different factors, the reports by Ahmed et al. and Osman et al. [9, 10]. They found that health care workers exhibited a favorable attitude towards adopting adaptive behaviors and implementing protective measures. Nonetheless, they also reported elevated levels of anxiety when compared to non-health care workers and it was worse by presence of stigmatizing in some occupations that deal with COVID-19 such as health care provider.

The repercussions of COVID-19 extend beyond adults and also impact children. As indicated by Ahmed et al. [11, 12], children and adolescents underwent psychological strain during the pandemic, including heightened fear of the virus, particularly among those who had been infected. Moreover, the study revealed that children faced various other issues, such as delayed speech development, affective disorders, anxiety, pervasive developmental challenges, and oppositional defiant problems.

A personality trait is a stable characteristic that determines how people experience the world and the impact of these experiences [13]. The COVID-19 pandemic led the researchers to examine how personality traits affect individual engagement in adaptive protective behaviors as well as maladaptive behaviors (e.g., hoarding behaviors and compulsive buying) depending on one's health beliefs about the virus [13], as beliefs about certain threat link personality traits to health outcomes [14]. There are many social cognitive models that stress on the role of health-related beliefs as key determinants of an individual's behaviors [15]. Health Belief Model (HBM) is one of the most commonly used models in the literature to examine the adoption of health-protective behaviors [16].

Since the declaration of COVID-19 as a worldwide pandemic in March 2020, WHO has reported that over 6 million people have died from COVID-19 all over the world, with more than 60% of those deaths occurring before the approval, and global use of COVID-19 vaccines [17]. During this period, the only effective measures to prevent the spread of COVID-19 were continent-wide measures and the adherence of populations worldwide to guidelines established by the WHO. Therefore, gaining an understanding of people's behavior, attitudes, beliefs, emotions, and personality factors during such a crisis can aid in the development of improved health policies and promote compliance among the population in the future. Numerous studies have been conducted to explore the behavior of populations in different countries, including Brazil [18], Belgium [19], Europe [20], and recently, the United States [21]. Our study contributes to this line of research by analyzing various variables that may influence the behaviors, including, personality traits, beliefs, and emotions of the population during the COVID-19 pandemic in Egypt, one of the largest countries in the Middle East. Therefore, the current study aimed to examine the role of personality traits and the degree of COVID-19-related fear and beliefs in practicing adaptive and maladaptive behaviors among the Egyptian population during the COVID-19 crisis.

Methods

Study design and participants

This cross-sectional survey among Egyptian persons was carried out from the 1st of June to the end of July 2020 in Egypt using an online questionnaire as a Google form. Our sample was a comprehensive sample composed of one thousand (1002) Egyptian persons of both sexes who were valid participants. The inclusion criteria included Egyptian adults who accepted to participate in the study. The exclusion criteria included past or current history of known mental, cognitive, and substance use disorders. The questionnaire link was shared through strict Egyptian social groups on the social media platform "Facebook" Anonymity was ensured and electronic informed consent was obtained from each participant prior to filling the questionnaire. Calculation of the sample size, based on an online sample size calculator program (available at https://www.calculator.net/sample-size-calculator.html) for an unlimited population with the following

parameters; Confidence Interval (CI) 95% and a Margin of error = 5% and a reference study by Carvalho et al. [18] in Brazil. The survey protocol was approved by the Zagazig university institutional review board (IRB) (IRB No. # 6244/12-7-2020).

Measurement tools

Structured questionnaire

It was designed to collect data about: (a) sociodemographic factors, (b) information related to COVID-19, (c) cognitive factors, (d) practicing adaptive behavioral responses, (e) practicing of maladaptive behavioral responses.

Sociodemographic factors It included: age, sex (male/female), marital state (single/married/divorced/widow), education (illiterate/write and read/high school/collage/postgraduate studies), residence (rural/urban) and occupation (working/not working, inside/outside medical field).

Factors related to health beliefs and expectations The participant's beliefs and expectations related to the COVID-19 pandemic were assessed using items based on the health belief model (HBM). It included four dimensions: perceived susceptibility, perceived severity, perceived benefits, and perceived risks.

Following Nasir et al. [22], we used 18 items assessing HBM dimensions. All items were rated on a five-point Likert's scale (strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree = 5) as following:

i. Self-efficacy: was assessed by five items (e.g., "maintaining good health is an important part of my life"). A sum variable "self-efficacy to prevent COVID-19" (Cronbach's α 0. 73) was constructed from the five items and the mean was 22.44 ± 2.21 SD with scores < 22.44 considered (0) no efficacy and scores ≥ 22.44 considered (1) yes.
ii. Perceived risk of COVID-19 infection which consisted of:
iii. Risk susceptibility which describes the participant's belief about the probability of having coronavirus infection, was assessed by two items (e.g., "Corona infection is likely to develop"). A sum variable "Perceived susceptibility to COVID-19" (Cronbach's α = 0.80) was constructed from the two items and the mean score was 6.66 ± SD 1.96 with scores < 6.66 and ≥ 6.66 were considered as low susceptibility (0) and high susceptibility (1), respectively.
iv. Risk severity which describes participant belief about the consequences of coronavirus infection if it occurred, was assessed by three items (e.g., "If I get corona infection, the situation is risky"). Cronbach's α = 0.68 and mean score 11.9 ± SD 2.4 with scores < 11.9 and ≥ 11.9 were considered as low severity (0) and high severity (1).
v. Perceived benefits from practicing protective behaviors, described the participant's belief about the value and effectiveness of these behaviors in decreasing the risk of COVID-19 infection. It was assessed by four items (e.g., "Hand washing, use of disinfectants, masks, and gloves will protect me completely from corona" and "Social distancing and avoidance of unnecessary leaving home protects from corona infection"). For the variable "benefits of hand washing, using of disinfectants, masks, and gloves", Cronbach's α = 0.68 and the mean score was 8.18 ± SD 1.76, with scores < 8.18 and ≥ 8.18 were considered (0) no and (1) yes, respectively. For "benefits of social distancing and avoidance of unnecessary leaving home", Cronbach's α = 0. 83 and the mean was 9.07 ± SD 1.18 with scores < 9.07 and ≥ 9.07 considered (0) no and (1) yes, respectively.
vi. Perceived barriers to practicing protective behaviors which describe participant belief about difficulties and obstacles they might encounter when practicing the protective behaviors of coronavirus infection, was assessed by four items (e.g., "My hands get damaged due to hand hygiene" and "I feel bad by applying social distancing"). For "barriers of hand washing, use of disinfectants, masks, and gloves", Cronbach's α = 0.10 and the mean was 7.20 SD ± 1.62 with scores < 7.20 and ≥ 7.20 considered (0) no and (1) Yes, respectively. For "barriers of social distancing and avoidance of unnecessary leaving home", Cronbach's α = 0. 48 and the mean was 7.22 ± SD 1.87 with scores < 7.22 and ≥ 7.22 were considered (0) no and (1) yes, respectively.

Practicing adaptive behavioral responses [23, 24]

Individual differences in compliance to protective behaviors (hand washing, using disinfectants, masks and gloves, social distancing, and avoidance of unnecessary leaving home) which were recommended by WHO and governments to reduce the spread of COVID-19, were measured using four questions asking about the frequency of practicing these behaviors during the previous month (e.g. Were you washing your hands properly after coming in contact with objects or surfaces or when returning from outside?, Did you complied on social distancing and avoiding gatherings?). Answers of participants were rated on 5 points Likert-type scale (1 = never,

2 = rare, 3 = sometimes, 4 = often, and 5 = always) with Cronbach's α = 0.277 for hand hygiene and Cronbach's α = 0.780 for social distancing behavior. Low and high scores for practice were calculated according to median value, where those with a median value or more were considered to have high scores

Practicing of maladaptive behavioral responses [23, 24]

Participants were asked if they have practiced maladaptive behaviors which are hoarding behaviors such as buying excessive amounts of supplies (foods, disinfectants, masks, gloves, and medications) (e.g., Did you buy large quantities of foods in excess of your need and store them?), taking medications as prophylaxis without prescription, visiting the physicians and doing many investigations for symptoms suspected COVID-19 infection more than one time since the beginning of COVID-19 pandemic. Answers were divided into yes or no. (Cronbach's α = 0.65, mean = 13.12) Low and high scores for practice were calculated according to median value, where those with a median value or more were considered to have high scores.

Fear of COVID-19 scale (FCV-19S)

This new psychometric tool was used for the assessment of the severity of fears related to COVID-19 virus infection. This scale consists of 7 questions and the participant chooses an answer from "strongly disagree" = 1, "disagree" = 2, "neither agree nor disagree" = 3, "agree" = 4, and "strongly agree" = 5 with scores from 1 to 5 for each question. Total scores on the scale ranged from 7 to 35. The higher the score, the greater the fear of COVID-19 virus infection [19]. The Arabic version of this scale, used in this study, was translated and its reliability and validity were published by Alyami et al. (2020) [25].

The Arabic Big Five Personality Inventory (ABFPI)

The individual differences in personality traits were assessed by the Arabic Big Five Personality Inventory (ABFPI). The ABFPI assesses the high-order personality traits of Extraversion (E), Neuroticism (N), Agreeableness (A), Openness (O), and Conscientiousness. It consists of 25 short statements (five items for each factor). These items were selected from a large item pool (455 items, 87, and 86 items for each of the factors N, E, A, O, and C, respectively). The selection of items was based on different steps [21]. Each item of the ABFPI consists of 3 to 5 words and is answered on a four-point Likert type scale: 1 (No), 2 (Some), 3 (Much), and 4 (Always). The total score in each factor could range from 6 to 24, with higher scores on the factor indicating a higher trait standing. The original version of ABFPI was consisting of 30 items (six items for each factor). Based on item response theory, the author performed several analyses which resulted in the removal of one item from each factor. ABFPI has acceptable good internal consistency, test–retest reliability, and validity [26, 27].

Statistical analysis

A statistical software Package for the Social Sciences was utilized to analyze the data (SPSS, version 22.0, Chicago, IL). Qualitative variables were described by frequencies and percentages. The chi-square test was used for categorical data. Quantitative variables were described by the means and standard deviations, and the independent sample *t* test was used for comparison between means. Pearson correlation coefficient was used to evaluate the degree of relationship between two variables with a linear relationship. All results were considered statistically significant when the significant probability was less than 5% ($p < 0.05$).

Results

Sociodemographic characteristics of the participants

The mean age of the participants was 33 years (± 8.0). Seventy-one percent of the participants were females, 72.5% were married, 77.9% had an urban residence, 31.2% were unemployed and 56.2% had a university degree.

Cognitive beliefs (Health belief model HBM)

About 60% of the participants had high perceived susceptibility (Cronbach's α 0.80, mean = 6.66, high: scores ≥ 6.66), 58.3% had high perceived severity (Cronbach's α 0.68, mean = 11.9, high: scores ≥ 11.9), 56% of the participants believe in benefits of hand hygiene (Cronbach's α 0.68, mean = 8.18, scores ≥ 8.18) and 52.2% believe in benefits of social distance (Cronbach's α 0. 83, mean = 9.07, scores ≥ 9.07), 39.7% had barriers in hand hygiene (Cronbach's α 0.10, mean = 7.20, scores ≥ 7.20), 53.9% had barriers in the social distance (Cronbach's α 0. 48, mean = 7.22, scores ≥ 7.22) and finally 54.6% had inefficient self-evaluation (Cronbach's α 0. 73, mean = 22.44, scores < 22.44).

Personality (ABFPI)

Three out of four participants had high Extraversion, 53.3% had high Neuroticism, 97.7% had high Agreeableness, 86.1% had high Openness and 88% had high Conscientiousness.

Frequencies of practicing adaptive and maladaptive behaviors

Among study participants, 57.6% and 63.5% had a low practice of hand hygiene (Cronbach's α = 0.766, mean = 8.6, scores ≥) and social distance (Cronbach's α = 0.800, mean = 8.3), respectively, while 54.6% had

a high practice of maladaptive behavior (Cronbach's α = 0.65, mean = 13.12).

Correlates of adaptive and maladaptive behaviors

Males, working in non-medical fields, and unmarried (single and divorced) had significantly lower scores of practicing hand hygiene and social distancing. In addition, participants who lived in rural areas (P = 0.008) had significantly lower scores for practicing social distancing. Nevertheless, there is no significant statistical connection observed between the implementation of adaptive behaviors (such as practicing hand hygiene or maintaining social distance) and factors like age and education. In addition, participants who were young (between the ages of 18 and 30), unmarried, and had lower levels of education had significantly higher scores in engaging in maladaptive behaviors. However, no significant statistical association was found between the practice of maladaptive behavior and factors such as gender, place of residence, or occupation.

Association between personality traits and adaptive and maladaptive behaviors

Participants with low to normal openness ($P = 0.043$), Conscientiousness ($P = 0.032$), and agreeableness ($P = 0.042$) significantly had low scores of practicing hand hygiene, while those with low to normal Conscientiousness ($P = 0.047$) significantly had low scores of practicing social distancing as shown in Table 1. High openness ($P = 0.029$) and low to normal extraversion ($P = 0.006$) were significantly associated with high scores of practicing maladaptive behaviors as shown in Table 2.

Association between health beliefs and adaptive and maladaptive behaviors

Low scores of perceived benefits and self-efficacy and high scores of barriers were significantly associated with low practicing of both hand hygiene ($P = 0.003, < 0.001, < 0.001$, respectively) and social distance ($P \leq 0.001$). The low score of perceived benefits of social distancing ($P = 0.036$) was associated with the high practice of maladaptive behavior as shown in Tables 1 and 2.

Association between COVID-19-related fear and adaptive and maladaptive behaviors

Lower levels of fear of COVID-19 were significantly associated with low levels of practicing hand hygiene ($P \leq 0.001$) and social distancing ($P \leq 0.001$) and high levels of practicing maladaptive behaviors ($P \leq 0.001$), as shown in Table 1.

Using multivariate regression analysis, this study found that perceived barriers to hand hygiene and social distance were risk factors for low practice (OR = 2.12 and 1.54), respectively. On the other hand, female gender, the medical profession, high fear of COVID, Social distance perceived benefits and High Self-efficacy were protective factors against low practice of hand hygiene (OR = 0.48, 0.66, 0.62, 0.56 and 0.52, respectively), as shown in Table 3.

Using multivariate regression analysis to investigate factors associated with the low practice of social distance; non-university education, perceived Barriers to hand hygiene, and perceived barriers to social distance increase risk by 5.82, 1.46, and 1.55 folds, respectively. While female gender, the medical profession, high fear of COVID, Social distance perceived benefits, and High Self-efficacy were protective factors against the low practice of social distance (OR = 0.44, 0.52, 0.64, 0.61 and 0.60, respectively), as shown in Table 4.

Using multivariate backward regression analysis, this study found that openness was a risk factor for high practicing of maladaptive behavior (OR = 1.71), while high fear and extraversion were protective factors against the high practice of maladaptive behavior (OR = 0.58 and 0.65), respectively, as shown in Table 5.

Discussion

In the twenty-first century, we find ourselves in confrontation with a pandemic caused by a coronavirus that transmits COVID-19 for a long time before the emergence of vaccinations. To limit its spread, various containment measures have been advised, such as practicing social distancing and maintaining proper hand hygiene through handwashing. However, several factors influence people's adherence to these measures, either increasing or decreasing their compliance or practice of maladaptive behaviors. Therefore, our objective was to explore the extent to which sociodemographic factors, beliefs and expectations, fear, and personality traits, are connected to individuals' behavior during the Pandemic.

The findings of the present study revealed a statistically significant correlation between being male, unmarried, or divorced and working in a non-medical profession with lower scores in adhering to adaptive behaviors like hand hygiene and social distancing. These results align with numerous studies conducted in various countries, providing further support for our findings. In France, Raude et al. [15] reported that male participants are less engaging in preventive behaviors aiming to contain the spread of COVID-19. In China, Zhong et al. [28] referred in their study that single and divorced subjects are less engaged in adaptive behaviors. Moreover, during the previous pandemics (e.g., in SARS in 2003 [29] and influenza A/H1N1'human swine flu outbreak in 2009 [30]). The studies showed that married women had

Table 1 Relation between personality type and HBM, fear of COVID-19 and adaptive behavior

Variable			Hand hygiene				p	Social distance				*p*
			Low (*n* = 577)		High (*n* = 425)			Low (*n* = 636)		High (*n* = 366)		
Personality trait			**No**	**%**	**No**	**%**		**No**	**%**	**No**	**%**	
Extraversion	Low to normal	N = 255	142	55.7	113	44.3	0.477	151	59.2	104	40.8	0.102
	High	N = 747	435	58.2	312	41.8		485	64.9	262	35.1	
Neuroticism	Low to normal	N = 468	282	60.3	186	39.7	0.109	307	65.6	161	34.4	0.191
	High	N = 534	295	55.2	239	44.8		329	61.6	205	38.4	
Agreeableness	Low to normal	N = 23	18	78.3	5	21.7	0.042*	18	78.3	5	21.7	0.136
	High	N = 979	559	57.1	420	42.9		618	63.1	361	36.9	
Openness	Low to normal	N = 139	91	65.5	48	34.5	0.043*	96	69.1	43	30.9	0.14
	High	N = 863	486	56.3	377	43.7		540	62.6	323	37.4	
Conscientiousness	Low to normal	N = 120	80	66.7	40	33.3	0.032*	86	71.7	34	28.3	0.047*
	High	N = 882	496	56.3	385	43.7		550	62.4	331	37.6	
HBM items												
Perceived susceptibility	Low	N = 406	232	57.1	174	42.9	0.815	252	62.1	154	37.9	0.446
	High	N = 596	345	57.9	251	42.1		384	64.4	212	35.6	
Perceived severity	Low	N = 418	246	58.9	172	41.1	0.492	273	65.3	145	34.7	0.307
	High	N = 584	331	56.7	373	43.3		363	62.2	221	37.8	
Barrier to hand hygiene	No	N = 604	296	49	308	51	< 0.001**	353	58.4	251	41.6	< 0.001**
	Yes	N = 398	281	70.6	117	29.4		283	71.1	115	28.9	
Barrier to social distance	No	N = 462	220	47.6	242	52.4	< 0.001**	254	55	208	45	< 0.001**
	Yes	N = 540	357	66.1	183	33.9		382	70.7	158	29.3	
Self-efficacy	Low	N = 547	365	66.7	182	33.3	< 0.001**	388	70.9	159	9.1	< 0.001**
	High	N = 455	212	46.6	243	53.4		248	54.5	207	45.5	
Benefit of hand hygiene	No	N = 441	277	62.8	164	37.2	0.003*	294	66.7	147	33.3	0.063
	Yes	N = 561	300	53.5	261	46.5		342	61	219	39	
Benefit of social distance	No	N = 479	314	65.6	165	34.4	< 0.001**	332	69.3	147	30.7	< 0.001**
	Yes	N = 523	263	50.3	260	49.7		304	58.1	219	41.9	
Fear of COVID-19												
High (≥ 18)		N = 531	272	51.2	259	48.8	< 0.001**	307	57.8	224	42.2	< 0.001**
Low (< 18)		N = 471	305	64.8	166	35.2		329	69.9	142	30.1	

p for Chi-square test

*$p < 0.05$ is statistically significant **$p < 0.001$ is statistically highly significant

the highest frequency of practicing protective behaviors multivariate regression analysis in our study revealed that being female is a protective factor against the low practice of adaptive behaviors in Egypt and similar findings were reported by Bazaid et al. [31] in the Kingdom of Saudi Arabia (KSA). Females are more adherent to adaptive behaviors due to many reasons. First, at times of crisis and change [32], and during the COVID-19 pandemic [33], women are inherently better suited to perform caring roles than men. Second, being more strongly attached to and/or worrying more about their families, women could be more motivated to engage in adaptive behaviors [34]. Finally, it is well-reported that women are suffering from greater stress and anxiety during the COVID-19 pandemic [35] which pushes them to be more cautious about the methods of prevention. However, Park et al. [36] reported that no significant differences in hand hygiene behaviors were observed between female and male respondents among physicians. The differences among the studies can be explained by enrolling different types of participants at different times (Nonpandemic vs. pandemic).

In our study, the findings showed that the profession and education level affect the person's behavior during COVID-19. Being a worker in the medical field is a good predictive factor of well-practicing adaptive behaviors. Limbu et al. [37] reported that healthcare workers had better knowledge and attitude regarding the practice

Table 2 Relation between personality type and HBM items and fear of COVID-19 and maladaptive behavior

Variable			Maladaptive behavior				*P*
			Low (*n* = 455)		High (*n* = 547)		
			No	%	No	%	
Personality trait							
Extraversion	Low to normal	N = 255	97	38	158	62	0.006*
	High	N = 747	358	47.9	389	52.1	
Neuroticism	Low to normal	N = 468	202	43.2	266	56.8	0.181
	High	N = 534	253	47.4	281	52.6	
Agreeableness	Low to normal	N = 23	9	39.1	14	60.9	0.541
	High	N = 979	446	45.6	533	54.4	
Openness	Low to normal	N = 139	75	54	64	46	0.029*
	High	N = 863	380	44	483	56	
Conscientiousness	Low to normal	N = 120	55	45.8	65	54.2	0.921
	High	N = 882	400	45.4	482	54.6	
HBM							
Perceived susceptibility	Low	N = 406	170	41.9	236	58.1	0.063
	High	N = 596	285	47.8	311	52.2	
Perceived severity	Low	N = 418	189	45.2	229	54.8	0.917
	High	N = 584	266	45.5	318	54.5	
Barrier to hand hygiene	No	N = 604	280	46.4	324	53.6	0.458
	Yes	N = 398	175	44	223	56	
Barrier to social distance	No	N = 462	214	46.3	248	53.7	0.592
	Yes	N = 540	241	44.6	299	55.4	
Self-efficacy	Low	N = 547	240	43	307	56.1	0.285
	High	N = 455	215	47.3	240	52.7	
Benefit of hand hygiene	No	N = 441	185	42	256	58	0.051
	Yes	N = 561	270	48.1	291	51.9	
Benefit of social distance	No	N = 479	201	42	278	58	0.036*
	Yes	N = 523	254	48.6	269	51.4	
Fear of COVID-19							
High (≥ 18)		N = 531	274	51.6	257	48.4	< 0.001**
Low (<18)		N = 471	181	38.4	290	61.6	

P for Chi-square test

*$p < 0.05$ is statistically significant **$p < 0.001$ is statistically highly significant

of health-protective behaviors of COVID-19 than non-medical workers. Furthermore, individuals with lower levels of education (below university) exhibit approximately six times (odds ratio = 5.82) lower likelihood of engaging in social distancing compared to individuals with higher education (university level). Comparable patterns have been documented in the Kingdom of Saudi Arabia (KSA) as well [31].

Regarding the practice of maladaptive behaviors, the young age (18–30 years) and single status were risk factors for high scores of practicing maladapting behaviors, while low education (uneducated or can read and write participants) was associated with less practicing of maladaptive behaviors (e.g., hoarding or excessive buying, frequent visiting of doctors and doing COVID-19 investigations). Oosterhoff et al. [38] reported that 20% of teens in the USA had maladaptive behaviors specifically hoarding during the COVID-19 pandemic. In addition, there was a negative correlation between age and COVID-19 stress in a sample of American adults, with younger individuals reporting more stress [36]. This suggests that young adults may engage in less positive thinking as a coping strategy, which could result in maladaptive outcomes [39]. Regarding the role of educational level, Syahrivar [40] reported in his study that highly educated people engaged in hoarding of basic needs during

Table 3 Multivariate analysis of factors associated with low hand hygiene practice behavior of the studied patients

Variable	B	S.E	Wald	Sig	OR	95% C.I	
Age class	− 0.033	0.166	0.039	0.843 NS	0.968	0.699	1.339
Female sex	− 0.743	0.196	14.371	< 0.001**	0.476	0.324	0.698
Married	− 0.335	0.191	3.077	0.079 NS	0.715	0.492	1.040
Urban residence	0.154	0.186	0.684	0.408 NS	1.167	0.810	1.681
Working in medical field	− 0.411	0.160	6.638	0.010*	0.663	0.485	0.906
Before university education levels	− 0.242	0.540	0.202	0.653 NS	0.785	0.273	2.260
High fear	− 0.477	0.156	9.343	0.002*	0.621	0.457	0.843
Perceived Susceptibility	0.072	0.148	0.238	0.626 NS	1.075	0.804	1.438
Perceived severity	− 0.016	0.155	0.011	0.918 NS	0.984	0.726	1.334
Hand hygiene perceived benefits	− 0.044	0.170	0.066	0.797 NS	0.957	0.685	1.337
Social distance perceived benefits	− 0.582	0.170	11.684	0.001*	0.559	0.401	0.780
Perceived Barriers for hand hygiene	0.752	0.153	24.109	< 0.001**	2.121	1.571	2.864
Perceived Barriers for social distance	0.431	0.150	8.262	0.004*	1.539	1.147	2.064
High Self efficacy	− 0.646	0.148	19.046	< 0.001**	0.524	0.392	0.701
Extraversion	0.045	0.166	0.073	0.788 NS	1.046	0.756	1.446
Neuroticism	− 0.299	0.165	3.276	0.070 NS	0.742	0.537	1.025
Agreeableness	− 0.545	0.590	0.852	0.356 NS	0.580	0.182	1.844
Openness	− 0.132	0.239	0.306	0.580 NS	0.876	0.549	1.399
Conscientiousness	− 0.235	0.265	0.782	0.376 NS	0.791	0.470	1.330

AOR: adjusted odds ratio; CI: confidence interval

Table 4 Multivariate analysis of factors associated with low social distancing practice behavior of the studied patients

	B	S.E	Wald	Sig	OR	95% CI	
Age class	0.086	0.167	0.262	0.609	1.089	0.785	1.512
Female sex	− 0.829	0.202	16.832	< 0.001**	0.437	0.294	0.649
Married	− 0.379	0.195	3.790	0.052 NS	0.684	0.467	1.003
Urban residence	0.308	0.194	2.530	0.112 NS	1.361	0.931	1.988
Working in medical field	− 0.655	0.160	16.726	< 0.001*	0.519	0.379	0.711
Before university education levels	1.761	0.807	4.762	0.029*	5.816	1.196	28.271
High fear	− 0.454	0.158	8.222	0.004*	0.635	0.465	0.866
Perceived Susceptibility	0.141	0.150	0.882	0.348 NS	1.152	0.858	1.546
Perceived severity	− 0.106	0.158	0.453	0.501 NS	0.899	0.660	1.225
Hand hygiene perceived benefits	− 0.037	0.173	0.047	0.828 NS	0.963	0.687	1.351
Social distance perceived benefits	− 0.498	0.172	8.350	0.004*	0.607	0.433	0.852
Perceived barriers for hand hygiene	0.377	0.156	5.847	0.016*	1.458	1.074	1.979
Perceived barriers for social distance	0.435	0.153	8.136	0.004*	1.545	1.146	2.084
High self efficacy	− 0.516	0.151	11.676	0.001*	0.597	0.444	0.803
Extraversion	0.141	0.167	0.717	0.397 NS	1.151	0.831	1.596
Neuroticism	− 0.081	0.167	0.237	0.626 NS	0.922	0.665	1.279
Agreeableness	− 0.182	0.593	0.095	0.758 NS	0.833	0.261	2.664
Openness	− 0.061	0.243	0.064	0.800 NS	0.940	0.584	1.513
Conscientiousness	− 0.375	0.271	1.924	0.165 NS	0.687	0.404	1.168

AOR: adjusted odds ratio; CI: confidence interval

the pandemic which supports our results. This could be rationally driven, because such a group of people constantly update their knowledge about disasters and anticipate future shortages of basic needs.

Table 5 Multivariate analysis of factors associated with high maladaptive behavior of the studied patients

Variable	B	S.E	Wald	P	AOR	95% CI	
Age class	− 0.071	0.156	0.208	0.648	.931	0.686	1.264
Female sex	0.304	0.178	2.912	0.088	1.355	0.956	1.921
Married	− 0.262	0.179	2.126	0.145	0.770	0.541	1.094
Urban residence	0.055	0.175	0.099	0.754	1.056	0.750	1.488
Working in medical field	0.113	0.152	0.559	0.455	1.120	0.832	1.508
Before university education levels	− 0.858	0.529	2.628	0.105	0.424	0.150	1.196
High fear	− 0.544	0.147	13.723	< 0.001**	0.580	0.435	0.774
Perceived susceptibility	− 0.193	0.140	1.908	0.167	0.824	0.627	1.084
Perceived severity	0.256	0.147	3.042	0.081	1.292	0.969	1.723
Hand hygiene perceived benefits	− 0.152	0.160	0.903	0.342	0.859	0.628	1.175
Social distance perceived benefits	− 0.069	0.161	0.185	0.667	0.933	0.681	1.279
Perceived Barriers for hand hygiene	0.055	0.143	0.148	0.701	1.056	0.799	1.397
Perceived Barriers for social distance	0.087	0.143	0.367	0.544	1.091	0.823	1.445
High self efficacy	− 0.152	0.141	1.155	0.282	0.859	0.651	1.133
Extraversion	− 0.439	0.158	7.692	0.006*	0.645	0.473	0.879
Neuroticism	− 0.209	0.154	1.844	0.174	0.811	0.600	1.097
Agreeableness	− 0.433	0.492	0.773	0.379	0.649	0.247	1.703
Openness	0.534	0.220	5.897	0.015*	1.705	1.108	2.623
Conscientiousness	− 0.117	0.240	0.236	0.627	0.890	0.556	1.424

AOR: adjusted odds ratio; CI: confidence interval

The present study brings attention to interesting findings concerning the relationship between the type of behavior and specific personality traits among the Egyptian population during the pandemic. Conscientiousness as a personality trait is directly proportionate with the practicing of adaptive behaviors, which aligns with other research findings in Japan [14]. This relationship can be explained by the view of conscientiousness, a measure of self-control and planning, is positively related to social distancing and to indicators of cautious rule-following like hand-washing and stockpiling goods. Therefore, our findings revealed that the degree of consciousness may be a good indicator for people to be adherent to health-related regulations, especially during crisis time.

Another aspect concerning the relationship between personality traits and population behavior is practicing maladaptive behaviors. Our study showed that higher openness is a risk factor, while higher extraversion was a protective factor against the practice of maladaptive behavior according to multivariate backward regression analysis. To interpret these findings, Openness includes the dimension of imaginativeness [41] and predicts various kinds of creativity such as divergent thinking [42]. Therefore, open people could come up with various preventive strategies. Being open helps individuals tackle novel situations effectively by visualizing precautions. Consequently, they may adopt hoarding behaviors as a preventive strategy [43].

Various maladaptive behavioral responses to the COVID-19 pandemic have been reported (e.g., buying and hoarding masks, alcohol for disinfection, instant foods, and toilet paper). Individuals engage in hoarding behavior to deal with situations in which they may not be able to buy products that are in short supply and to decrease their risk of infection by buying large quantities of essential products and staying home [43]. This behavior leads to a shortage of products crisis which is well-reported in many countries such as Australia, Italy, Japan, Singapore, Spain, the United Kingdom, and the United States [44]. Therefore, our study helps to identify the risk factors of such behavior and represents a focus for further research for a better understanding of those maladaptive behaviors. our results revealed that perceived benefits, barriers, and self-efficacy assessed by HBM have a significant impact on the practicing of adaptive protective behaviors by the Egyptian population during the COVID-19 pandemic. High perceived hand hygiene and social distance barriers were significant risk factors that decrease the practicing of both adaptive behaviors, while high perceived benefits and high self-efficacy were significant protective factors that enhance the practicing of adaptive behaviors. These findings are consistent with the findings of Barakat and Kasemy [45] who reported that benefits and self-efficacy had a significant positive relationship, while barriers had a significant negative relationship with

adherence to COVID-19 preventive behaviors in Egypt. Other supporting findings to our results, reported in different countries (United States, Mexico, China, and Taiwan) [46].

Similarly, Tong et al. [47] showed that perceived benefits, with positive valence, and perceived barriers, with negative valence, were both significantly related to practicing COVID-19 precautionary behaviors. Mehanna et al. [48] also found that high self-efficacy enhances; however, high perceived barriers decrease the adherence to protective behaviors among the Sudanese population.

Another exciting result emerges when examining the association between engaging in maladaptive behavior and the nature of one's beliefs. In our study, practicing-maladaptive behaviors (e.g., hoarding or excessive buying and frequent visiting of doctors and doing COVID-19 investigations) was associated with lower benefits of social distancing; however, none of the HBM model items was a significant predictor of practicing maladaptive behaviors. This result can be attributed to, individuals who perceive low benefits in practicing social distancing, would exhibit poor adherence to social distancing measures, and would frequently go out to excessively stock up on supplies or visit medical professionals. in Inharmony with our findings, Chua, et al. [49] found that perceived susceptibility, outcome expectation, cues to action, and self-efficacy have a significant influence on consumers' perception of scarcity which had a strong link to panic buying during the COVID-19 pandemic.

Emotion is another variable that impacts the outcome of behaviors. In this study, we tried to explore the relationship between COVID-19-related fear and individual behavior. A significant positive relationship between fear of COVID-19 and practicing both adaptive behaviors, while there is a negative relationship between fear of COVID-19 and practicing of maladaptive behavior. The most striking finding of this study, a high level of fear was a protective factor against low scores inpracticing adaptive behaviors. This means that fear of COVID-19 had a functional role that promoting the practicing of adaptive behaviors. Moreover, Cypryańska and Nezlek [50] found that COVID-19 fear and anxiety mediated relationships between threat perceptions and coping protective behaviors; however, feeling panic/paralyzed by fear mediated the relationship between the threat and hoarding behaviors. Analyzing these findings through the lens of the previous study, we can infer that fear of COVID-19 can be viewed as a double-edged sword. On one hand, it can bolster adherence to adaptive behaviors, while on the other hand, if the fear surpasses a tolerable threshold, it may lead to a variety of psychological and psychiatric symptoms.

Limitations

First, the design of the present study is cross-sectional, so it is not feasible to trace the cause–effect relationship between different factors and the practice of adaptive and maladaptive behaviors. Second, there may be self-report biases (e.g., social desirability) and systematic sampling errors (e.g., failure to reach all the eligible participants of the target population) in this self-report survey. Third, it remains unknown how cultural factors would influence COVID-19 precautionary behaviors. Fourth, cues to action as one of the HBM constructs were not assessed in this study to avoid a long questionnaire; however, knowing the triggers instigating participants to adhere to the protective measures would have certainly added to this work.

Despite these limitations, this study had strengths and clinical implications. This study is one of few studies in Arab countries and especially Egypt which assessed the role of many factors including sociodemographic factors, personality, cognitive beliefs, and fear of COVID-19 on compliance on practicing adaptive and maladaptive behaviors among a large sample of Egyptian people during COVID-19 pandemic. Our findings support the role of beliefs, personality traits, and fear as predictors for compliance with COVID-19 precautionary behaviors and also give insight into the promotion of precautionary measures via HBM and personality-based interventions in the COVID-19 pandemic and other possible pandemics in the future.

Conclusions

Many factors affect the behavior of the population during COVID-19. Female sex and being a worker in the medical field are significant factors that promote practicing adaptive behavior. Although low educated people are less practicing of maladaptive behaviors; however, they are less practicing of protective adaptive behaviors. All these factors should be considered while preparing the preventive programs. Personality can act as a mediator between demographic factors and individual coping and health-related behavior, especially consciousness traits. High perceived barriers are cognitive risk factors for poor compliance, while high perceived benefits, self-efficacy, and higher levels of fear were the most significant predictors of good compliance in practicing of adaptive protective behaviors among the population during the COVID-19 pandemic.

Abbreviations

ABFPI	Arabic Big Five Personality Inventory
COVID-19	Coronavirus-2019
FCV-19	Fear of COVID-19 Scale
HBM	Health belief model
IRB	Institutional review board

KSA	Kingdom of Saudi Arabia
O.D.	Odds Ratio
SPSS	Statistical software Package for the Social Sciences
USA	United States of America
WHO	World Health Organization

Acknowledgements
Not applicable.

Author contributions
MB put the idea and the design of the study. EF, SA, and MS have collected the data and tabulate them. DE analyzed the data. All authors were involved in writing and editing the manuscript before submission.

Funding
Not applicable.

Availability of data and materials
Data will be available from the corresponding author if needed.

Declarations

Ethics approval and consent to participate
This study was approved by IRB of the faculty of medicine, Zagazig university, Egypt and all participants signed a written consent to be included in the study.

Consent for publication
All authors agreed to publish the manuscript and reviewed it before submission.

Competing interests
The authors declare that they do not have any competing interests.

Received: 14 September 2022 Accepted: 18 August 2023
Published online: 31 August 2023

References

1. Ali SA, Baloch M, Ahmed N, Ali AA, Iqbal A. The outbreak of Coronavirus Disease 2019 (COVID-19)—an emerging global health threat. J Infect Dis Public Health. 2020;13:644–6.
2. Anderson RM, Heesterbeek H, Klinkenberg D, Hollingsworth TD. How will country-based mitigation measures influence the course of the COVID-19 epidemic? Lancet. 2020;395:931–4.
3. Cowling BJ, Ali ST, Ng TWY, Tsang TK, Li JCM, Fong MW, Liao Q, Kwan MY, Lee SL, Chiu SS, Wu JT, Wu P, Leung GM. Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study. Lancet Public Health. 2020;5(5):e279–88. https://doi.org/10.1016/S2468-2667(20)30090-6.
4. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiatry Res. 2020;288: 112954.
5. Mukhtar S. Pakistanis' mental health during the COVID-19. Asian J Psychiatry. 2020;51: 102127.
6. Friedman HS, Kern ML. Personality, well-being, and health. Annu Rev Psychol. 2014;65:719–42.
7. Ahmed GK, Ramadan HK, Refay SM, et al. Comparison of knowledge, attitude, socioeconomic burden, and mental health disorders of COVID-19 pandemic between general population and health care workers in Egypt. Egypt J Neurol Psychiatry Neurosurg. 2021;57:25. https://doi.org/10.1186/s41983-021-00280-w.
8. Osman DM, Khalaf FR, Ahmed GK, et al. Worry from contracting COVID-19 infection and its stigma among Egyptian health care providers. J Egypt Public Health Assoc. 2022;97:2. https://doi.org/10.1186/s42506-021-00099-6.
9. Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target populations. Psychiatry Clin Neurosci. 2020;74:281–2. https://doi.org/10.1111/pcn.12988.
10. Shiina A, Niitsu T, Kobori O, Idemoto K, Hashimoto T, et al. Relationship between perception and anxiety about COVID-19 infection and risk behaviors for spreading infection: a national survey in Japan. Brain Behav Immun Health. 2020;6: 100101.
11. Ahmed GK, Elbeh K, Gomaa HM, et al. Does COVID-19 infection have an impact on children's psychological problems? Middle East Curr Psychiatry. 2021;28:77. https://doi.org/10.1186/s43045-021-00155-z.
12. Ahmed GK, Mostafa S, Elbeh K, et al. Effect of COVID-19 infection on psychological aspects of pre-schooler children: a cross-sectional study. Middle East Curr Psychiatry. 2022;29:42. https://doi.org/10.1186/s43045-022-00207-y.
13. Carvalho LF, Pianowski G, Gonçalves AP. Personality differences and COVID-19: Are extroversion and conscientiousness personality traits associated with engagement with containment measures? Trends Psychiatry Psychother. 2020;42:1–6.
14. Yoshitake N, Omori M, Sugawara M, Akishinonomiya K, Shimada S. Do health beliefs, personality traits, and interpersonal concerns predict TB prevention behavior among Japanese adults? PLoS ONE. 2019;14(4): e0211728. https://doi.org/10.1371/journal.pone.0211728.
15. Raude J, Lecrique J-M, Lasbeur L, Leon C, Guignard R, du Roscoät E, Arwidson P. Determinants of preventive behaviors in response to the COVID-19 pandemic in France: comparing the sociocultural, psychosocial, and social cognitive explanations. Front Psychol. 2020;11:584500. https://doi.org/10.3389/fpsyg.2020.
16. Conner, M., & Norman, P. (Eds.). (2015). Predicting Health Behavior, Coronavirus disease (COVID-19) advice for the public. 3rd ed. London: McGraw-Hill Education. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public. Accessed 21 Mar 2020.
17. World Health Organization. WHO Coronavirus (COVID-19) Dashboard. https://covid19.who.int. Accessed 21 Oct 2020.
18. Carvalho LF, Pianowski G, Gonçalves AP. Personality differences and COVID-19: are extroversion and conscientiousness personality traits associated with engagement with containment measures? Trends Psychiatry Psychother. 2020;42(2):179–84. https://doi.org/10.1590/2237-6089-2020-0029.
19. Hoffmann A, Plotkina D, Roger P, D'Hondt C. Superstitious beliefs, locus of control, and feeling at risk in the face of Covid-19. Pers Individ Diff. 2022;196:111718. https://doi.org/10.1016/j.paid.2022.111718.
20. Airaksinen J, Komulainen K, Jokela M, Gluschkoff K. Big Five personality traits and COVID-19 precautionary behaviors among older adults in Europe. Aging Health Res. 2021;1(4):1–5. https://doi.org/10.1016/j.ahr.2021.100038.
21. Peters H, Götz FM, Ebert T, Müller SR, Rentfrow PJ, Gosling SD, Obschonka M, Ames D, Potter J, Matz SC. Regional personality differences predict variation in early COVID-19 infections and mobility patterns indicative of social distancing. J Pers Soc Psychol. 2023;124(4):848–72. https://doi.org/10.1037/pspp0000439.
22. Nasir EF, Yagoub HMA, Alhag AK. Study of the Sudanese perceptions of COVID-19: applying the Health Belief Model. medRxiv. 2020. https://doi.org/10.1101/2020.05.28.20115477.
23. Nowak B, Brzóska P, Piotrowski J, Sedikides C, Żemojtel-Piotrowska M, Jonason PK. Adaptive and maladaptive behavior during the COVID-19 pandemic: the roles of dark triad traits, collective narcissism, and health beliefs. Pers Individ Diff. 2020;167:110232. https://doi.org/10.1016/j.paid.2020.110232.
24. Brailovskaia J, Margraf J. Predicting adaptive and maladaptive responses to the Coronavirus (COVID-19) outbreak: a prospective longitudinal study. Int J Clin Health Psychol. 2020;20(3):183–91.
25. Alyami M, Henning M, Krägeloh CU, Alyami H. Psychometric Evaluation of the Arabic Version of the Fear of COVID-19 Scale. Int J Ment Health Addict. 2020. https://doi.org/10.1007/s11469-020-00316-x.
26. Abdel Khalek AM. The Arabic big five personality inventory (ABFPI): setting the stage. Psychol Behav Sci Int J. 2018. https://doi.org/10.19080/PBSIJ.2018.09.555766.
27. Abdel Khalek AM. Psychometric properties of the Arabic big five personality inventory (ABFPI). Psychol Behav Sci Int J. 2019;11:555820. https://doi.org/10.19080/PBSIJ.2019.11.555820.

28. Zhong BL, Luo W, Li HM, Zhang QQ, Liu XG, Li WT, Li Y. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. Int J Biol Sci. 2020;16:1745–52. https://doi.org/10.7150/ijbs.45221.
29. Tang CS, Wong CY. Factors influencing the wearing of facemasks to prevent the severe acute respiratory syndrome among adult Chinese in Hong Kong. Prev Med. 2004;39:1187–93.
30. Lau JT, Griffiths S, Choi KC, Lin C. Prevalence of preventive behaviors and associated factors during early phase of the H1N1 influenza epidemic. Am J Infect Control. 2010;38:374–80.
31. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and practice of personal protective measures during the COVID-19 pandemic: a cross-sectional study in Saudi Arabia. PLoS ONE. 2020;15:e0243695. https://doi.org/10.1371/journal.pone.0243695.
32. Brescoll VL, Uhlmann EL, Newman GE. The effects of system-justifying motives on endorsement of essentialist explanations for gender differences. J Pers Soc Psychol. 2013;105:891–908. https://doi.org/10.1037/a0034701.
33. Ausín B, González-Sanguino C, Castellanos MA, Muñoz M. Gender-related differences in the psychological impact of confinement as a consequence of COVID-19 in Spain. J Gender Stud. 2020. https://doi.org/10.1080/09589236.2020.1799768.
34. Androsik A. Gendered understanding of Ebola crisis in Sierra Leone. Lessons for COVID-19. Population and Economics. 2020;4:88–95. https://doi.org/10.3897/popecon.4e53301.
35. Fisher AN, Ryan MK. Gender inequalities during COVID-19. Group Process Intergroup Relat. 2021;24:237–45.
36. Park S, Lee E, Park SY, Lee E, Park JWN, Yu SN, Kim T, Jeon MH, Choo EJ, Kim TH. Gender divergences in psychosocial determinants of hand hygiene among doctors. Open Forum Infect Dis. 2019;6:428.
37. Limbu DK, Piryani RM, Sunny AK. Healthcare workers' knowledge, attitude and practices during the COVID-19 pandemic response in a tertiary care hospital of Nepal. PLoS ONE. 2020;15(11): e0242126. https://doi.org/10.1371/journal.pone.0242126.
38. Oosterhoff B, Palmer CA. Attitudes and psychological factors associated with news monitoring, social distancing, disinfecting, and hoarding behaviors among US adolescents during the coronavirus disease 2019 pandemic. JAMA Pediatr. 2020. https://doi.org/10.1001/jamapediatrics.2020.1876.
39. Volk AA, Brazil KJ, Franklin-Luther P, Dane AV, Vaillancourt T. The influence of demographics and personality on COVID-19 coping in young adults. Personal Individ Diff. 2021;168:110398. https://doi.org/10.1016/j.paid.2020.110398.
40. Syahrivar J. COVID-19-induced hoarding intention among the educated segment in Indonesia. SAGE Open. 2021. https://doi.org/10.1177/21582440211016904.
41. John OP, Naumann LP, Soto CJ. Paradigm shift to the integrative big five trait taxonomy. History, measurement, and conceptual issues. In: John OP, Robins RW, Pervin LA, editors. Handbook of personality theory and research. 3rd ed. New York: Guilford Press; 2008. p. 114–59.
42. Silvia PJ, Nusbaum EC, Berg C, Martin C, O'Connor A. Openness to experience, plasticity, and creativity: exploring lower-order, high-order, and interactive effects. J Res Pers. 2009;43:1087–90. https://doi.org/10.1016/j.jrp.2009.04.015.
43. Yoshino S, Shimotsukasa T, Hashimoto Y, Oshio A. The association between personality traits and hoarding behavior during the COVID-19 pandemic in Japan. Person Individ Diff. 2021;179:110927. https://doi.org/10.1016/j.paid.2021.110927.
44. Bentall RP, Lloyd A, Bennett K, McKay R, Mason L, Murphy J, et al. Pandemic buying: testing a psychological model of over-purchasing and panic buying using data from the United Kingdom and the Republic of Ireland during the early phase of the COVID-19 pandemic. PLoS ONE. 2021;16(1): e0246339. https://doi.org/10.1371/journal.pone.0246339.
45. Barakat AM, Kasemy ZA. Preventive health behaviors during coronavirus disease 2019 pandemic based on health belief model among Egyptians. Middle East Curr Psychiatry. 2020;27:43. https://doi.org/10.1186/s43045-020-00051-y.
46. Hsing JC, Ma J, Barrero-Castillero A, Jani SG, Pulendran UP, Lin BJ, Thomas-Uribe M, Wang CJ. Influence of health beliefs on adherence to COVID-19 preventative practices: international, social media-based survey study. J Med Internet Res. 2021;23: e23720.
47. Tong KK, Chen JH, Yu EW, Wu AM. Adherence to COVID-19 precautionary measures: applying the health belief model and generalized social beliefs to a probability community sample. Appl Psychol Health Well Being. 2020. https://doi.org/10.1111/aphw.12230.
48. Mehanna A, Elhadi YA, Lucero-Prisno DE. Factors influencing intention to adhere to precautionary behavior in times of COVID-19 pandemic in Sudan an application of the Health Belief Model. medRxiv. 2020. https://doi.org/10.1101/2020.12.25.20248859.
49. Chua G, Yuen KF, Wang X, Wong YD. The determinants of panic buying during COVID-19. Int J Environ Res Public Health. 2021;18:3247. https://doi.org/10.3390/ijerph18063247.
50. Cypryańska M, Nezlek JB. Anxiety as a mediator of relationships between perceptions of the threat of COVID-19 and coping behaviors during the onset of the pandemic in Poland. PLoS ONE. 2020. https://doi.org/10.1371/journal.pone.0241464.

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