Fear of the coronavirus (COVID-19): Predictors in an online study conducted in March 2020

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Abstract

Fear is an adaptive response in the presence of danger. However, when threat is uncertain and continuous, as in the current coronavirus disease (COVID-19) pandemic, fear can become chronic and burdensome. To identify predictors of fear of the coronavirus, we conducted an online survey (N = 439) three days after the World Health Organization declared the coronavirus outbreak a pandemic (i.e., between March 14 and 17, 2020). Fear of the coronavirus was assessed with the newly developed Fear of the Coronavirus Questionnaire (FCQ) consisting of eight questions pertaining to different dimensions of fear (e.g., subjective worry, safety behaviors, preferential attention), and an open-ended question. The predictors included psychological vulnerability factors (i.e., intolerance of uncertainty, worry, and health anxiety), media exposure, and personal relevance (i.e., personal health, risk for loved ones, and risk control). We found four predictors for the FCQ in a simultaneous regression analysis: health anxiety, regular media use, social media use, and risks for loved ones ($R^2 = .37$). Furthermore, 16 different topics of concern were identified based participants' open-ended responses, including the health of loved ones, health care systems overload, and economic consequences. We discuss the relevance of our findings for managing people's fear of the coronavirus.

Keywords: Fear; Coronavirus; Intolerance of uncertainty; Health anxiety; Media

1. Introduction

Fear is an adaptive emotion that serves to mobilize energy to deal with potential threat. However, when fear is not well calibrated to the actual threat, it can be maladaptive. For instance, when fear is too excessive, this may have detrimental effects both at the individual level (e.g., mental health problems such as phobia and social anxiety), and at the societal level (e.g., panic shopping or xenophobia). On the other hand, when there is insufficient fear, this may also result in harm for individuals and society (e.g., due to people ignoring government measures to slow the spread of coronavirus or due to reckless policies that ignore the risks). Furthermore, fear triggers safety behaviors (e.g., hand washing) that can mitigate certain threats (e.g., contamination), but they may paradoxically also enhance fear (e.g., contamination concerns and health anxiety) (see Deacon & Maack, 2008; Engelhard et al., 2015; Olatunji et al., 2011). Likewise, societal safety measures (e.g., lockdowns) have their use to prevent spreading of infections. However, when such safety measures are too prolonged or strict, they can have negative consequences (e.g., disruption of the economy, unemployment).

With the outbreak of the coronavirus disease (COVID-19; from here on simply referred to as the coronavirus) in China in December 2019 and in Europe in February 2020, national polls indicate sharp increases in fear and worries relating to the virus (Asmundson & Taylor, 2020a; McCarthy, 2020). In a survey of 44,000 participants conducted in Belgium in the beginning of April 2020, the number of people reporting an anxiety (20%) or a depressive disorder (16%) had increased substantially compared to a survey conducted in 2018 (i.e., 11% and 10% prevalence, respectively) (Sciensano, 2020). Furthermore, economic forecasts are predicting reduced economic growth (OECD, 2020) and preliminary reports are indicating increased negative attitudes to nationals from countries most heavily affected by the coronavirus (Sorokowski et al.,

2020). As fear may be a central construct in explaining these negative individual and societal consequences of the coronavirus pandemic, it is important to better understand what people are exactly afraid of and establish relevant predictors.

Initial reports indicate that people's fears of the coronavirus relate to different topics. Particularly, Taylor et al. (2020) recently developed the Coronavirus Stress Scale (CSS) and identified five factors of stress and anxiety symptoms relating to the coronavirus in two large samples in Canada and the United States: (1) Danger and contamination, (2) fears about economic consequences, (3) coronavirus-related xenophobia, (4) compulsive checking and reassurance seeking, and (5) traumatic stress symptoms. In parallel, but based on a conceptual analysis, Schimmenti et al. (2020) identified four domains of fear: (1) Fear for the body, (2) fear for significant others, (3) fear of not knowing, and (4) fear of inaction. Though these reports provide an initial overview of different topics of fear and anxiety-related behaviors relating to the coronavirus pandemic, they did not give an indication of the relative prevalence to which people worry about these different topics of fear. Furthermore, fear is a subjective emotion that can involve idiosyncrasies. Therefore, concerns that individuals have may extend beyond those identified in this prior work. As such, a first research goal of our study (see below) was to exploratively investigate the different topics of fear that people worried about due to the coronavirus and provide an indication of their prevalence.

Another goal of our study was to investigate possible predictors of increased fear of the coronavirus. Several possible predictors can be derived from the scientific literature. First, there are psychological vulnerability factors (see also Asmundson & Taylor, 2020a). One relevant construct is health anxiety. Health anxiety refers to the tendency to misinterpret normal or benign physical symptoms and believe that one has or is acquiring a serious illness, in the absence of

any actual illness (Abramowitz et al., 2007; Salkovskis et al., 2002). In two studies with university students, more health anxiety was associated with increased fear for the 2009-2010 H1N1 "Swine flu" pandemic (Wheaton et al., 2012) and the outbreak of the Zika virus in 2015-2016 (Blakey & Abramowitz, 2017). Hence, we expected that health anxiety is predictive for increased fear of the coronavirus.

Another potential psychological vulnerability factor is intolerance of uncertainty, which can be defined as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" (Carleton, 2016, p. 31). Higher intolerance of uncertainty is associated with anxiety-related disorders, such as generalized anxiety disorder, social anxiety disorder, panic disorder and obsessive-compulsive disorder (Boswell et al., 2013; Carleton et al., 2012; Rosser, 2019), and can therefore be seen as a transdiagnostic vulnerability factor for psychopathology (Carleton, 2016). Given that there is much uncertainty within the current coronavirus context (due to, among other things, limited available tests), we examined whether intolerance of uncertainty was related to fear of the coronavirus.

A final psychological vulnerability factor we wanted to look into was worrying. Worrying refers to a psychological process of having repeated negative and catastrophic thoughts and has been related to depression and several anxiety-related disorders (Davey & Wells, 2008; Meyer et al., 1990). While health anxiety and intolerance of uncertainty are focused on health related concerns and the uncertainty of the situation, worrying seems to capture a general tendency to have catastrophic thoughts. Such thoughts could be related to health or uncertainty, but also potentially to other topics. Hence, we included worrying as a third psychological vulnerability predictor in our study because we thought that it could potentially explain

additional variance in fear of the coronavirus beyond variance explained by health anxiety and intolerance of uncertainty.

Another predictor of interest is exposure to information about the impending threat. Threat information is known to elevate levels of fear, both in laboratory (Mertens et al., 2018; Muris & Field, 2010) and field (Cauberghe et al., 2009) studies. There is evidence that repeatedly engaging with trauma-related media content for several hours daily shortly after collective trauma may prolong acute stress experiences (e.g., Holman et al., 2014). Also for previous disease outbreaks (e.g., the H5N1 avian influenza), more media exposure was found to be related to increased fear (Van den Bulck & Custers, 2009). As such, we expected that for the coronavirus outbreak, more exposure to threat information (e.g., reading news bulletins about new deaths, social media posts) would increase fear of the virus.

Finally, it is important to consider whether the threat is personally relevant, either to oneself or to loved ones (Stussi et al., 2015). As such, one would expect more worry and fear if the person perceives more personal threat (e.g., because of worse general health) or threat to loved ones (e.g., grandparents). Fear of the virus may also be predicted by perceived coping resources. Coping is a common central mitigating factor in models of health, fear, and pain (Salkovskis & Warwick, 2001; Vlaeyen & Linton, 2000). Coping resources refers to available (mental) resources to mitigate potential threat (S. E. Taylor & Stanton, 2007). If perceived coping resources are high, threat perception and fear are expected to be low. Here, we will focus on risk control as a coping resource (S. E. Taylor & Stanton, 2007). Hence, we expected that more personal relevance of the threat for oneself and loved ones, and less risk control would be related to more coronavirus fear.

Taken together, the goal of our study was to assess people's different fears and concerns regarding the coronavirus pandemic and establish possible predictors based on prior research. Note, however, that our goal was not to provide an exhaustive assessment of all possible concerns and related predictors. Fear is a subjective conscious experience (LeDoux, 2014) involving idiosyncratic concerns and fluctuations over time (Walz et al., 2014). Furthermore, many different psychological, sociological and genetic factors have been linked to fear (Coelho & Purkis, 2009; S. Taylor et al., 2020). As such, a complete assessment of concerns and predictors relating to the coronavirus was out of the scope of our study (for a study employing memory ecological assessment methods in the context of the coronavirus, see Fried et al., 2020). However, our study does address several of the most plausible concerns and predictors based on prior research and can therefore provide valuable information for health practitioners, policy makers, and other researchers (Holmes et al., 2020).

To investigate fear of the coronavirus and the above-mentioned predictions (i.e., individual vulnerability, media exposure, personal relevance, and risk control), we conducted a cross-sectional online survey. The study was conducted between March 14 and 17, 2020. This was three days after the coronavirus outbreak was declared a pandemic (World Health Organization, 2020), and it included the weekend after most European countries announced increasingly strict measures to contain the coronavirus outbreak.

2. Methods

2.1. Sample and sample size determination

Respondents for this study were recruited through online advertisements using social media platforms (e.g., LinkedIn, Facebook, Twitter, Reddit). In total, 695 respondents provided consent to participate. However, 256 respondents did not fill out the survey. Hence, the final sample consisted of 439 respondents (completion rate: 63.17%), representing 28 different countries. The majority of our sample consisted of women (69.93%) and a large portion of the respondents lived in the Netherlands (47.61%) (see Table 1 for a detailed overview of the demographics of our sample). Participation was on a voluntary basis. The Ethics Committee of the Faculty of Social and Behavioral Science of Utrecht University approved this study (FETC20-166).

The minimal sample size of this study was based on an a priori power calculation. Particularly, we decided to recruit at least 194 respondents, as this would provide sufficient statistical power (.80) to detect small sized correlation coefficients (.20) (https://www.sample-size.net/correlation-sample-size/). We allowed a larger sample size, because this would increase the statistical power for detecting smaller effects and strengthen the robustness of the findings. Data collection was stopped after three days due to the collection of sufficient responses and the announcement of stricter safety measures by the Dutch government and other European countries (which could affect subsequent responses).

Table 1. *Demographic information of the respondents (total N = 439).*

	N	%
Age in years		
16-20	46	10.48%
21-30	215	47.97%
31-40	98	22.32%
41-50	47	10.71%
51-60	16	3.64%
61-70	16	3.64%
71-80	1	0.23%
Gender		
Male	126	28.70%
Female	307	69.93%
Prefer not to say	6	1.37%
Highest education		
Less than High School	22	5.01%
High School diploma	34	7.74%
College degree	63	14.35%
Master's degree	277	63.10%
Doctorate (PhD or equivalent)	43	9.79%
Country of residence by region[1]		
Asia (incl. India)	3	0.68%
Australia	4	0.91%
Europe (incl. Russia)	321	73.12%
Middle-East (incl. Israel)	2	0.46%
North-America	102	23.23%
South-America	7	1.59%
Sub-Sahara Africa	0	0%
Work in healthcare		
Yes	48	10.93%
No	345	78.59%
Unsure	46	10.48%
Infected by the coronavirus?		
Yes	0	0%
No	392	89.75%
Unsure	47	10.71%

Note: [1]Full list of countries of residence*:* Australia, Austria, Belgium, Canada, Chile, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hong Kong (S.A.R.), India, Israel, Italy, Latvia, Netherlands, Norway, Peru, Romania, Russian Federation, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, USA.

2.2. Materials & Procedure

2.2.1. Measures

2.2.1.1. Fear of the Coronavirus Questionnaire

Fear of the coronavirus was measured using an 8-item questionnaire designed for this study (from here on further referred to as the Fear of the Coronavirus Questionnaire; FCQ). Respondents were asked to rate their level of agreement with each statement on a 5-point Likert scale (1 = "Strongly disagree", 5 = "Strongly agree"). Examples of the items are: "I am very worried about the coronavirus", "I am taking precautions to prevent infection (e.g., washing hands, avoiding contact with people, avoiding door handles)", and "I am constantly following all news updates regarding the virus" (see Supplementary Table 1 for a full list of items). These items were chosen because they correspond with different fear components, such as subjective experiences (worrying), attentional biases, and avoidance behaviors (Lang, 1968). The internal consistency of the FCQ was acceptable (Cronbach's alpha = 0.77). Please note that recently, other scales measuring coronavirus fear have been developed (e.g., Ahorsu et al., 2020; S. Taylor et al., 2020). However, these scales were not used because they were not yet available at the time of our study.

To complement the FCQ and to assess idiosyncrasies in fear of the coronavirus, we included one open-ended question in which respondents were asked to describe their biggest concern about the coronavirus. Respondents were required to provide an answer to this question in order to be able to complete the survey.

2.2.1.2. Intolerance of uncertainty scale

Intolerance of uncertainty (IU) was measured using the IUS-12 developed and validated by Carleton et al. (2007), which assesses an individual's propensity to find uncertain situations unpleasant. It consists of 12 statements scored on 5-point Likert scales (1 = "Not at all characteristic of me", 5 = "Entirely characteristic of me"). Examples of the statements are: "Unforeseen events upset me greatly", "It frustrates me not having all the information I need", and "Uncertainty keeps me from living a full life". The internal consistency of this scale was excellent in the current sample (Cronbach's alpha = 0.92).

2.2.1.3. Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ) was used to measure a person's tendency to worry. The PSWQ is a well-validated questionnaire that is often used in clinical settings (Meyer et al., 1990). In this study, we used a shortened version consisting of eight items rated on 5-point Likert scales (1 = "Not at all typical of me", 5 = "Very typical of me"). Examples of the items are: "My worries overwhelm me", "Many situations make me worry", and "I know I should not worry about things, but I just cannot help it". The internal consistency of this scale was excellent in the current sample (Cronbach's alpha = 0.94).

2.2.1.4. Short Health Anxiety Inventory

The Short Health Anxiety Inventory (SHAI) was used to evaluate individuals' tendency to worry about their health (Abramowitz et al., 2007; Salkovskis et al., 2002). It consists of 18 four-choice questions. Examples include "1 = I do not worry about my health; 2 = I occasionally worry about my health; 3 = I spend much of my time worrying about my health; 4 = I spend most of my time worrying about my health" and "1 = I notice aches/pains less than most other people (of my age);

2 = I notice aches/pains as much as most other people (of my age); 3 = I notice aches/pains more than most other people (of my age); 4 = I am aware of aches/pains in my body all the time." The internal consistency of this scale was good in the current sample (Cronbach's alpha = 0.85).

2.2.1.5. Media exposure

To measure voluntary exposure to news about the coronavirus, respondents were asked to answer the following question: "Have you looked up any extra information regarding the coronavirus outbreak? (not taking into account coincidentally seeing/reading about it in the news)" with yes or no. Furthermore, if they had looked up any information, they were asked to indicate what sources they consulted (options: "Regular newspapers/websites/TV news", "Social media (Facebook, Twitter, Instagram, ...)", "Professional websites (health institute, blogs posted by virologists/biologists, ...)", "Friends/family/acquaintances", "Online searches (e.g., through Google, Bing, Ecosia, etc.)", "Other (please specify)"; multiple answers were possible). Finally, they were asked to rate the extent to which they paid attention to the source of the media outlet when looking up new information using 5-point Likert scales (1 = "Strongly agree", 5 = "Strongly disagree"). Dummy variables were created for each of the media sources used.

2.2.1.6. General health, risk control, and risk for loved ones

Respondents were asked to rate their general health, their perceived control, and risk for their loved ones using 5-point rating scales. Particularly, they were asked to answer the following question: "Overall, I would rate my general health as:" (options: "Extremely good", "Somewhat good", "Neither good nor bad", "Somewhat bad", "Extremely bad"). Perceived control was assessed with the following question: "Overall, I believe that I can control or avoid becoming

infected by the coronavirus (e.g., by limiting social contact, washing hands, wearing a face mask, etc.):" (options: "Strongly agree', "Somewhat agree", "Neither agree nor disagree", "Somewhat disagree", "Strongly disagree"). Finally, risk perception for loved ones was assessed with the following question: "Overall, I believe that people that I care about (e.g., grandparents) are at risk of becoming infected and seriously ill due to the coronavirus outbreak:" (options: "Strongly agree', "Somewhat agree", "Neither agree nor disagree", "Somewhat disagree", "Strongly disagree").

2.2.1.7. Demographic information

As demographic predictors, respondents were asked to indicate the gender they identify with the most ("male", "female", "prefer not to say"), their age (in decade categories), their highest educational level obtained (from "less than high school degree" to "Doctorate (PhD or equivalent)"), whether they work in healthcare ("yes", "no", "unsure (please clarify)"), whether they already got infected by the virus ("yes", "no", "unsure"), and their country of residence.

2.2.2. Survey administration

All questionnaires described above were delivered through an online survey using the Qualtrics platform (https://www.qualtrics.com/). The online survey could be completed with the use of a personal computer/laptop, tablets, or smartphone. The complete survey consisted of 60 self-report items and took approximately 15 minutes to complete.

2.3. Data analysis strategy

First, respondents' answers to the open-ended question regarding their biggest concern for the coronavirus were hand-coded by the second author. Sixteen different topics were identified

relating to respondents' concerns. Coding was independently checked by the first author. Cohen's Kappa was calculated to determine the degree of inter-rater agreement (Cohen, 1960). Conflicts were resolved by conservatively coding each conflicting response as relating to a particular topic.

Second, we evaluated the factor structure of the FCQ using a Principle Components Analysis (PCA). Kaiser's criterium of 1 and a scree plot was used to select the number of components (Kaiser, 1960). Additionally, we conducted parallel analysis using an existing syntax written in SPSS (O'connor, 2000). It was based on random data generation, which is parallel to the actual dataset (Horn, 1965). The focal point in this analysis was how many of the factors obtained from the actual data have an eigenvalue greater than that of the simulated data, and accordingly, the number of factors was determined.

Third, predictors of coronavirus fear as assessed by the FCQ were investigated using simple Pearson's correlation coefficients for the continuous predictors and one-way ANOVAs for the categorical predictors. All predictors were included, with the exception of country of residence. This was not included as a predictor because the majority of the respondents (78.36%) was from a limited number of countries (Belgium, the Netherlands, the United Kingdom, and the United States).

Following univariate analyses, a simultaneous linear regression was conducted including all significant predictors from the univariate analyses to investigate the unique contribution of each of the predictors in explaining variance in the FCQ. Analyses were conducted in IBM SPSS v26 and an alpha cut-off of .05 was used.

3. Results

3.1. Data availability.

The data files and data analysis syntax of the results reported here can be obtained through the Open Science Framework (https://osf.io/t5uvn/).

3.2. Respondents' main concern about coronavirus (open-ended question)

Responses from two respondents were missing, so data were available for 437 respondents who completed the open-ended question. The results are summarized in Table 2. Each open-ended answer could relate to several concerns, so the percentages reflect the number of respondents who indicated a particular topic as a concern.

Table 2. *Coded answers regarding respondents' biggest concerns about the coronavirus.*

Biggest concern	N (%)	Interrater agreement (Cohen's κ)	Example
Health of others (friends, grandparents, loved ones)	202 (46.22%)	0.85	"Loved ones get very ill or die."
Healthcare collapse	85 (19.45%)	0.83	"That it may infect too many people and turns uncontrollable."
Consequences for the economy	79 (18.08%)	0.82	"People losing their jobs and livelihoods."
Mass panic	67 (15.33%)	0.85	"Panicking people stressing out the economy creating their own disasters."
Personal health	48 (10.98%)	0.83	"Because of my lung disease, I am afraid of getting the virus and dying."
Societal breakdown	45 (10.25%)	0.59	"Panic, disturbed balance in society."
Personal economy (e.g., losing job/future prospects)	42 (9.61%)	0.66	"I live paycheck to paycheck and can't afford disruption to work."
Virus itself being dangerous, not disappearing, mutating	40 (9.15%)	0.59	"Virus mutation into a deadlier strain."
Unknowingly spreading virus to others	40 (9.15%)	0.71	"That I will unknowingly infect others who are immuno-compromised."
Others not following rules	30 (6.86%)	0.58	"Many people underestimate the disease and its effect on some people."
Being in quarantine/lockdown	25 (5.72%)	0.51	"My biggest concern about corona virus is about how long I will be able to handle isolation."
Not trusting government or believing government is acting adequately	25 (5.72%)	0.55	"I wonder whether the government is providing us with all the available information."
Food/supplies shortage	24 (5.49%)	0.69	"Being quarantined and not having enough food."
Disruption in personal routine	23 (5.26%)	0.40	"Missing a lot of school."
Travel ban	20 (4.58%)	0.61	"I'm currently abroad for work. Not being able to return home as planned."
Role of media/ fake news	11 (2.52%)	0.62	"Mass panic and fake news."

Note: All inter-rater reliabilities were significantly higher than chance, *p*s < .001.

3.3. Factor analysis of the FCQ

Results of the PCA on the FCQ indicated that one component had an eigenvalue over Kaiser's criterion of 1 (Kaiser, 1960), and explained 39.84% of the variance. The scree plot showed a point of inflexion that would justify retaining the first component. Additionally, the results of the parallel analyses showed that the eigenvalue of the actual dataset only exceeded the eigenvalue of the simulated dataset for the first factor (see Supplementary Table 2). Based on these results, we decided on a one-factor structure for the FCQ. As such, we calculated a sum score of this scale (possible range: 8-40), with higher scores indicating more fear of the coronavirus.

3.4. Univariate analyses

3.4.1. Continuous predictors

Pearson's correlation coefficients between the sum score of the FCQ and the continuous predictors are provided in Table 3. As can be seen, these were all significant (p-values < .01), except for perceived control of being infected, age, and education level. Risk of infection for loved ones was the strongest predictor of fear of the coronavirus.

Table 3. *Pearson's correlation coefficients between fear of the coronavirus and the continuous predictors*

	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Fear of coronavirus	25.85	5.91	-								
2. IU	29.22	9.78	.27**	-							
3. Worry	21.15	8.59	.26**	0.71**	-						
4. Health anxiety	13.42	6.24	.34**	0.49**	0.57**	-					
5. Overall health (1-5)	4.07	0.83	-.15**	-.26**	-.27**	-.45**	-				
6. Control being infected (1-5)	3.61	1.00	.01	-.00	-.05	-.14**	.10*	-			
7. Danger loved ones (1-5)	4.11	0.91	.43**	.06	.10*	.18**	-.01	-.06	-		
8. Age (in decades)	2.60	1.17	.05	-.36**	-.35**	-.22**	.03	.03	-.04	-	
9. Highest education (1-6)	4.74	1.51	-.07	-.25**	-.20**	-.22**	.24**	-.07	-.00	.33**	-

Note: *$p < .05$; **$p < .01$; IU = Intolerance of Uncertainty.

3.4.2. Categorical predictors

The results of the one-way ANOVAs investigating the categorical predictors of the FCQ are summarized in Table 4. Looking up additional information through different media sources was significantly associated with increased fear of the coronavirus. The other categorical predictors (gender, infection status, and working in health care) were not predictive of increased fear of the coronavirus.

Table 4. *Results from univariate ANOVAs for the categorical predictors of fear of the coronavirus.*

Predictors	Mean (SD) fear of coronavirus	*F*-value	*p*-value	Partial Eta^2
Gender		1.64	.194	.007
Female (n = 307)	26.16 (5.73)			
Male (n = 126)	25.05 (6.28)			
Prefer not to say (n = 6)	26.67 (6.47)			
Looked up information: Regular news		**41.22**	**< .001**	**.086**
No (n = 185)	23.82 (6.02)			
Yes (n = 254)	27.33 (5.38)			
Looked up information: Social media		**34.66**	**< .001**	**.073**
No (n = 297)	24.74 (5.73)			
Yes (n = 142)	28.16 (5.63)			
Looked up information: Professional websites		**22.05**	**< .001**	**.048**
No (n = 153)	24.08 (5.60)			
Yes (n = 286)	26.79 (5.86)			
Looked up information: Friends, family, etc.		**7.71**	**.006**	**.017**
No (n = 356)	25.47 (5.94)			
Yes (n = 83)	27.46 (5.56)			
Looked up information: Online search		**28.57**	**< .001**	**.061**
No (n = 251)	24.58 (5.77)			
Yes (n = 188)	27.54 (5.68)			
Looked up information: Other		2.13	.145	.005
No (n = 409)	25.74 (5.89)			
Yes (n = 30)	27.37 (6.05)			
Infected by the virus		0.04	.852	.000
No (n = 392)	25.83 (5.90)			
Unsure (n = 47)	26.00 (6.10)			
Work in healthcare		0.29	.887	.003
No (n = 345)	25.85 (5.92)			
Yes (doctor) (n = 9)	24.56 (9.17)			
Yes (nurse) (n = 12)	26.83 (5.80)			
Yes (tech/support) (n = 27)	25.26 (5.74)			
Unsure (n = 46)	26.15 (5.40)			

3.5. Simultaneous regression analysis

To investigate which predictors uniquely explained the variation in the FCQ, all significant continuous predictors (IU, worry, health anxiety, overall health, and danger for loved ones), and the significant categorical dummy predictors for media usage were entered into a simultaneous regression model. This model explained 37% of the variance in the FCQ ($F(10, 427) = 24.99$, $p < .001$). The predictors IU, information through professional sources, online searches, general health, worry, and information through family and friends did not significantly predict fear of the coronavirus, whereas risk for loved ones, information through regular media, information through social media, and health anxiety did. Table 5 provides the standardized regression coefficients of the predictors in the simultaneous regression model.

Table 5. *Predictors of fear of the coronavirus questionnaire in a simultaneous regression analysis.*

Predictor	Standardized β	*t*-statistic	*p*-value
Risk for loved ones	0.361	9.11	< .001
LUI: Regular media	0.191	4.37	< .001
LUI: Social media	0.135	3.18	.002
Health anxiety	0.145	2.80	.005
IU	0.107	1.90	.058
LUI: Professional media	0.073	1.67	.096
LUI: Online searches	0.041	0.971	.332
General health	-0.038	-0.860	.390
Worry	0.035	0.598	.550
LUI: family/friends	0.018	0.434	.665

Note: LUI = looked up information; IU = Intolerance of Uncertainty.

3.6. Addressing overlap between predictors and the FCQ

Because some of the items in the FCQ closely corresponded with some of our predictors (i.e., risks for loved ones and looking up additional information) we re-ran all analyses without two items from the FCQ that overlapped with the predictors. Particularly, items "I am worried that friends or family may get infected" (item 7) and "I am constantly following all news updates regarding the virus" (item 3) were excluded from the sum score of the questionnaire. Although explained variance in the simultaneous regression was slightly lower ($R^2 = 31$, $F(10, 427) = 19.08$, $p < .001$), exactly the same predictors for fear of the coronavirus were found (see https://osf.io/t5uvn/).

4. Discussion

The current report investigated predictors of fear of the coronavirus outbreak in an online survey study. Based on the literature, we expected that individual difference variables (IU, worry-proneness, and health anxiety) would predict increased fear of the coronavirus. Additionally, we expected that more media exposure and higher personal relevance of the threat (for both oneself and loved ones, and less risk control) would predict increased levels of fear. In line with these predictions, we found that all these factors predicted higher scores on the FCQ. Particularly, health anxiety, risk for loved ones, and looking up additional information (i.e., through regular media and social media) were independent predictors for the FCQ. Furthermore, we found a wide range of worries that respondents reported in the open-ended question, of which concerns for others' was the most often indicated concern. Such results are relevant for policy makers and (mental) healthcare workers to know who is more inclined to react fearfully toward

the coronavirus outbreak, and for journalists to be aware the potential impact of their work (see also Asmundson & Taylor, 2020b).

Our results replicate findings from earlier studies. Particularly, we found that, as in the 2009-2010 Swine flu pandemic and the 2015-2016 Zika virus outbreak (Blakey & Abramowitz, 2017; Wheaton et al., 2012), health anxiety was related to increased fear of the current coronavirus pandemic. Furthermore, our findings replicate earlier reports that more media exposure is related to more fear (Garfin et al., 2020; Van den Bulck & Custers, 2009). Additionally, we found a trend that increased fear of the coronavirus is related to IU, confirming other work showing that IU is related to increased levels of fear (Carleton, 2016). Finally, it is interesting to note that the most commonly reported concern and the best predictor of more fear of the coronavirus was concerns for the health of loved ones. This latter finding corresponds well with the initial reports that the coronavirus may be particularly dangerous for certain risk groups (e.g., elderly, people with chronic diseases) (World Health Organization, 2020), suggesting that people calibrate their risk perception and worries well towards such information.

Interestingly, from the different psychological vulnerability factors, only health anxiety was a significant predictor for fear of the coronavirus in the simultaneous regression model, whereas IU and worry were not (though a trend was found for IU). It is interesting that health anxiety explained additional variance beyond the variance explained by both the IUS-12 and PSWQ. This indicates that health anxiety is a unique component in explaining fear of the coronavirus beyond more general measures of anxiety and worry, which corresponds well with previous results obtained in the 2009-2010 Swine flu pandemic (Wheaton et al., 2012).

One finding from our study that merits highlighting is that answers of respondents to the open question revealed a wider range of concerns than those included in the fear of the coronavirus questionnaire. Particularly, apart from concerns for their own safety, those of others, and related safety and avoidance behaviors (which were already included as items in our questionnaire), respondents also worried about the impact of the coronavirus on the healthcare system, the economy, society, losing their job and changes in daily routines. To a lesser extent, respondents reported concerns regarding properties of the virus itself, reactions of others, effects of the lock downs, and inadvertently spreading the virus. There results indicate that a full assessment of coronavirus related fear requires measurement across different dimensions. This is in part already achieved by the CSS (S. Taylor et al., 2020), which assesses anxiety and stress symptoms relating to the coronavirus pandemic across five different factors (see the Introduction). However, our results suggest that this scale could profit from further extension based on the current findings. Particularly, items could be further added regarding the personal (e.g., loss of routines), societal (e.g., mass panic), economic (e.g., job loss), governmental (e.g., extended lockdowns), and biological (e.g., virus mutating and not disappearing) properties and consequences of the pandemic. Nonetheless, whether such an extensive assessment of coronavirus fear is preferable depends of course on one's research questions, resources, and practical considerations. For many purposes, more brief assessments of fear of the coronavirus most likely suffice (Pakpour et al., 2020).

Some suggestions for the management of coronavirus fear can be made based on our findings. Particularly, the observed relationship between media exposure and fear of the coronavirus suggests that more exposure to media can lead to more fear. If this is indeed the

causal connection between these constructs, then there are opportunities for policy makers and journalists to affect excessive fear. One way to do this is to ensure that communication is clear and unambiguous, because uncertainty tends to increase fear (Lissek et al., 2006). Information should also be provided without sensationalism or disturbing images (Garfin et al., 2020). In addition, there are opportunities for individuals themselves to tackle their fear. People can be advised to somewhat restrict their exposure to media coverage of the COVID-19 crisis (e.g., to check media sources only a limited number of times per day and not continuously throughout the day) and avoid sensational media, which may enhance stress and decrease well-being.

Another way to manage fear of the coronavirus could focus on the perceived risk of the virus for loved ones. In fact, this was the strongest predictor of the FCQ in our sample and the most often reported concern in the open-ended question by the respondents. This worry could be mitigated by providing the general public with clear information about the risk of threat and by taking (additional) steps to protect vulnerable groups for risk of infection. Clear communication regarding this concern may also be helpful in motivating people to follow government guidelines: when they ignore social distancing guidelines, because they deem their own risk to be low, they are actually increasing health risks for their loved ones.

Our results may also be taken as indicative that stronger messages in the media may induce more fear and therefore more compliance with the social distancing and lock down policies imposed. However, we caution against using media messages to induce more fear in the general public. There is evidence that suggest that such ‘fear appeals’ do not work very well to promote behavior change (Peters et al., 2013), particularly when people have little coping strategies. Under such circumstances, which may apply to the current COVID-19 crisis, it may

not be very helpful to maximize fear, as this may only increase distress. Furthermore, a substantial proportion of respondents in our sample was concerned about the role of (social) media, mass panic, and hysteria. Hence, fear appeals in the media should be used carefully and whether fear appeals work for the current situation requires empirical evaluation.

Some strengths and limitations of this study can be noted. The strengths include the temporal proximity to the initial developments regarding the coronavirus outbreak. This study was conducted within days that the WHO declared the coronavirus outbreak a pandemic and strict safety measures imposed by various European countries. Another strength is that the included measurement instruments had good psychometric properties and that our sample size was sufficiently large for detecting small correlations. Limitations of this study include the non-representativeness of our sample, which consisted to a large extent of Dutch highly educated females aged between 20 and 40, and the cross-sectional nature of the study. This may limit the generalizability of our results to a wider population and claims about the directionality of the results.

In conclusion, in this online study, we found that respondents report a wide range of concern regarding the coronavirus outbreak. Furthermore, anxiety-related individual differences, looking up information about the coronavirus outbreak, and risks for loved ones were positively related to increased fear of the coronavirus. These results may help policy makers and healthcare workers to manage maladaptive levels of fear and worry due to the coronavirus outbreak.

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Supplementary Materials

Supplementary Table 1. *Items of the fear of the coronavirus questionnaire and the observed means, standard deviation and range in the current sample.*

Please select the extent to which the following thoughts, feelings and behaviors apply to you: (anchors: 1 = "Strongly disagree"; 5 = "Strongly agree")	Mean	SD	Corrected Item-total correlation	Cronbach's alpha if item deleted
1. I am very worried about the corona virus outbreak.	3.49	1.11	.58	.73
2. I am taking precautions to prevent infection (e.g., washing hands, avoiding contact with people, avoiding door handles).	4.29	0.85	.41	.76
3. I am constantly following all news updates regarding the virus.	3.80	1.16	.37	.76
4. I have stocked up on supplies to prepare for problems related to the coronavirus outbreak.	2.32	1.31	.42	.76
5. For my personal health I find the virus to be much more dangerous than the seasonal flu.	2.66	1.33	.53	.74
6. I feel that the health authorities are not doing enough to deal with the virus.	2.87	1.37	.36	.77
7. I am worried that friends or family will be infected.	3.77	1.13	.53	.74
8. I take more precautions compared to most people to not become infected.	2.65	1.19	.63	.72

Supplementary Table 2. *Eigenvalues of the actual data and the simulated data.*

Factor	Eigenvalues of the actual data	Eigenvalues of the simulated data
1	3.187	1.202
2	.968	1.133
3	.876	1.072
4	.776	1.024