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ORIGINAL ARTICLE

Psychological Predictors of Anxiety in Response to the H1N1 (Swine Flu) Pandemic

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Abstract Pandemic illnesses, such as the H1N1 influenza (swine flu) are often highly publicized in the mass media and can be associated with high levels of anxiety and compensatory behavior (e.g., using hand sanitizers). The present research sought to investigate the psychological processes associated with swine-flu related anxiety during the H1N1 influenza pandemic of 2009–2010. Participants were 315 college students who completed survey measures between September 25th 2009 and February 16th 2010, which encompassed the peak of flu season and a time of intense media attention to this particular outbreak. Data revealed that anxiety in response to the swine flu was common in the sample. Regression analysis indicated that health anxiety, contamination fears and disgust sensitivity were significant predictors of swine flu-related anxiety. Implications for how concerns over pandemic illnesses such as the swine flu can be conceptualized and clinically managed are discussed.

Keywords Swine Flu · Health anxiety · Contamination fear · Disgust sensitivity

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Introduction

Spread of the H1N1 strain of the influenza virus, commonly referred to as the "swine flu," was detected in April 2009, and by June of that year the World Health Organization had declared it a global pandemic (Chan 2009). The following months witnessed a global response of alarm as governments and health organizations prepared for an apparent looming catastrophe. For example, in China passengers on incoming international flights were screened and those displaying flu-like symptoms (as well as those seated around them) were quarantined to prevent the possible spread of the virus (Lacey and Jacobs 2009). In the United States, the following fall and winter months (which comprise flu season) saw a deluge of media reports on the swine flu as it spread across the country. Many reports compared the outbreak to the 1918 "Spanish flu," the most deadly influenza pandemic in history, which killed up to 50 million people (Johnson and Mueller, 2002). Such media attention may have been a mixed blessing. On the one hand, rapid communication of the risks of infection would seem to promote healthy behavior change and reduce the spread of contagion (Sandman 2009). On the other hand, mass media coverage of a pandemic can potentially lead to mass hysteria and fear; as was observed during the 2005 outbreak of the avian flu during which greater television exposure was associated with greater fear of this illness (Van den Bulck and Custers 2009).

Rubin and colleagues (2009) reported that 23.8% of a British sample screened in the early stages of the H1N1 influenza outbreak (May 8th–12th 2009) reported significant anxiety in response to the outbreak. Increased anxiety was positively associated with the likelihood of engaging in behavioral changes that had been recommended to prevent the spread of H1N1, such as washing hands and

disinfecting doorknobs. However, increased anxiety was also predictive of non-recommended, unwarranted, and potentially interfering behaviors such as taking time off of work and avoiding public transportation and crowds. This highlights an important distinction: a certain amount of illness-related anxiety can be adaptive in that it focuses attention and motivates appropriate protective behavior. For some individuals, however, worries about contracting H1N1 influenza may become excessive, leading to inordinate distress and anxiety, as well as avoidance behaviors that significantly impair functioning.

Very little research has been conducted on excessive anxiety in response to pandemic illnesses in general, and the swine flu in particular. However, understanding the psychological factors that predict anxiety in response to such phenomena is important because for some people this results in clinically significant distress (e.g., anxiety and fear), avoidance, and functional impairment. Excessive safety behaviors—responses designed to minimize the perceived risk of illness (e.g., excessive hand washing, repeatedly seeking reassurance from medical professionals) may also be performed, further impairing functioning. Highly publicized disease outbreaks can also result in mass psychogenic illness, in which medically healthy individuals misinterpret benign bodily signs and sensations (e.g., temporary dizziness or shortness of breath) as indicating that they have become infected, causing them to become health anxious, hypervigilant, and engage in excessive safety behaviors (Taylor and Asmundson 2004). Adding further to the costs to society, such individuals might over-utilize medical resources and miss days of work. Such costs highlight the importance of identifying the psychological factors that may predict swine flu-related anxiety; which was the aim of the present study.

Health anxiety is one factor likely to be associated with excessive swine flu-related worries. Research on the structure of health anxiety reveals that it consists of inflated estimates of the likelihood of becoming ill and an exaggerated perception of the negative consequences of having a serious illness (Wheaton et al. 2010; Salkovskis et al. 2002). Anxiety sensitivity, which refers to the tendency to misinterpret benign physical sensations (especially those associated with anxious arousal) as being harmful (e.g., Taylor et al. 2007) is associated with health anxiety (Cox et al. 1999; Abramowitz et al. 2007) and also likely to predict swine flu-related fears. For example, highly anxiety sensitive individuals might misconstrue temporary and harmless episodes of dizziness or indigestion as indicating the presence of the flu, triggering anxiety and excessive health-related behaviors (e.g., visiting doctors). Body vigilance, which refers to the tendency to carefully monitor one's bodily sensations (Olatunji et al. 2007a), may also predict excessive swine flu anxiety. Individuals high in body vigilance are highly sensitive to internal bodily sensations, and are therefore likely to notice benign perturbations (e.g., "body noise") that could be misinterpreted as signs of serious illness.

Because H1N1 is a highly communicable virus, most recommendations for preventing infection prescribe frequent hand washing and use of disinfectants. Such recommendations, however, might activate fears of contamination similar to that often observed in individuals with obsessive–compulsive disorder (OCD; Abramowitz et al. 2010; American Psychiatric Association 2000). A number of psychological processes have been implicated in contamination fears, including the tendency to overestimate the likelihood and perceived negative outcomes of contamination (Deacon and Olatunji 2007; Rachman 2004). Recent findings have also implicated elevated levels of disgust sensitivity—the propensity to experience disgust across situations—in contamination-related fears (e.g., Olatunji and Sawchuk 2005; Olatunji et al. 2004). Thus, contamination fears and disgust sensitivity may be associated with excessive anxiety over the H1N1 influenza.

In order to better understand anxiety focal to the H1N1 influenza, we generated a questionnaire assessing this construct, and administered it along with a battery of measures to assess the various constructs described above, as well as general stress, depression, and anxiety. The study was conducted with undergraduate students at the University of North Carolina at Chapel Hill and data collection occurred between September 25th 2009 and February 16th 2010. A brief history of the H1N1 influenza over the course of the data collection is warranted to put participant responses in context. The Centers for Disease Control and Prevention (CDC) maintains a summary of the key events of the pandemic for historical purposes (CDC 2010). As reported, confirmed cases of H1N1 influenza were sporadic in the early summer of 2009 but began to increase during the last 2 weeks of August. In mid-September (just as data collection began), the CDC announced two confirmed cases of H1N1 in two campers in North Carolina. The University of North Carolina at Chapel Hill issued numerous campus-wide announcements (e.g., mass emails to all students, faculty, and staff) and flyers (e.g., in all bathrooms on campus) highly publicizing the risks and precautions pertaining to the H1N1 influenza (e.g., reminders and instructions for proper hand washing). Efforts were made to make all university students aware of the risks as it was believed that even healthy young adults were susceptible to H1N1.

A vaccine for the H1N1 virus was approved in mid-September, but supplies were initially very limited and were therefore restricted to targeted high-risk groups (e.g., health care providers). The vaccine became more widely

available by December, and flu activity leveled off through January. Although substantially lower than during the peak period of October 2009, H1N1 cases, hospitalizations and deaths continued to occur through February of 2010 (CDC 2010). Thus, a strength of the present research is that it allowed us to study responses to the pandemic as it unfolded, as the period of data collection encompassed the peak of the H1N1 outbreak. In addition, the sample we recruited was believed to be especially susceptible to the virus. Thus this study represents a unique opportunity to better understand pandemic concerns. As this study is the first of its kind, we considered our analyses to be exploratory in nature and thus did not have specific a priori hypotheses regarding which variables would emerge as independent predictors of swine flu-related anxiety.

Method

Participants

Participants for this study were drawn from Introductory Psychology classes at the University of North Carolina at Chapel Hill. The present study consisted of a computer-administered online questionnaire packet described as a "Survey of Thoughts and Feelings" which was approved by the University IRB. Participants who signed up for the study on the department's webpage were provided with a link to the online survey, which included a set of instructions for each questionnaire. Of the roughly 900 students enrolled in these classes, 374 individuals signed up for the study. However, of those who signed up, 22 failed to submit responses. Of the remaining 352 participants, missing data on one or more study measure were present in 37 cases, further reducing the sample to 315 individuals who completed all study measures. Participants were approximately 74% female and had a mean age of 20.02 (SD = 1.75, range 18–43). The ethnic composition of the sample was as follows: 73.3% Caucasian, 9.8% African American, 7.6% Hispanic/Latino, 6% Asian/Pacific Islander, and 3.2% "Other." The ethnic composition of the sample was generally consistent with that of the University as a whole and psychology classes in particular (UNC-Chapel Hill 2009):

Procedure

Participation in this study was available to all undergraduate students enrolled in Introductory Psychology classes at the study site. These classes include a research participation requirement, and all participants received course credit for their participation in the study. The study was reviewed and approved by the University IRB. Responses were collected between September 25th 2009 and February 16th 2010, which encompassed the peak of flu season when there was intense publicity about the seriousness of the H1N1 influenza. After signing up for the experiment via an internet-based software program, participants provided consent to participate and were directed to a secure project website where they completed the study measures. All data were collected using Qualtrics, an online web survey development tool. Results from a number of studies indicate that the administration of anxiety-related assessment measures using Internet-based and paper-and-pencil formats yield highly comparable results (e.g., Coles et al. 2006).

Measures

The following measures were included in the present study. The order of questionnaires was set such that the questions about the swine flu-related anxiety were presented last so that respondents were not primed to think about the swine flu when answering the other questionnaires.

Swine Flu Anxiety Items

A pool of 10 items were collaboratively developed by a group of clinicians and researchers with experience evaluating and treating individuals with anxiety disorders and somatization. Items were designed based on clinical observations to assess participants' concerns about the spread of H1N1 influenza, perceived likelihood of contracting H1N1 influenza, perceived severity of infection, avoidance of certain places and people, use of safety behaviors, and degree of exposure to information about this flu virus (see Table 1 for specific item content). Respondents rated their agreement with each item on a 5-point scale ranging from 0 ("very little") to 4 ("very much").

Anxiety Sensitivity Index-3 (ASI-3)

The ASI-3 (Taylor et al. 2007), the most widely used self-report measure of anxiety sensitivity, is an 18-item version of the original ASI (Reiss et al. 1986) that measures beliefs about the feared consequences of symptoms associated with anxious arousal (e.g., "It scares me when I become short of breath"). Respondents indicate their agreement with each item from 0 to 4. The ASI-3 contains three empirically established subscales relating to fears of social concerns (e.g., It is important for me not to appear nervous), fears of physical symptoms (e.g., It scares me when my heart beats rapidly), and fears of cognitive dyscontrol (e.g., It scares me when I am unable to keep my mind on a task). The measure possesses excellent psychometric properties, performing well on various indices of reliability

Table 1 Item properties of the Swine Flu inventory

Item	*M* (SD)	*M* inter-tem	Item-total
1. To what extent are you concerned about Swine Flu?	2.27 (1.01)	0.42	0.67
2. To what extent do you believe that Swine Flu could become a "pandemic" in the U.S.?	2.45 (1.08)	0.38	0.59
3. How likely is it that you could become infected with Swine Flu?	2.82 (1.19)	0.33	0.52
4. How likely is it that someone you know could become infected with Swine Flu?	3.63 (1.16)	0.34	0.53
5. How quickly do you believe contamination from Swine Flu is spreading in the U.S.?	3.05 (0.98)	0.42	0.67
6. How much exposure have you had to information about Swine Flu?	3.70 (1.09)	0.18	0.27
7. If you did become infected with Swine, to what extent are you concerned that you will be severely ill?	2.49 (1.13)	0.36	0.54
8. To what extent has the threat of Swine Flu influenced your decisions to be around people?	1.96 (1.07)	0.39	0.60
9. To what extent has the threat of Swine Flu influenced your travel plans?	1.39 (0.83)	0.30	0.43
10. To what extent has the threat of Swine Flu influenced your use of safety behaviors (e.g., hand sanitizer)?	2.82 (1.26)	0.38	0.58

Note: Items rated from 0 to 4

Inter-item = Mean inter-item correlation; item-total = Mean corrected item-total correlation

and validity (Taylor et al. 2007). We calculated subscale scores for each of the three factors: Physical, Social and Cognitive.

Body Vigilance Scale (BVS; Schmidt et al. 1997)

The BVS is a four item scale that measures the tendency to attend to panic-related body sensations. It is the only available measure of body vigilance. The first three items assess the degree of attentional focus, perceived sensitivity to changes in bodily sensations, and the average amount of time spent attending to bodily sensations as measured on a 0–10 scale. The fourth item measures the extent to which the respondent reports attending to 15 panic-related bodily sensations (e.g., heart palpitations), which are averaged to yield a single score. The BVS has demonstrated good internal consistency and adequate test–retest reliability (Olatunji et al. 2007a; Schmidt et al. 1997).

Contamination Cognitions Scale (CCS; Deacon and Olatunji 2007)

The CCS is designed to assess the tendency to overestimate the likelihood and severity of contamination, which we hypothesized to be associated with flu-related anxiety. Participants are asked to imagine touching 13 objects often associated with germs (e.g., toilet seats, door handles) and then rate on a 0–100 scale (a) the likelihood that touching each would result in contamination, and (b) how severe such contamination would be. CCS total scores are calculated by averaging responses to each question and have been found to have excellent internal consistency, test–retest reliability and content validity (Deacon and Olatunji 2007).

Disgust Scale-Revised (DS-R; Haidt et al. 1994 modified by Olatunji et al. 2007b)

The DS-R is a revised version of the widely-used original DS (Haidt et al. 1994), a widely used broad index of sensitivity to disgust-eliciting stimuli. The 25-item measure includes 0–4 ratings of how disgusting particular experiences would be, such as, "You see maggots on a piece of meat in an outdoor garbage pail." The scale covers several domains of disgust, including core disgust, animal remainder disgust and contamination disgust. The DS-R yields both subscale and total scores but only the total score was used in this study because subscale scores have been shown to be less reliable (Haidt et al. 1994). The DS-R total score has demonstrated adequate internal consistency and convergent and disciminative validity (Olatunji et al. 2007b).

Depression Anxiety Stress Scales 21 (DASS-21; Antony et al. 1998)

The DASS-21 is a short form of the original 42-item DASS (Lovibond and Lovibond 1995). The scales comprise three separate subscales, measuring self-reported depression, anxiety, and stress on a 0–4 scale. The DASS-21 subscales have been found to have good reliability and construct validity in both clinical (Page et al. 2007) and non-clinical samples (Henry and Crawford 2005) and are commonly used in research studies.

Short Health Anxiety Inventory (SHAI; Salkovskis et al. 2002)

The SHAI is a self-report measure that contains 18 items assessing health anxiety independently of physical health status. Items measure worry about health, awareness of bodily sensations or changes, and feared consequences of having an illness using a multiple choice format from 0 (no symptoms) to 3 (severe). The SHAI has demonstrated good reliability and validity as a measure of health anxiety in clinical and nonclinical samples (Abramowitz et al. 2007; Salkovskis et al. 2002) and is commonly used in research studies.

Data Analytic Strategy

First, we conducted an item analysis of the swine flu anxiety items and evaluated them as a measure of this construct (Swine Flu Inventory; SFI) using current recommendations for scale development (DeVellis 1991). To ascertain the relationship between anxiety about the swine flu and other variables we next correlated the SFI with the other measures included in the study. Finally, to determine which variables would make significant contributions in predicting swine flu-related anxiety we computed a regression in which the SFI served as the dependent variable, and the other study measures were entered simultaneously as predictors.

Results

Item Analysis of the Swine Flu Anxiety Inventory Items

We examined the performance of the 10 SFI items following recommendations for item retention by DeVellis (1991). Table 1 presents the mean, standard deviation, corrected item-total correlation and average inter-item correlation for each of the 10 items. As can be seen, nearly all of the items had corrected item-total correlations that exceeded the minimum criterion for acceptability of .30 (Nunnally and Bernstein 1994) and also met the recommended threshold of .30 for average inter-item correlation. The lone exception was item 6 ("How much exposure have you had to information about Swine Flu?"), which was therefore excluded from the remaining analyses and not retained in the final scale. We computed a total score from the remaining nine items.[1] Cronbach's alpha indicated that the 9-item SFI had acceptable reliability ($\alpha = .85$). A Kolmogorov–Smirnov test indicated that SFI scores were normally distributed in the sample, $z = .82$, $p > .05$.

Table 2 Descriptive statistics for all study measures

	M	*SD*	Range	$\acute{\alpha}$
SFI	22.87	6.56	9–45	.85
ASI-3 cognitive	2.72	4.01	0–21	.88
ASI-3 physical	3.63	4.14	0–23	.84
ASI-3 social	7.56	4.76	0–22	.78
BVS	11.96	7.36	0–38	.86
CCS	39.53	23.8	1–97	.98
DASS-depression	6.72	7.27	0–38	.87
DASS-anxiety	5.42	6.03	0–28	.77
DASS-stress	11.18	7.97	0–40	.85
DS-R	53.55	15.66	14–90	.87
SHAI	12.03	6.75	1–47	.89

SFI Swine Flu inventory, *ASI-3* anxiety sensitivity index-3, *Physical* physical concerns subscale, *Social* social concerns subscale, *Cognitive* cognitive concerns subscale, *BVS* body vigilance scale, *CCS* contamination cognitions scale, *DASS* depression anxiety stress scales, *DS-R* disgust scale-revised, *SHAI* short health anxiety inventory

Descriptive Statistics

Table 2 presents the group mean scores, standard deviations, ranges, and Cronbach's alpha for each study measure. As can be seen, the group's scores on all measures fell within normal range reported in other undergraduate samples (e.g., Wheaton et al. 2010; Deacon and Olatunji 2007; Henry and Crawford 2005). Internal consistency estimates for all measures were acceptable or better (e.g., Cronbach's alpha $> .75$).

Zero-Order Correlations

To examine the relationship between swine flu concerns and the other study variables we first computed zero-order

[1] In order to test the dimensionality of the SFI we submitted the nine retained items to a principal axis factor analysis with oblique (promax) rotation to allow the factors to be correlated. The first three eigenvalues from this analysis were 4.16, 1.44 and 0.77 and examination of the scree plot suggested retaining a two-factor solution. In the promax-rotated solution, five items (# 1, 7–10) saliently loaded on the first factor, three items (#3–5) saliently loaded on the second factor and one item (#2) loaded on both factors. The factors were correlated ($r = .55$). Importantly, the statements in three items saliently loading on the second factor all began with the question "how" while all of the other items began differently, indicating that question wording may have influenced the separation of these items from the others (e.g., a method factor). Recommendations for factor analysis have suggested that factors defined by three or fewer items may be less reliable and replicable, and four or more items are generally recommended to retain a factor (Guadagnoli and Velicer 1988). As such we opted to consider the SFI as a unidimensional measure and used the total score in all analyses.

Table 3 Correlations between Swine Flu Inventory and other study measures

	SFI	ASI-3 cognitive	ASI-3 physical	ASI-3 social	BVS	CCS	DASS-depression	DASS-anxiety	DASS-stress	DS-R
ASI-3 cognitive	.12	–								
ASI-3 physical	.22*	.64*	–							
ASI-3 social	.14	.52*	.51*	–						
BVS	.31*	.27*	.47*	.21*	–					
CCS	.49*	.16*	.28*	.10	.37*	–				
DASS-Depression	.05	.57*	.38*	.33*	.27*	.08	–			
DASS-Anxiety	.12†	.56*	.57*	.37*	.44*	.18*	.62*	–		
DASS-Stress	.20*	.45*	.38*	.31*	.38*	.18*	.59*	.66*	–	
DS-R	.48*	.13	.18*	.06	.27*	.52*	.09	.16*	.17*	–
SHAI	.36*	.38*	.57*	.32*	.70*	.35*	.33*	.47*	.40*	.25*

SFI Swine Flu inventory, *ASI-3* anxiety sensitivity index-3, *Physical* physical concerns subscale, *Social* social concerns subscale, *Cognitive* cognitive concerns subscale, *BVS* body vigilance scale, *CCS* contamination cognitions scale, *DASS* depression anxiety stress scales, *DS-R* disgust scale-revised, *SHAI* short health anxiety inventory

* $p < .01$

† $p = .03$

correlations between SFI total scores and the other study measures. These results are presented in Table 3. In order to correct for multiple comparisons we used a conservative alpha level of $p < .01$. As can be seen, the SFI was significantly correlated with the BVS, CCS, DS-R and SHAI. It was also significantly associated with the physical domain of anxiety sensitivity, but not with the social or cognitive domains. Finally, the SFI was significantly associated with DASS-stress subscale, but not the DASS-depression subscale. The SFI was also associated with the DASS-anxiety subscale at a trend level ($p = .03$) that did not achieve our more conservative alpha level of $p < .01$.

Regression Analysis

We next computed a multiple regression analysis predicting SFI scores. Only those variables that were significantly correlated with the SFI were entered as predictors. Summary statistics for each variable in this equation are presented in Table 4. Together, the predictor variables accounted for 34% of the variance in SFI scores, and the model was highly significant ($R^2 = .34$, $p < .001$). Examination of the individual beta weights revealed that only the CCS, DS-R and SHAI emerged as significant individual predictors of swine-flu-related anxiety.

Table 4 Summary statistics for the regression equation predicting swine flu scores

Variable	R^2	Beta	t	p
Final model	.34			<.001
ASI-3 Physical		−.04	−0.72	n.s.
BVS		−.01	−0.05	n.s.
CCS		.28	4.71	<.001
DASS-Stress		.03	0.62	n.s.
DS-R		.28	4.91	<.001
SHAI		.21	2.80	<.01

SFI Swine Flu inventory, *ASI-3* anxiety sensitivity index-3, *BVS* body vigilance scale, *CCS* contamination cognitions scale, *DASS-stress* depression anxiety stress scale-stress subscale, *DS-R* disgust scale-revised, *SHAI* short health anxiety inventory

Time Course Analysis

We compared responses collected during the first 3 months of the study (September–November, $N = 149$) to responses collected during the final 3 months (December–February, $N = 158$) to determine if responses changed over the course of the study. An independent samples t-test revealed that there was a significant effect for time, $t = 3.38$, $p < .001$, with participants in the first group ($M = 24.15$ $SD = 6.25$) endorsing significantly more H1N1 anxiety compared to participants enrolled during the second half of the study ($M = 21.66$ $SD = 6.64$). To determine if the same patterns of association with other measures held for both time periods we recomputed separate regressions predicting SFI scores in each of the two groups. Due to the reduced sample size and exploratory nature of these analyses we set alpha at a less conservative $p < .05$. Each regression model was the same as that specified above and for both groups the regression equation predicted significant variance in SFI scores (see Table 5). The general pattern of these regressions was identical to that for the combined group, with the CCS, SHAI and DS-R emerging as the only significant individual predictors. The lone

Table 5 Summary statistics for the regression equations predicting Swine Flu scores by enrollment period

Variable	R^2	Beta	*t*	*P*
First half (September–November)				
Final model	.31			< .001
ASI-3 physical		.00	.02	n.s.
BVS		.09	0.87	n.s.
CCS		.25	2.76	<.01
DASS-stress		.00	−0.04	n.s.
DS-R		.19	2.31	=.02
SHAI		.21	1.77	=.08
Second half (December–February)				
Final model	.40			< .001
ASI-3 physical		−.11	−1.30	n.s.
BVS		−.05	−0.50	n.s.
CCS		.32	4.04	<.001
DASS-stress		.04	0.53	n.s.
DS-R		.35	4.54	<.001
SHAI		.20	2.06	<.05

SFI Swine Flu inventory, *ASI-3* anxiety sensitivity index-3, *BVS* body vigilance scale, *CCS* contamination cognitions scale, *DASS-stress* depression anxiety stress scale-stress subscale, *DS-R* disgust scale-revised, *SHAI* short health anxiety inventory

exception was that in the early response group the SHAI did not meet statistical significance at $p < .05$, but trended towards significance ($\beta = .21$, $p = .08$).

Discussion

Little research has been conducted on anxiety in response to pandemic illnesses such as the H1N1 influenza outbreak of 2009–2010. However, elucidating the factors that contribute to such anxiety may be of value in understanding how the public responds to large scale illness threats, and identifying individuals who might be vulnerable to maladaptive responses. Accordingly, in the present study we examined the extent of anxiety about H1N1 influenza in a college student population during the pandemic; thus avoiding problems associated with retrospective reporting. We also investigated the relationships between swine flu-related anxiety and a number of psychological constructs implicated in contemporary cognitive-behavioral models of health-related concerns.

To assess swine flu-related anxiety, we first developed a brief measure: the SFI. Items on this scale tapped worries about the spread of the disease and the possibility of being infected, as well as behavioral responses to such fears, such as avoidance of certain places and the use of safety behaviors (e.g., excessive hand washing). The SFI demonstrated sound psychometric properties and acceptable internal consistency. Scores on the 9-item instrument were normally distributed, suggesting that some level of concern about the H1N1 influenza was common among participants, with fewer individuals being excessively concerned or not at all concerned. This is consistent with the amount of media attention paid to this epidemic during the period that the study was conducted. In fact, for the item "How much exposure have you had to information about Swine Flu?" 59% of participants reported either "much" or "very much exposure." This item, however, was not retained in the final version of the scale because it was very weakly correlated with the other items, indicating that concern with the swine flu was only weakly related to one's exposure to information about the H1N1 virus. This might have been due to a ceiling effect whereby most individuals felt substantially informed about the illness.

Zero-order correlations revealed that anxiety pertaining to the swine flu was positively associated with health-related anxiety, concerns about the likelihood and severity of contamination, disgust sensitivity, and the tendency to carefully monitor one's internal bodily sensations. These associations provide evidence for the construct validity of the SFI, which also demonstrated patterns of convergence/divergence with other constructs. For example, the SFI was correlated with the physical domain of anxiety sensitivity, but not the social or cognitive subscales. In addition, the SFI was associated with stress, and general anxiety on a trend level, but not with depression. Although the SFI was significantly correlated with health anxiety, contamination cognitions and disgust sensitivity, the magnitude of these correlations suggests that the SFI measures a distinct construct.

Our regression analysis indicated that only health anxiety, contamination cognitions, and disgust sensitivity, emerged as significant individual predictors. The measures of stress, body vigilance and physical anxiety sensitivity were not significant predictors of swine flu anxiety in the regression, indicating that the significant zero-order associations between these variables and swine flu anxiety are better accounted for by health anxiety, contamination cognitions, and disgust sensitivity.

It is not surprising that health anxiety was a significant predictor of swine flu-related fear. Indeed, health anxiety is a function of how likely and how severe a feared illness is perceived to be (Salkovskis et al. 2002; Wheaton et al. 2010). During the H1N1 influenza outbreak, the media portrayed this virus as easily communicable, suggesting a high likelihood of exposure and of becoming infected. For example, a running tally of nationwide infections was kept and routinely broadcast. Although the number of people who were actually infected was fairly low overall, the sheer repetition of this information might have increased the perceived likelihood of infection. Media reports also

emphasized the severity of this particular strain of the flu as compared to the common flu by reporting on the number of fatalities. For example, in Canada, media reports about a healthy teenager who died from H1N1 provoked a rush on immunization clinics as well as the closing of the school (Daubs 2009). Thus, skewed media coverage may have fueled the erroneous impression that most individuals infected with H1N1 influenza would die.

The tendency to exaggerate the likelihood and severity of contamination was also a significant predictor of anxiety related to the swine flu outbreak. Indeed, H1N1 was described as a highly communicable virus, thus, people with pre-existing concerns about contamination might have been especially vulnerable to worrying about coming into contact with sources of this disease. Alternatively, given the cross-sectional nature of our data, it could also be the case that even individuals who were not already highly concerned about contamination, became so due to the recommended preventative strategies against H1N1 influenza. These included taking measures such as washing hands for 15 s several times per day, avoiding shaking hands with others, wiping down surfaces such as computer keyboards, telephone receivers, and door knobs, and avoiding sneezing on your hands. Consistent with previous research (Deacon and Maack 2008), these strategies might have facilitated inflated beliefs about the probability and severity of contamination by the flu virus. The general propensity to experience disgust was also a significant predictor of swine flu-related anxiety. Indeed, disgust has been conceptualized as a defensive emotion which adaptively functions to protect the organism from potentially harmful material (Izard 1993), such as that which communicate disease (Deacon and Olatunji 2007).

Our comparison of study enrollment periods revealed that participants enrolled during the first 3 months of the study endorsed significantly more H1N1-related anxiety than those enrolled during the second half of the study. This is perhaps not surprising given that the peak of H1N1 infections occurred during October 2009 and decreased thereafter (CDC 2010). However, mean SFI scores collected during the period from December-February were only 10.3% lower than those collected during the first half of the study, indicating that substantial H1N1 anxiety remained. Indeed, hospitalizations and deaths due to H1N1 infection and intense media coverage continued during those later months (CDC 2010). Importantly, the regression analyses conducted separately for each half of data collected yielded congruent results, indicating that the same psychological factors were associated with H1N1-related anxiety during both halves of the study.

These results have potential clinical implications. Although our data are correlational, they are consistent with the idea that individuals with health anxiety or contamination-related OCD symptoms could be vulnerable to developing excessive fear regarding pandemic illnesses such as the swine flu. Thus, clinicians should be aware of, and monitor such concerns in the event of a highly popularized disease outbreak. The success of cognitive-behavioral therapy techniques for excessive health anxiety, such as psychoeducation, cognitive restructuring, and exposure therapy (e.g., Abramowitz and Braddock 2008; Taylor and Asmundson 2004) may be undermined by frequent media reports documenting the spread of the disease (leading to erroneously high estimates of likelihood) and the need to employ stringent precautionary measures (leading to erroneously high estimates of severity). Recommendations put forth by health organizations may further reinforce such perceptions and require treatment providers to spend a great deal of time helping affected patients carefully consider (and challenge) how their excessive fears and avoidance behavior might be influenced by this information. Clinicians should encourage more objective beliefs and more reasonable levels of concern in response to pandemics.

A number of limitations of this study should be mentioned. First, as we have mentioned, the cross-sectional nature of this investigation precludes us from drawing causal inferences regarding the relationships between the psychological variables and concerns about the swine flu. It cannot be determined, for example, whether the cognitive factors we assessed represent an etiological factor for flu-related anxiety symptoms, or merely an epiphenomenon. It is important to note that the variables found to be significant predictors of swine flu anxiety cannot be assumed to cause such symptoms. Future longitudinal research is needed to determine the direction of causality for these associations, as well as the presence of any intermediary factors.

The sample used in the current study also represents a limitation. As mentioned earlier, the use of an undergraduate sample in investigating anxiety in response to the swine flu is appropriate given that H1N1 was believed to be dangerous even for healthy young adults. However, care should be taken not to generalize the findings from this sample to other populations. It cannot be said for certain the same results would hold in other samples, including individuals with clinically significant anxiety problems (e.g., OCD or hypochondriasis) or those at high risk for influenza (e.g., elderly individuals). Future research is needed on how these individuals respond to pandemic threats.

In addition, all data in the current study were collected via self-report; thus shared method variance may have inflated the relationships between study variables. Future studies might include longitudinal designs with multiple assessment modalities being to determine the direction of causality and increase method variance. For example, flu season and concerns about pandemic illnesses often follow cyclical patterns. Thus, a future study could utilize multiple assessment points

to track these illness concerns through the course of flu season and identify any psychological diatheses.

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