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Dispositional pandemic worry and the health belief model: promoting vaccination during pandemic events

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ABSTRACT

Background Promoting vaccination during pandemics is paramount to public health, yet few studies examined theoretical motivations for vaccination during pandemics. Thus, the relationships between dispositional pandemic worry, constructs of the health belief model (HBM) and vaccination during the H1N1 pandemic were studied.

Methods Participants (N = 1377) completed surveys assessing dispositional pandemic worry, HBM variables and H1N1 vaccination. Principle axis factor analysis and point biserial correlations were conducted. Differences in worry and vaccination were assessed via independent samples t-tests. Relationships between vaccination, demographics and worry were investigated using hierarchical linear regression. PROCESS analysis was conducted to explicate the relationship between worry and vaccination intention.

Results A two-factor structure of dispositional pandemic worry—worry frequency and worry severity—was confirmed. Dispositional worry was higher among those who intended to and received H1N1 vaccine. Worry frequency and worry severity were positively related to vaccination. Threat, benefits and barriers mediated the impact of worry severity and threat and barriers mediated the impact of worry frequency on vaccination intentions.

Conclusions Messages increasing dispositional worry and benefits while decreasing barriers may boost vaccination behavior during a pandemic event. Future study of relationships between dispositional worry and HBM variables is warranted.

Keywords communicable diseases, population-based and preventative services, psychological determinants

Introduction

Uncontained infectious disease outbreaks can escalate to pandemics, resulting in significant morbidity and mortality[1, 2] and economic disruption.[3] Outbreak containment can be achieved through vaccine development and vaccination promotion via effective communication strategies.[4] However, previous public health messages lacked theoretically driven development and evaluation during pandemic events preventing the identification of public motives for vaccination and impeding the development of future campaign strategies during infectious disease pandemics.[5]

The health belief model (HBM) presents one model by which to evaluate vaccination.[6] The HBM consists of an individual's assessment of their 'susceptibility' to and 'severity' of a threat to their health, the 'benefits' of taking a particular action to reduce the threat, the 'barriers' to taking an action to reduce the threat, 'self-efficacy'—the perception one can successfully complete a prescribed behavior to reduce their risk, and 'cues to action' including messages motivating action.[7] A meta-analysis of studies utilizing the HBM to evaluate adult vaccination against infectious disease concluded perceived likelihood, susceptibility and severity (e.g. perceived risk or threat) were strongly associated with vaccination.[8] Results indicated public health professionals should construct messages that increase perceptions of likelihood and threat of a pandemic event to promote vaccination. However, one criticism of the HBM and other traditional health behavior theories is the absence of affect,[9] and research on emotions' impact on health cognitions and behavior remains limited.[10] For example, when

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functioning optimally, state-based worry provides information about threat, assists with problem solving[11] and is associated with prevention behaviors[12] including vaccination.[13–17] The relationship between state-based worry and vaccination is clear, but nothing is known about the relationship between dispositional (i.e. trait-based worry) and vaccination. Understanding how dispositional worry impacts vaccination behavior via HBM constructs will provide further guidance for message development during pandemic events.

Dispositional worry is chain of unwanted chronic thoughts, negative in affect, about future outcomes.[11,18,19] Because thoughts are constant and uncontrollable, dispositional worry may be indicative of poor problem solving,[11,18,19] thus high dispositional worry may paralyze, not motivate, protective behavior. Alternatively, worry is closely related to the fear process;[19] therefore, dispositional worry may influence preventive behaviors in ways similar to fear.[18] For example, as described in the Extended Parallel Process Model (EPPM),[20,21] fear may motivate or inhibit prevention behavior. According to the EPPM, if an individual is faced with a message high in threat and low in efficacy, the individual will engage in fear-control by ignoring the message to reduce their fear. Alternatively, if faced with a message high in threat and efficacy proportionate to the threat, an individual will engage in danger-control by taking action to reduce the threat. However, dispositional worry is trait-based,[19] whereas fear is state-based;[22] therefore, it is unclear how dispositional pandemic worry relates to vaccination during a pandemic event. Dispositional worry may be enacted in different contexts;[23] therefore, experience of dispositional worry and coping may differ based on context.

Recently, Jensen and colleagues developed[24] and validated[25,26] a dispositional cancer worry scale, providing a basic template to measure dispositional worry. As part of a study examining vaccination in a statewide population,[27] we adapted the dispositional cancer worry scale for pandemic events to learn if dispositional pandemic worry was related to vaccination during the H1N1 flu pandemic of 2009–2010. Considering the ability for HBM constructs to predict vaccination behaviors in previous studies, this study also examined the relationship between dispositional worry, key HBM constructs and H1N1 vaccination.

Methods

Procedures

Following University Institutional Review Board Approval, adults were recruited from seven shopping malls in the state of Indiana in the USA between May and June, 2010 by three-to-five researchers. After providing voluntary written consent, participants completed a ~15 min survey and received a $10 Visa gift card.

Measures

Basic demographic information

Participants reported basic demographic information. Participants were also asked to disclose if they ever had H1N1 flu, response options were 'yes' or 'no'.

Dispositional pandemic worry

Past research suggested dispositional worry may consist of two underlying factors—worry frequency and worry severity,[28] advanced by findings from the development and validation of the dispositional cancer worry scale.[24–26] Responses were measured on a 6-point scale ranging from 'not at all' (1) to 'very much' (6) and included items related to worry frequency, for example, 'I have dreams about the H1N1 flu' ($M = 1.26$, SD = 0.65, $\alpha = 0.85$) and worry severity, for example, 'I am afraid of the physical consequences of getting the H1N1 flu' ($M = 2.13$, SD = 1.23, $\alpha = 0.82$).

Vaccination behaviors

To measure vaccination behaviors, participants were asked how often they received the seasonal flu vaccine, response options included 'never,' 'once before,' 'a few times,' 'almost every year' and 'every year'. To measure H1N1 vaccination, participants were asked if they received the H1N1 flu vaccine, response options included 'yes' or 'no'. Vaccination intention was measured using a single item based on the transtheoretical model of behavior change[29] asking 'do you intend to get the H1N1 vaccine?' with response options including: 'no', 'maybe', 'yes, in the next 30 days', 'yes, in the next 6 months', 'yes, but I don't know when' and 'I already got the H1N1 flu vaccine'.

HBM variables

Questions related to HBM variables developed by Champion and colleagues[30,31] were modified for the current study. Responses to all HBM questions were measured on a 5-point scale from strongly disagree (1) to strongly agree (5).

Perceived susceptibility and perceived severity were combined into a single construct called perceived threat.[30] Perceptions about the H1N1 threat were assessed using a 4-item scale including items such as, 'It is likely I will get the H1N1 flu', and 'I believe that the H1N1 flu is severe' ($M = 3.15$, SD = 0.92, $\alpha = 0.80$).

Perceived self-efficacy was measured using a modified version of the mammography self-efficacy scale,[30] and

included 9-items, such as, 'You can arrange transportation to get the H1N1 flu vaccine' ($M = 4.09$, SD = 0.87, $\alpha = 0.94$).

Using a modified version of Champion's scale,[31] perceived benefits were measured using a 4-item scale including items such as, 'Getting the H1N1 vaccine will decrease my chances of dying from the H1N1 flu' ($M = 3.40$, SD = 0.92, $\alpha = 0.89$).

Also modified from Champion's scale,[31] perceived barriers were measured using a 10-item scale including items such as, 'Getting the H1N1 flu vaccine exposes me to unnecessary health risks' ($M = 1.80$, SD = 0.65, $\alpha = 0.85$).

Analysis

The dispositional cancer worry factor structure was validated across several studies,[24–26] but no study has examined dispositional worry about a pandemic event. Principal axis factor analysis with direct oblimin rotation was utilized to examine the factor structure. Point biserial correlations were conducted between all variables to examine relationships between dispositional pandemic worry, vaccination behaviors and intention and HBM constructs. An independent samples t-test examined the relationship between H1N1 vaccination, worry frequency and worry severity. A hierarchical linear regression was utilized to examine whether age, education, seasonal vaccination frequency, H1N1 vaccination and personal H1N1 flu history were correlated with intention at the point biserial level. As such, they were entered in the first block of the regression as controls, and worry frequency and worry severity were entered in the second block. To fully explicate the relationship between worry and intention, a path-analysis was carried out using PROCESS.[32] PROCESS utilizes an ordinary least-squares path analytical framework to test for both direct and indirect effects and allows researchers to identify and test models that articulate the mechanisms underlying direct effects. All indirect effects were subjected to follow-up bootstrap analyses with 10 000 bootstrap samples and 95% bias corrected confidence intervals.

Results

Participants

Participants ($N = 1377$) ranged in age from 18 to 90 ($M = 34.70$, SD = 15.21). Over half were female ($n = 824$; 59.8%), the majority white ($n = 1096$; 79.6%), had health insurance ($n = 72.1\%$), had not received H1N1 vaccine ($n = 10\,601$; 77%), and did not intend to receive it ($n = 740$; 53.7%). Most participants were low in dispositional worry ($M = 1.69$; Table 1).

Principle axis analysis

Factor analysis revealed two factors with eigenvalues >1, explaining 50.75% and 19.01% of the variance respectively (Table 2). The first factor consisted of the four worry frequency items and the second factor consisted of the four worry severity items. Thus, two measures were constructed representing dispositional pandemic worry—worry frequency (FREQ; $M = 1.26$, SD = 0.65, $\alpha = 0.85$) and worry severity (SEV; $M = 2.13$, SD = 1.23, $\alpha = 0.82$; Table 1).

Point biserial correlations

Worry frequency ($M = 1.26$) and worry severity ($M = 2.13$) were significantly correlated ($r = 0.45$; Table 3). Both were positively related to seasonal flu vaccination frequency, H1N1 vaccination behavior, H1N1 vaccination intention, perceived barriers to H1N1 vaccine and perceived threat to develop H1N1. In addition, worry frequency was positively related to benefits and being female. Worry severity was negatively related to education. See Table 3 for all point biserial correlations.

Dispositional worry and H1N1 flu shot behavior

At the time of the survey, 296 (22%) participants reported receiving H1N1 vaccine. For worry frequency, Levene's test for equality of variances was violated, $F(1, 1349) = 16.31$, $P < 0.001$. Owing to this violated assumption, a t-statistic, not assuming homogeneity of variance, was computed. An independent samples t-test revealed those who received H1N1 vaccine ($M = 1.34$, SD = 0.75) had significantly higher worry frequency scores than those who had not ($M = 1.23$, SD = 0.60; $t(407.22) = -2.41$, $P = 0.016$, $d = 0.17$). Levene's test for equality of variances also was significant for worry severity, $F(1, 1349) = 9.85$, $P = 0.002$. An independent samples t-test revealed those who received H1N1 vaccine ($M = 2.36$, SD = 1.33) had significantly higher worry severity scores than those who had not ($M = 2.05$, SD = 1.18; $t(433.92) = -3.63$, $P < 0.001$, $d = 0.25$).

Dispositional worry and H1N1 flu shot intentions

Approximately 78% of participants had not received H1N1 vaccine at the time of the survey. The hierarchical linear regression was significant at both blocks (reported at block 2): $r = 0.51$, $R^2 = 0.26$, $F(7, 1198) = 60.28$, $P < 0.001$. Block 1 explained ~23% of the variance in intention, with seasonal vaccination frequency ($\beta = 0.24$, $P < 0.001$) and H1N1 vaccination behavior ($\beta = 0.32$, $P < 0.001$) significantly related to intention. Block 2 explained an additional 3% of the variance in H1N1 vaccination intention. Within block 2, worry severity ($\beta = 0.13$, $P < 0.001$) was positively

Table 1 Demographic characteristics of participants ($N = 1377$)

Variable	n *(%)*[a]
Age (mean [range])	35 [18–90]
Sex	
Male	524 (38.1)
Female	824 (59.8)
Race	
White/Caucasian	1096 (79.6)
Black	129 (9.4)
Asian	63 (4.6)
Hispanic	55 (4)
Native American	18 (1.3)
Other	36 (2.6)
Education	
Less than high school	41 (3.0)
High school graduate	347 (25.2)
Some secondary education	694 (50.4)
College graduate	186 (13.5)
Postgraduate education	2 (0.1)
Health Insurance	
None	278 (20.9)
Private	961 (72.1)
Medicare/Medicaid	91 (6.8)
Seasonal flu vaccination	
Never	399 (29.0)
Once before	210 (15.3)
A few times	337 (24.5)
Almost every year	180 (13.1)
Every year	234 (17.0)
Had H1N1 flu	
Yes	135 (9.8)
No	1198 (87)
Received H1N1 flu vaccination	
Yes	296 (21.5)
No	1060 (77)
Intend to receive H1N1 flu vaccination	
Yes[b]	90 (6.5)
Maybe	230 (16.7)
No	740 (53.7)
Dispositional Flu Worry (mean [range])	1.69 [1–6]
Worry frequency	1.26 [1–6]
Median	1.00
Mode	1.00
Skewness [std. error of skewness]	3.79 [0.07]
Kurtosis [std. error of kurtosis]	17.99 [0.132]
Score of 1 *n* (%)	1023 (74.3)
Worry severity	2.13 [1–6]
Median	1.75
Mode	1.00
Skewness [std. error of skewness]	1.21 [0.07]
Kurtosis [std. error of kurtosis]	0.96
Score of 1 *n* (%)	433 (31.4)

[a]Percentages may not sum to 100% due to missing data.
[b]All three 'yes' responses options from the item based on the trans-theoretical model of behavior change were collapsed to a single 'yes' response.

related to intention and worry frequency ($\beta = 0.05$, $P = 0.055$) was just beyond the 95% cut-off.

Process analysis of dispositional worry and H1N1 flu shot intentions

Two parallel mediation models were tested—one for worry frequency and one for worry severity—with H1N1 vaccination intention as the outcome, the controls from the hierarchical linear regression as covariates, and the HBM variables as mediators. Even though frequency was marginally related to intention ($P = 0.055$) in the previous analysis, Hayes[32] argued even non-significant direct effects can still yield significant indirect paths.

Three HBM variables significantly mediated the relationship between worry severity and vaccination intention: barriers ($b = -0.03$, SE = 0.01, 95% CI: −0.0545, −0.0049), benefits ($b = 0.01$, SE = 0.01, 95% CI: 0.0048, 0.0269) and threat ($b = 0.09$, SE = 0.02, 95% CI: 0.0633, 0.1232; Fig. 1a). Worry severity increased vaccination intentions through benefits of vaccine and threat of H1N1 flu, and decreased vaccination intentions through barriers to obtaining H1N1 vaccine.

Two HBM variables significantly mediated the relationship between worry frequency and intention: barriers ($b = -0.04$, SE = 0.02, 95% CI: −0.0861, −0.0028) and threat ($b = 0.08$, SE = 0.03, 95% CI: 0.0304, 0.1424; Fig. 1b). Worry frequency increased vaccination intentions through threat of H1N1 flu, and decreased intentions to vaccinate through barriers to obtaining H1N1 vaccine.

Discussion

Main findings of this study

This study examined the relationship between dispositional pandemic worry, vaccination and HBM constructs. Dispositional pandemic worry was measured using an adapted version of the dispositional cancer worry scale—comprising

Table 2 Principle axis analysis of dispositional pandemic worry

	Factor 1 (FREQ)	*Factor 2 (SEV)*
1. I had trouble falling asleep or staying asleep, because of pictures or thoughts about H1N1 that came to mind	0.82	
2. I had waves of strong feelings about H1N1	0.73	
3. I had dreams about H1N1	0.89	
4. Pictures about H1N1 popped into my mind	0.62	
5. I am afraid of the physical consequences of getting H1N1		0.64
6. I worry about my health because of my chances of getting H1N1		0.83
7. I feel anxiety when I think of the possible consequences of getting H1N1		0.80
8. I brood about the physical consequences of getting H1N1		0.68
Eigenvalue	4.06	1.52
% of Variance	50.75%	19.01%

Note: Principle axis analysis with direct oblimin rotation. Factor loadings below 0.30 are omitted to ease interpretation.

two factors, worry frequency and worry severity.[24,26] Pandemic worry frequency and worry severity were positively related to perceived threat of flu acquisition, frequency of seasonal flu vaccination, H1N1 vaccination intention and H1N1 vaccination, thus providing preliminary evidence for the use of this scale in the context of pandemic. These results are consistent with findings that state-based worry about flu is positively related to vaccine intention and behavior;[14–17] both worry frequency and worry severity were significantly higher for those who received H1N1 vaccine than those who did not, indicating dispositional pandemic worry may motivate vaccination, findings theoretically consistent with the link between risk perception, affect and behavior.[33–35]

A closer examination revealed that worry severity was positively related with perceived barriers and benefits to H1N1 vaccination. Those higher in worry severity may believe vaccine benefits to be great, but consider barriers too much to overcome, thus causing additional worry. Meta-worry, or worrying about worry is a key feature of dispositional worry, compared to state-based worry,[36] thus barriers to vaccination may trigger meta-cognitions related to H1N1 flu—worry about worrying. As such, barriers to protective health behaviors may partly drive dispositional worry, particularly worry severity; however, we were unable to assess directionality due to the study's retrospective and cross-sectional design. In the future, longitudinal research examining dispositional worry should assess whether perceptions of barriers to reducing threat compound dispositional pandemic worry.

Of HBM variables (i.e. barriers, benefits, efficacy and threat), parallel mediation analysis revealed worry frequency increased intentions to vaccinate through H1N1 threat and decreased intentions to vaccinate through barriers to obtaining H1N1 vaccine. In addition, this study found threat of H1N1 mediated the relationship between worry frequency and worry severity suggesting perceptions of threat of H1N1 are an important factor in motivating behavioral intention among those with high dispositional worry. Therefore, when promoting vaccination among those with high dispositional pandemic worry, increasing threat of the pandemic event and decreasing barriers to taking action (i.e. vaccination) may be an effective messaging strategy to increasing vaccination. Results from the current study include threat and barriers as mediators of behavior based on dispositional worry. Interestingly, benefits only mediated the relationship between worry severity and vaccination intention. Dispositional worry may increase H1N1 vaccination intention when threat and benefits are high and barriers are low, these findings should be further tested in future research related to behavior in pandemics as well as research in other health contexts.

What is already known on this topic

Theoretical frameworks are necessary to ensure effective vaccination promotion during pandemic events.[5] The HBM is an ideal model to promote vaccination,[6] and a recent meta-analysis found perceived likelihood, susceptibility and severity were strongly associated with vaccination.[8] Additionally, past research found barriers mediated cues to action and H1N1 vaccination;[27] potentially a significant predictor of behavior.[6] However, such theories neglected the impact of affect on behavior. Independent of HBM constructs, prior research found 'state-based' worry to be associated with H1N1 vaccination.[14–17]

What this study adds

This study adds to our understanding about vaccination promotion during pandemic events by exploring the impact of dispositional pandemic worry on vaccination. Additionally, this study goes one step further to consider how dispositional worry interacts with HBM constructs during a pandemic event to identify salient construct to promote vaccination. This study provides support for the adoption of a previously validated dispositional worry scale [24,26] for a pandemic event. Findings add to the literature regarding the impact of affect on vaccination and indicate dispositional worry may act similarly to state-based worry by inciting

Table 3 Point biserial correlation matrix

	Flu worry severity	*Flu worry frequency*	*Gender*	*Age*	*Education*	*Race*	*Seasonal flu vaccine frequency*	*Had H1N1*	*Received H1N1 vaccine*	*Intention to receive H1N1 vaccine*	*Barriers*	*Benefits*	*Threat*	*Efficacy*
Flu worry severity	1													
Flu worry frequency	0.454**	1												
Gender	0.101**	0.024	1											
Age	0.034	−0.34	0.088*	1										
Education	−0.050	−0.112**	0.055	0.190**	1									
Race	−0.048	−0.026	−0.035	0.047	0.008	1								
Seasonal flu vac freq	0.082**	0.067*	0.020	0.250**	0.074**	−0.020	1							
Had H1N1	0.007	0.029	0.041	−0.030	−0.031	0.000	0.134**	1						
Received H1N1 vaccine	0.105**	0.074**	0.045	0.031	0.071*	−0.003	0.425**	0.326**	1					
Intention to receive the H1N1 vaccine	0.223**	0.153**	0.035	0.119**	0.057*	−0.015	0.379**	0.120**	0.416**	1				
Barriers	0.255**	0.219**	−0.084**	−0.071**	−0.168**	−0.043	−0.171**	−0.088**	−0.305**	−0.159**	1			
Benefits	0.137**	0.036	0.062*	0.083**	0.099**	−0.001	0.253**	0.097**	0.338*	0.321**	−0.153**	1		
Threat	0.315**	0.140**	0.181**	0.171**	0.026	−0.012	0.222**	0.115**	0.243**	0.380**	−0.023	0.428**	1	
Efficacy	−0.004	−0.044	0.102**	−0.027	0.156**	0.012	0.097**	0.061*	0.209**	0.159**	−0.317**	0.300**	0.225**	1

Notes: **Point biserial correlation is significant at the 0.01 level (2-tailed); *Point biserial correlation is significant at the 0.05 level (2-tailed).

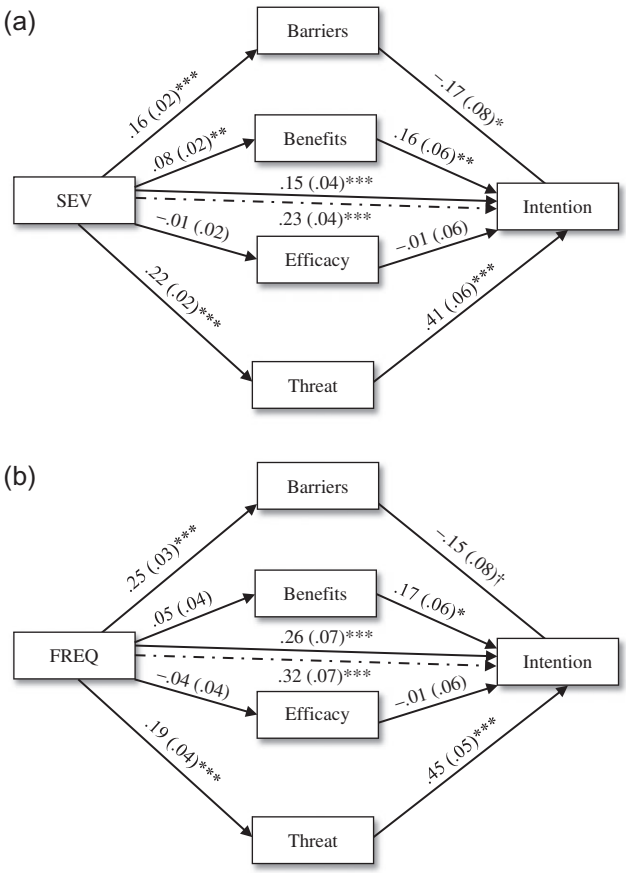

Fig. 1 (**a**) Parallel mediation for SEV. (**b**) Parallel mediation for FREQ.

vaccination. Results from this study add to the literature about vaccination promotion indicating messages created for those high in dispositional worry should focus on increasing the threat of pandemic event and highlighting the benefits and decreasing barriers to vaccination. Fortunately, as messages increasing perceptions of threat are known to increase vaccination behavior in the general population, and barriers were found to mediate H1N1 vaccination, it seems messages theoretically grounded in such ways can be motivational for those high in dispositional worry.

Limitations of this study

Limitations include the retrospective cross-sectional design which makes it impossible to establish causality. Furthermore, the sample in this study was primarily white, highly educated and held private health insurance and thus is not representative of the general population. HBM constructs from mammography screening were adapted in this study based on stakeholder requests due to prior successful use in the Indiana population. However, there are questionnaires that assess HBM constructs in vaccination.[37–40] The directionality of the mediational analyses conducted in this study implies dispositional worry is mediated by HBM constructs. Theoretically, the direction of this mediational analysis makes sense as dispositional worry is a trait—an automatic response to a threat based on cognitive mechanisms including for example, deficits in attention control and difficulty in suppressing negative intrusive thoughts.[41] Therefore, it is expected that dispositional pandemic worry would be present, even in the absence of pandemic events. Data collection occurred during H1N1 epidemic decline, yielding fewer who intended to receive the vaccine. Lack of intention for H1N1 vaccination may be reflective of the declining threat, and thus this study should be replicated at the beginning or height of a pandemic event. Although a minority in this study received H1N1 vaccination (~22%), rates were only slightly lower than national vaccination rates (~27%).[42]

Conclusions

Understanding how dispositional worry influences health protective behavior during pandemic events is important for future public health campaign design, and as pandemics

cannot be predicted, should be explored prior to an outbreak. Results from this study indicate that dispositional worry motivates vaccination behaviors during pandemic events when threat and benefits of vaccination are high and barriers are low. Given increasing evidence that dispositional worry plays a key role in promoting health protective behaviors, future research should continue to examine the impact of dispositional worry in other contexts related to health protective behaviors.

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