Journal of Anxiety Disorders 26 (2012) 425–429

Contents lists available at SciVerse ScienceDirect

Journal of Anxiety Disorders

Worry and perceived threat of proximal and distal undesirable outcomes

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ARTICLE INFO

Article history:
Received 22 June 2011
Received in revised form 13 October 2011
Accepted 5 January 2012

Keywords:
Worry
Perceived threat
Probability estimates
Cost estimates
Timeframe

ABSTRACT

Individuals who are prone to worry tend to overestimate the likelihoods and costs of future undesirable outcomes. However, it is unclear whether these relations vary as a function of the timeframe of the event in question. In the present study, 342 undergraduate students completed a self-report measure of worry and rated the perceived probabilities and costs of 40 undesirable outcomes. Specifically, each participant estimated the probability that each of these outcomes would occur within three different timeframes: the next month, the next year, and the next 10 years. We found that the strength of the association between worry and probability estimates was strongest for the most proximal timeframe. Probability estimates were more strongly associated with worry for participants with elevated cost estimates, and this interactive effect was strongest for the most distal timeframe. Implications of these findings for understanding the etiology and treatment of excessive worry are discussed.

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1. Worry and perceived threat of proximal and distal negative outcomes

According to Borkovec, Alcaine, and Behar (2004), "it is the perception of threat that initiates the anxiety process" (p. 81). Perceptions of threat are composed of two critical elements: (a) the perceived probability of an undesirable outcome and (b) the perceived cost of the outcome should it come true (Carr, 1974; Foa & Kozak, 1986). Past research has shown that individuals who believe that undesirable outcomes are more likely to occur tend to have higher levels of worry than do individuals who believe that undesirable outcomes are less likely to occur (Berenbaum, Thompson, & Bredemeier, 2007; Berenbaum, Thompson, & Pomerantz, 2007; Butler & Mathews, 1983; MacLeod, Williams, & Bekerian, 1991; Miranda & Mennin, 2007). The present study examined whether the relation between worry and perceived probability varies as a function of the timeframe of the potential undesirable outcomes under consideration (e.g., will the unpleasant outcome occur in the next month vs. in the next 10 years).

Past research examining the relations between perceived threat and worry has not explored whether these associations are moderated by timeframe. Specifically, researchers have either failed to explicitly indicate the timeframe of the undesirable outcomes in question, or have instructed participants to focus on one specific timeframe (e.g., the next 2 years; MacLeod et al., 1991). This is particularly problematic given that the *actual* probability of any outcome is highly dependent upon the timeframe under consideration (e.g., your chances of being in a car accident in the next week are quite different from your chances of being in a car accident in the next year). Thus, it is unclear whether individuals who are prone to worry tend to systematically overestimate the likelihood of future undesirable outcomes across all potential timeframes, or whether the relation between worry and probability estimates is dependent on the timeframe.

There are two reasons to suspect that timeframe may be a critical issue to consider when examining the relation between worry and the perceived probability of an undesirable outcome. First, according to the looming vulnerability model (Riskind, 1997), individuals who are prone to worry tend to perceive threats or dangers as unfolding or increasing over time (i.e., "looming"). One implication of this might be that worriers can accurately estimate the likelihood of distal negative outcomes, but they begin to overestimate the likelihood of these outcomes as they approach. Second, one factor that may contribute to elevated probability estimates, and hence to elevated levels of worrying, is how abstractly vs. concretely people think about the outcomes. This explanation is consistent with the findings that "unpacking" the details of a possible event leads to lower probability estimates (Redden & Frederick, 2011), along with the finding that individuals who are prone to worry tend to think about future negative outcomes in an abstract fashion (Stober & Borkovec, 2002). Given that most people (including non-worriers) tend to construe distal outcomes in an abstract fashion (e.g., Liberman & Trope, 1998), differences in probability estimates between worriers and non-worriers may become smaller for possible events that are further in the future, and greater as these events draw nearer in time.

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0887-6185/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
doi:10.1016/j.janxdis.2012.01.001

Past research has also shown that individuals who believe that undesirable outcomes will be more costly tend to have higher levels of worry (Berenbaum, Thompson, & Bredemeier, 2007; Berenbaum, Thompson, & Pomerantz, 2007; Butler & Mathews, 1983). Furthermore, Berenbaum, Thompson, and Pomerantz (2007) found that the interaction of probability and cost estimates significantly predicted worry above and beyond the direct effects of each – specifically, the impact of probability estimates increased as cost estimates increased. However, Berenbaum, Thompson, and Bredemeier (2007) failed to replicate this finding. One possible explanation for these discrepant findings is that the interactive effect of probability and cost estimates may vary by timeframe. Different methods were employed in these two studies to measure perceived threat – specifically, Berenbaum, Thompson, and Pomerantz (2007) asked participants to generate a short list of undesirable outcomes that they think most about and provide probability and cost estimates for each, whereas Berenbaum, Thompson, and Bredemeier (2007) asked participants to provide probability and cost estimates for a standardized list of undesirable outcomes.[1] These approaches could have (inadvertently) tapped into different timeframes. For example, asking participants to generate their own set of undesirable outcomes may encourage them to focus on long-term concerns rather than day-to-day worries, whereas asking them to provide probability and cost estimates for specific outcomes without reference to a timeframe may encourage them to focus on the near future when generating these estimates.

In the present study, we sought to address this important yet unexamined issue by exploring whether the relation between perceived threat and worry is moderated by timeframe. Specifically, we asked participants to generate probability estimates for a set of undesirable outcomes for three different timeframes (the next month, the next year, and the next 10 years). We hypothesized that elevated levels of worry would be associated with elevated probability estimates for proximal but not distal undesirable outcomes. In other words, we expected that timeframe would interact with worry to predict probability estimates. We also examined whether the relation between worry and the interaction of probability and cost estimates varied as a function of the timeframe upon which the probability estimates were based. Finally, to examine specificity, we also measured participants' levels of anhedonic depression and anxious arousal. While both of these variables are associated with elevated probability estimates Berenbaum, Thompson, and Bredemeier (2007), neither are thought to be related to "looming vulnerability" or abstract construal of threat. Thus, we predicted that timeframe would not interact with anhedonic depression or anxious arousal to predict threat estimates. Findings in line with these hypotheses would have important implications for our understanding of the relation between worry and perceived threat, and in turn, interventions designed to target biased threat estimates in individuals experiencing excessive worry.

2. Methods

2.1. Participants

Three hundred and forty-two college students (62% female), ranging in age from 18 to 26 years (M = 18.9; SD = 1.0), participated in the study for course credit. Most (63%) reported being European American, 16% were Asian American, 6% were African American, 6% were Latino/a, 2% were Biracial, and 7% selected the descriptor "other."

2.2. Measures

Worry was measured using the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990). The PSWQ is composed of 16 items (e.g., "My worries overwhelm me"), and participants rate how typical each statement is of them on a scale from 1 ("not at all typical") to 5 ("very typical"). Thus, scores can range from 16 to 80. Importantly, this full range of scores was represented in our sample. In fact, individuals with high PSWQ scores were not rare; 91 participants had scores of 62 or greater (which represents a proposed cutoff for identifying individuals with pathological levels of worry in unselected student samples; see Behar, Alcaine, Zuellig, & Borkovec, 2003). Past research suggests that the PSWQ has excellent test-retest reliability (r = .92 over 8–10 weeks; Meyer et al., 1990). Further, this scale has good convergent validity (with self-report measures and clinical ratings of related constructs; see Behar et al., 2003; Meyer et al., 1990). Internal consistency of the PSWQ (measured using Cronbach's alpha) in the present sample was .94.

Anxious arousal and anhedonic depression were measured using the relevant subscales from the Mood and Anxiety Symptom Questionnaire (MASQ; Watson, Weber, Assenheimer, Clark, Strauss, & McCormick., 1995). On the MASQ, individuals indicate how frequently they have experienced a variety of symptoms during the past week. The anxious arousal subscale is composed of 17 items related to somatic tension and sympathetic hyperarousal (e.g., "hands were shaky", "startled easily"). The anhedonic depression subscale is composed of 22 items related to experiences of pleasant mood, as well as other symptoms that distinguish depression from anxiety (e.g., "felt like nothing was very enjoyable", "thoughts of death or suicide"). Past research suggests that these subscales have good convergent validity (e.g., with other self-report measures of related constructs; see Nitschke, Heller, Imig, McDonald, & Miller, 2001; Watson et al., 1995). Importantly, these scales have been shown to effectively distinguish among dimensions/types of depression and anxiety (e.g., they are modestly correlated with one another and can distinguish individuals with depressive disorders from individuals with anxiety disorders; see Buckby, Yung, Cosgrave, & Killackey, 2007; Nitschke et al., 2001). Internal consistency for the anxious arousal and anhedonic depression subscales in our sample were .84 and .91, respectively.

To measure perceived threat, participants were asked to indicate "how likely" (0 = not at all likely; 6 = almost certain) it was that 40 negative outcomes (e.g., "your health deteriorating," "losing a close friend," "making a mistake at work") were to occur in three different timeframes: (1) the next month; (2) the next year; and (3) the next 10 years. Then, participants were asked to indicate "how bad" (0 = not at all bad; 6 = horrific) it would be if each of these outcomes were to occur, *independent of timeframe*. Thus, participants provided three probability estimates for each undesirable outcome, but only one cost estimate for each. This strategy of measuring perceived threat has been used in past research (e.g., Berenbaum, Thompson, & Bredemeier, 2007; Butler & Mathews, 1983), but without asking participants to provide separate probability estimates for different timeframes. Our list of undesirable outcomes included several from each of the major sources of worry identified in past research (e.g., interpersonal, achievement, financial, health) – it was largely derived from the list used in by Berenbaum, Thompson, and Bredemeier (2007), eliminating a few for which there was very little variability and adding a few that we anticipated would be more likely to occur within the next month (e.g., "making a mistake at work"). Probability estimate scores were computed

[1] In Study 2 of Berenbaum, Thompson, and Bredemeier (2007), participants also completed an idiographic measure in addition to the standardized list of undesirable outcomes. However, a composite score was used for analyses, and the instructions for the idiographic measure differed slightly from those used in Berenbaum, Thompson, and Pomerantz (2007) – specifically, participants' were asked to generate a list of the five undesirable outcomes they worry about most, as opposed to the five undesirable outcomes they think about most.

by averaging the 40 "how likely" ratings *within each timeframe*, and cost estimate scores were computed by averaging the 40 "how bad" ratings. Internal consistencies of probability estimates for the next month, next year, and next 10 years were .94, .93, and .95, respectively. Internal consistency of cost estimates was .95.

2.3. Statistical analyses

To test whether cost estimates are associated with worry, we computed a zero-order correlation between these two scores. To examine specificity, correlations were computed with anhedonic depression and anxious arousal scores. To determine if probability estimates varied as a function of timeframe, we conducted repeated measures analysis of variance (ANOVA), treating probability estimates as a within-subjects variable with 3 levels (next month, next year, and next 10 years) using Geisser–Greenhouse corrections for violations of sphericity. To test whether the relation between probability estimates and worry varied based upon the timeframe of the outcome in question, worry was included in this analysis as a between-subjects covariate. We hypothesized that there would be a significant timeframe × worry interaction. Again, to examine specificity, comparable analyses were conducting with anhedonic depression and anxious arousal scores as between-subjects covariates. For significant interactions, follow-up analyses were conducted by computing zero-order correlations between probability estimates and worry separately for each timeframe, then statistically comparing the magnitude of these associations by using structural equation modeling (SEM), following recommendations from Preacher (2006). Similar methods were used to examine whether the association between the interaction of probability and cost estimates and worry varied by timeframe, except: (1) residualized product scores were used in the repeated measures ANOVA to remove the marginal effects of probability and cost estimates; (2) follow-up analyses were conducted using hierarchical regression, entering standardized probability and cost estimates in the first step and the interaction term in the second step; and (3) we compared part correlations between the product scores and worry in the SEM analyses, again following procedures described by Preacher (2006).

3. Results

Fourteen participants were excluded from the analyses (13 were missing data for ten or more items within any timeframe on the perceived threat survey and 1 was a multivariate outlier), resulting in a total sample size of 328. Consistent with past research (e.g., Berenbaum, Thompson, & Pomerantz, 2007; Butler & Mathews, 1983), perceived cost estimates for future undesirable outcomes were significantly associated with self-reported levels of worry ($r = .27$, $p < .01$). Also consistent with past research (Berenbaum, Thompson, & Bredemeier, 2007), this association was unique to worry, as neither anxious arousal nor anhedonic depression was significantly associated with cost estimates ($r = .09$ and $r = .08$, respectively).

Not surprisingly, probability estimates increased as a function with time, as reflected by a significant main effect of timeframe in the repeated measures ANOVA ($F(1.14, 373.18) = 511.78$, $p < .01$, $\eta_p^2 = .61$). As hypothesized, the association between probability estimates and worry varied by timeframe, as reflected by a significant timeframe × worry interaction in the repeated measures ANOVA ($F(1.18, 369.71) = 4.95$, $p < .05$, $\eta_p^2 = .016$). In contrast, neither anxious arousal nor anhedonic depression significantly interacted with timeframe to predict probability estimates ($ps > .10$). Follow-up analyses revealed that, in line with our predictions, the association between worry and probability estimates was weakest for the next 10 years timeframe ($r = .07$, $p = .20$), stronger for the next year timeframe ($r = .15$, $p < .01$), and strongest for the next month timeframe ($r = .20$, $p < .01$). In other words, the strength of the association between probability estimates and worry increased as the timeframe for the outcomes in question decreased. This pattern is portrayed graphically on the left side of Fig. 1. Statistical comparisons of these associations revealed significant differences between the strength of the association for the next month and next 10 years timeframes (CMIN = 6.07, $p < .05$) as well as the next year and next 10 years timeframes (CMIN = 6.44, $p < .05$), but not the next month and next year timeframes (CMIN = 2.74, $p = .10$).

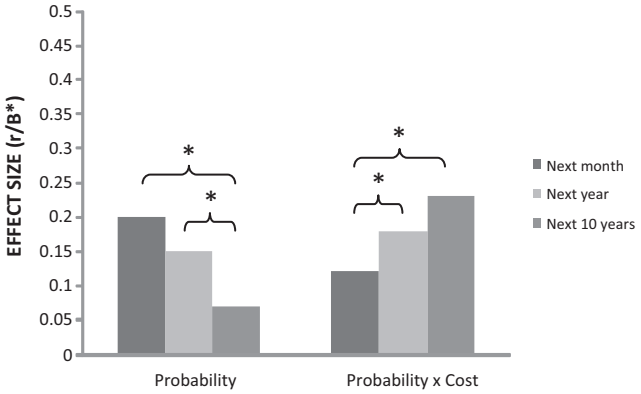

Fig. 1. Effect sizes for the relations between worry and probability estimates (left) and the relations between worry and the interaction of probability and cost estimates (right) as a function of timeframe. *Note*: *Significant difference between effects, alpha: $p < .05$.

The degree to which the interaction of probability and cost estimates was associated with worry (above and beyond the marginal effects) also varied by timeframe, as reflected by a significant timeframe × worry interaction in the repeated measures ANOVA involving the residualized product scores ($F(1.20, 374.28) = 3.87$, $p < .05$, $\eta_p^2 = .012$). Again, neither anxious arousal nor anhedonic depression significantly interacted with timeframe to predict the residualized product scores ($ps > .10$). Follow-up analyses revealed that the association between worry and the interaction of probability and cost estimates was weakest for the next month timeframe ($B = .12$, $p < .05$), stronger for the next year timeframe ($B = .18$, $p < .01$), and strongest for the next 10 years timeframe ($B = .23$, $p < .01$). In other words, the pattern of results regarding the interaction terms was opposite to that regarding probability estimates alone. This pattern is portrayed graphically on the right side of Fig. 1. Statistical comparisons of these associations revealed significant differences between the strength of the association for the next month and next year timeframes (CMIN = 5.41, $p < .05$) as well as the next month and next 10 years timeframes (CMIN = 4.50, $p < .05$), but not the next year and next 10 years timeframes (CMIN = 2.20, $p = .14$). The nature of these interactive effects is shown in Fig. 2. As can be seen in Fig. 2, for the next 10 years timeframe, probability estimates were more strongly associated with worry for participants with elevated cost estimates, and this interactive effect decreased as the timeframe became shorter. Importantly, the pattern of this interactive effect is quite similar to the pattern of the probability × cost interaction reported by Berenbaum, Thompson, and Pomerantz (2007), who also found that probability estimates are more strongly associated with worry for individuals with elevated cost estimates.

4. Discussion

In the present study, we examined whether the relation between perceived threat of a future undesirable outcome and worry is moderated by the timeframe of the outcome in question.

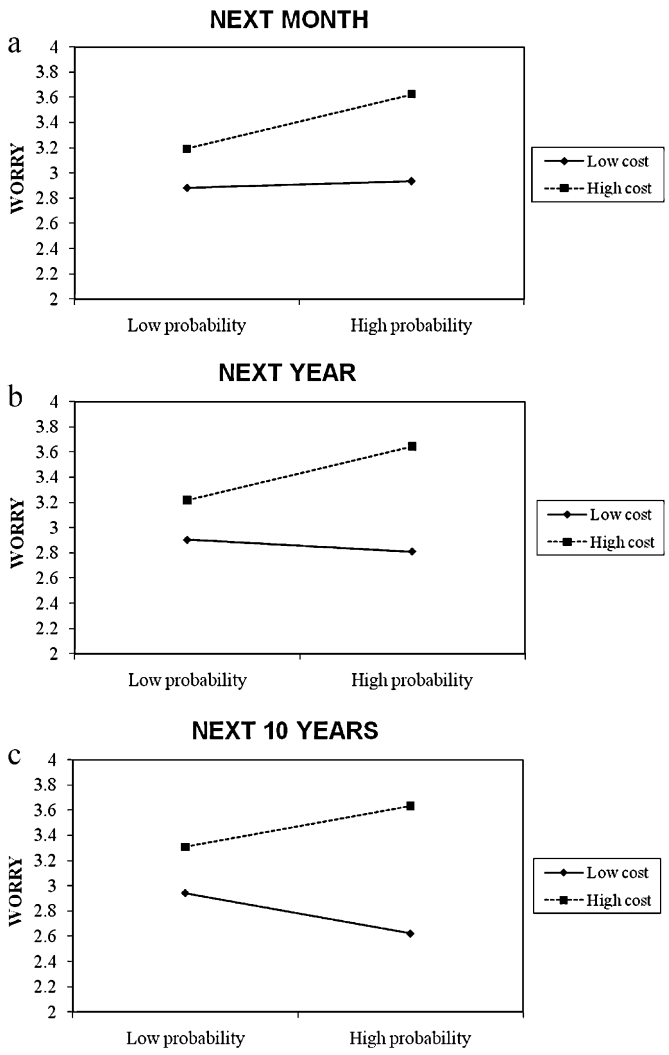

Fig. 2. Probability × cost estimates interactions predicting worry for: (a) the next month; (b) the next year, and (c) the next 10 years.

Consistent with past research (e.g., Berenbaum, Thompson, & Bredemeier, 2007; Butler & Mathews, 1983), we found that cost estimates were uniquely associated with worry. Moreover, we found that the relation between worry and probability estimates varies by timeframe, as does the relation between worry and the interaction of probability and cost estimates. Specifically, the relation between worry and probability estimates was stronger for proximal outcomes, whereas the relation between worry and the interaction of probability and cost estimates was stronger for distal outcomes. These findings may have a number of important implications for our understanding of the relation between worry and perceived threat, and in turn, the etiology and treatment of excessive worry.

First and foremost, our findings suggest that the role of probability estimates in initiative worry depends upon the timeframe of the feared outcome in question. Specifically, when not taking perceived costs into account, worry is associated with probability estimates for undesirable outcomes in the relatively near future, suggesting that the tendency to overestimate the likelihood that these outcomes will occur could play a more independent role in the initiation of worry about proximal outcomes. In contrast, worry is more strongly associated with probability estimates for undesirable outcomes in the distant future when cost estimates are also high, suggesting that the combined effects of overestimating probabilities and costs could play a more critical role in the initiation of worry about distal outcomes. Of course, it is important to note that the data from the present study are correlational. Thus, we cannot draw definitive conclusions about whether these relations are causal. Future research should employ longitudinal and/or experimental designs to explore this issue.

Second, our findings may have important implications for some existing theories of worry. In particular, while a number of theories posit that perceived threat plays a prominent role in the initiation of worry (e.g., Berenbaum, 2010; Borkovec et al., 2004), our findings suggest that, by ignoring the issue of timeframe, these theories do not adequately characterize the nature of the relation between worry and perceived threat. Furthermore, the looming vulnerability model (Riskind, 1997) asserts that worry is associated with perceptions of increasing threat. Our findings suggest that one potentially important (but previously unexplored) implication of this tendency is that worriers could experience steadily increasing probability estimates as the event in question draws nearer. Finally, Borkovec et al. (2004) have argued that worry functions as a means of cognitive avoidance. Our findings provide indirect support for the idea that using worry as an avoidance strategy over time may prevent worriers from engaging with evidence that conflicts with their concerns, which in turn may prevent them from correcting their inaccurate likelihood estimates over time and lead to a stronger association between probability estimates and worry for proximal outcomes. In line with this idea, Stapinski, Abbott, and Rapee (2010) recently found experimental evidence that worrying maintains elevated perceptions of threat. Nevertheless, in order to fully understand the implications of our findings for these (and other) theories of worry, it will be necessary to directly explore the mechanisms accounting for the moderating effect of timeframe on the relation between worry and perceived threat.

Third, our findings may help to explain some inconsistencies from past research. In particular, inconsistent findings have been reported regarding whether the interaction of probability and cost estimates predicts worry (Berenbaum, Thompson, & Bredemeier, 2007; Berenbaum, Thompson, & Pomerantz, 2007). We found that the strength of the relation between worry and the interaction of probability and cost estimates was strongest in regards to distal outcomes. One potential explanation for this pattern is that, over longer timeframes, negative outcomes are inherently more likely to occur (e.g., you are more likely to suffer a serious injury in the next 10 years than you are to suffer a serious injury in the next week). Thus, the interactive effect of probability and cost estimates may become more robust when the actual probability of the event in question is relatively high. Another possibility is that distal outcomes only become sufficiently salient to garner attention when they are perceived as both very likely and very costly, given that there are lots of low cost outcomes that are fairly likely to occur in the long run (and one cannot attend to them all). Either of these accounts could explain why asking individuals to rate the probabilities and costs of self-generated outcomes (Berenbaum, Thompson, & Pomerantz, 2007) would be more likely to yield a probability × cost interaction, relative to having them rate probabilities and costs for a specified list of outcomes with no explicit reference to timeframe (Berenbaum, Thompson, & Bredemeier, 2007). Future research should explore these ideas, along with other possible accounts for why the interactive effect of probability and cost estimates on worry is more prominent for distal outcomes. Furthermore, whereas the present study examined the extent to which probability estimates vary as a function of timeframe, we did not examine the extent to which cost estimates vary as a function of timeframe. In light of evidence that people tend to discount the value of future outcomes as a function of temporal distance (e.g., Myerson & Green, 1995), it may be useful to explore if and how cost estimates (and their relation to worry) vary by timeframe as well.

Fourth, our findings may have important implications for the treatment of excessive worry. Specifically, in our own clinical work, we have found that it can be useful to have clients keep a log of their worries on a day-to-day basis in which they record: (1) the feared outcome they were worried about; (2) their estimate of how likely that outcome is to occur; (3) their estimate of how bad that outcome would be if it did occur; (4) whether or not that outcome actually did occur; and, if so, (5) how bad it actually was. This approach allows clients to systematically evaluate the accuracy of their predictions over time. The findings from the present study suggest that it may be fruitful to encourage clients to focus on proximal feared outcomes as a means of systematically evaluating and correcting biased probability estimates. For example, if a client endorses worrying about not being able to pay their bills, it might be fruitful to have them fill out an entry on the log that focused on the feared outcome of not being able to pay their bills *in the next month*. Not only does this approach force clients to concretize their worries in a way that could facilitate systematic evaluation (see Stober & Borkovec, 2002), but our findings suggest that biased probability estimates may be more likely to emerge for shorter timeframes. In contrast, when clients report worrying about outcomes that are clearly distal in nature (e.g., a college freshman worrying about not getting a good job after graduation), it may be more fruitful to focus on correcting biased cost estimates rather than probability estimates (e.g., by having them engage in imaginal exposure to their feared outcomes). Not only would this allow clients to begin challenging their predictions before the event in question could occur, but our findings suggest that correcting overestimations of costs might decrease the impact of probability estimates on worry for distal events.

Of course, given that the present study utilized a college sample, caution needs to be exercised in generalizing to treatment-seeking samples. Although existing evidence suggests that worry is dimensional in nature (Olatunji, Broman-Fulks, Bergman, Green, & Zlomke, 2010; Ruscio, Borkovec, & Ruscio, 2001), our findings warrant replication in clinical samples. Furthermore, it is important to note that, without any evidence of the *actual* likelihood of these undesirable outcomes for participants, it is impossible to determine whether elevated probability estimates reflect overestimation, more realistic predictions, or genuine differences in risk for experiencing these outcomes. Future research should aim to explore this issue.

In conclusion, we replicated previous findings that there is an association between worry and both probability and cost estimates of future undesirable outcomes (Berenbaum, Thompson, & Bredemeier, 2007; Berenbaum, Thompson, & Pomerantz, 2007; Butler & Mathews, 1983; MacLeod et al., 1991; Miranda and Mennin, 2007). Moreover, we found that the relation between worry and the perceived threat of undesirable outcomes is moderated by the timeframe of the outcome in question. Specifically, the association between worry and probability estimates was strongest for proximal outcomes, whereas the association between worry and the interaction of probability and cost estimates was strongest for distal outcomes. While some questions about the relation between worry and perceived threat remain unanswered, our findings may have important implications for understanding the etiology and treatment of excessive worry.

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