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Effects of optimism on recovery and mental health after a tornado outbreak

Eric G. Carbone[*] and **Erin Thomas Echols**

U.S. Centers for Disease Control and Prevention (CDC), Office of Public Health Preparedness and Response (OPHPR), Atlanta, GA, USA

Abstract

Objective—Dispositional optimism, a stable expectation that good things will happen, has been shown to improve health outcomes in a wide range of contexts, but very little research has explored the impact of optimism on post-disaster health and well-being.

Design—Data for this study come from the Centers for Disease Control and Prevention's Public health systems and mental health community recovery (PHSMHCR) Survey. Participants included 3216 individuals living in counties affected by the April 2011 tornado outbreak in Mississippi and Alabama.

Main outcome measures—This study assesses the effect of dispositional optimism on post-disaster recovery and mental health.

Results—Dispositional optimism was found to have a positive effect on personal recovery and mental health after the disaster. Furthermore, it moderated the relationship between level of home damage and personal recovery as well as the relationship between home damage and post-traumatic stress disorder (PTSD), with stronger effects for those with increased levels of home damage.

Conclusions—The utility of screening for optimism is discussed, along with the potential for interventions to increase optimism as a means of mitigating adverse mental health effects and improving the recovery of individuals affected by disasters and other traumatic events.

Keywords

optimism; recovery; mental health; disasters; tornado

Introduction

Dispositional optimism is a generally stable expectation that good things will happen (Carver, Scheier, & Segerstrom, 2010). Previous research has linked dispositional optimism to more effective coping strategies and positive health behaviors, leading to better health outcomes and subjective well-being (Aspinwall & Tedeschi, 2010; Carver et al., 1994, 2010; Nes & Segerstrom, 2006). Optimistic individuals make greater use of problem-focused

[*]Corresponding author: ecarbone@cdc.gov.

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strategies, such as planning, when confronted with difficult but controllable circumstances and characteristically switch to emotion-focused strategies, such as cognitive restructuring, in the face of uncontrollable events (Nes & Segerstrom, 2006). Optimism has also been linked to attentiveness in critical circumstances, leading to more constructive coping strategies (Abele & Gendolla, 2007; Carver & Connor-Smith, 2010; Geers, Wellman, & Lassiter, 2009). Not surprisingly, optimism was identified as one of the strongest predictors of successful completion of basic military training by recruits who experienced stress sufficient to warrant referral for psychological evaluation (Carbone, Cigrang, Todd, & Fiedler, 1999). Recruits who were optimistic that they would be successful, in spite of significant setbacks, were in fact much more likely to graduate rather than to be discharged during training. In contrast, pessimists across a range of situations are more likely to cope with stress through denial or disengagement (Scheier et al., 1994).

Optimism helps to buffer stressors, increase perceived social support, and improve health behaviors such as abstaining from negative coping strategies like drug abuse or overeating (Carver et al., 2010; Rasmussen, Scheier, & Greenhouse, 2009; Srivastava, McGonigal, Richards, Butler, & Gross, 2006; Terrill, Ruiz, & Garofalo, 2010; Vollmann, Antoniw, Hartung, & Renner, 2011). The effect of optimism operates through several pathways: behavioral, cognitive and neurobiological (Armbruster, Pieper, Klotsche, & Hoyer, 2015). For example, cognitive and behavioral processes link optimism to positive coping strategies and proactive steps to protect one's health. Optimists are more likely to take energetic and task-focused approaches that lead to persistence in educational efforts and increases in socio-economic status. These behaviors improve individuals' social status and objective health (Carver et al., 2010).

While researchers have explored the effect of optimism on a wide range of health conditions and life circumstances, very few studies have examined this characteristic in relation to the health and well-being of individuals affected by natural disasters. This is surprising, given the worldwide impact of disasters. A recent International Monetary Fund (IMF) study found that the number of natural disasters that occur around the world is rising (Laframboise & Loko, 2012). In the US., the number of Federal Emergency Management Agency (FEMA) disaster declarations have likewise increased, with an average of 65 major declarations per year and a total of 1907 declarations from 2002 to 2014 (Federal Emergency Management Agency, 2016).

Natural disasters often lead to heightened stress for affected individuals, negatively impacting the health, well-being and recovery of populations exposed to these events. Distress in a variety of circumstances has been shown to result in inflammatory responses that accelerate disease processes (Stewart, Rand, Muldoon, & Kamarck, 2009; Suls & Bunde, 2005). Prolonged distress is also linked to an increase in negative health behaviors (Baumeister, Vohs, & Tice, 2007) and weakened social support systems (Umberson, Crosnoe, & Reczek, 2010). Natural disasters specifically are associated with significant adverse mental health effects, some manifesting immediately and others emerging weeks or months later (Foa, Stein, & McFarlane, 2006; Meewisse, Olff, Kleber, Kitchiner, & Gersons, 2011; Smid, Mooren, van der Mast, Gersons, & Kleber, 2009). In a landmark disaster studies review conducted 15 years ago, Norris, Friedman, and Watson (2002b) stated that the

evidence base was by that point sufficient to conclude with certainty that disasters result in significant adverse mental health effects. They noted that the most prevalent mental health consequence of disasters is post-traumatic stress disorder (PTSD), followed by depression and anxiety in various forms. Moreover, there is strong evidence that the majority of injuries in most disaster settings are psychological, rather than physical, by ratios ranging from 4:1 to as high as 50:1, depending on the nature of the event (McCabe et al., 2014).

Only two papers among the hundreds of studies of optimism and health published over the last several decades were found to explore this construct in the context of natural or human-caused disasters. In a 2011 study that examined risk factors for PTSD among Chinese students who had been exposed to a snowstorm disaster, Zhou et al. (2011) found that optimism was associated with fewer PTSD symptoms following this adverse weather event. In contrast, pessimism was associated with more PTSD symptoms, as well as a greater magnitude of avoidance, intrusive thoughts and hyperarousal. A second study addressing optimism and disasters utilised data from Dutch victims who were exposed to the Enschefe Fireworks Disaster, along with a comparison group of unaffected Dutch participants. van der Velden et al. (2007) found that pessimistic victims were at increased risk for depressive symptoms and obsessive–compulsive thoughts and behaviors. In addition, they found that pessimistic participants who were in the non-affected comparison group were also at increased risk for anxiety, sleep disturbance, somatic problems and impairments in social functioning (van der Velden et al., 2007).

The present study examines the relationship of optimism and self-reported personal and household recovery among a large sample of individuals who lived in regions of Alabama and Mississippi that experienced a severe tornado outbreak in 2011. Between April 25 and 28 of 2011, 351 tornadoes swept through the Southeastern United States. Tornadoes in the US kill an average of more than 60 people and injure about 1500 annually. The April 2011 tornado outbreak resulted in 338 fatalities in Arkansas, Mississippi, Alabama, Tennessee and Georgia. In addition to these fatalities, the storms also caused 2000 injuries and $4.2 billion in property damage in Alabama alone (Chiu et al., 2013).

Because optimism has been linked to positive health behaviors that help to buffer stress and improve health, we were particularly interested in understanding its potential effect on recovery after a significant disaster. No work to date that we are aware of has explored the relationship between optimism and personal or household recovery from disasters. In addition, because substantial prior research has demonstrated a connection between optimism and mental health in other contexts, we also sought to examine whether similar effects would be observed in the population affected by this disaster.

Methods

To assess the role of dispositional optimism in disaster recovery, this study uses data from the Center for Disease Control and Prevention’s Public Health Systems Mental Health Community Recovery (PHSMHCR) Survey. The PHSMHCR Survey intended to study factors potentially related to individual and household recovery in four areas of Alabama and Mississippi affected by a severe tornado outbreak in April 2011. The sampling frame for

each of the four regions was based on addresses residing in zip codes within a five-mile radius of the path of the tornadoes that occurred on April 25–27, 2011. If any portion of the zip code was in the five-mile radius, the entire zip code was included in the region.

The sample was selected in two phases. First, a sample of addresses was randomly selected from residences that met the inclusion criteria above and reverse matched to telephone directories. Based on the outcome of the reverse match, the sample was stratified as 'matched' to a telephone number or 'unmatched'. A final subsample of addresses (13,000 in each region) was then selected to maximise the percentage of households with a matching phone number (59% of the final subsample were matched). Matched addresses received a letter in advance, followed by Computer-assisted telephone interviewing (CATI) to complete the interview. Unmatched addresses received a letter inviting them to either call in to be interviewed or to provide their phone number in order to complete the household survey via CATI. Household members were required to be 18 years or older to complete the survey and only one participant per household was selected for participation. For the matched sample, the household member with the most recent birthday was selected for participation. For the unmatched sample, the selected respondent was the person answering the phone or the respondent who had replied to the mailed form. Of 21,572 unmatched sample addresses, 927 households provided contact information via form, email, or inbound dialing, representing an unadjusted 4% return rate.

Of those 927, 376 would complete the survey (a 41% response rate on returned forms). In contrast, of 30,428 matched sample addresses, 2840 complete surveys were achieved, representing an unadjusted response rate of 9%. Respondents were asked to confirm their location during the 2011 tornado outbreaks. Those that indicated they lived in a different residence were asked to provide the zip code and nearest intersection, if the zip code provided was still within the sampled affected regions.

A total of 3216 participants who were 18 years or older and residing in the tornado-affected region completed the 25 min household telephone survey. Overall, this constitutes 3216 of 52,000 (6.2%) of all addresses. All surveys were conducted between 11 April 2014 and 9 July 2014, approximately 3 years after the tornadoes struck.

Measures

Home damage—In order to measure home damage, respondents were asked to indicate the extent to which their homes were damaged by the tornados. Participants selected a response from the following categories: not affected at all, minor damage or closed briefly, moderate damage or closed for a short period of time, significant damage or closed for an extended period and destroyed.

Recovery—Four self-report variables were used to assess recovery following the tornados. Two of these were focused at the household level: The first, *household change*, was the respondent's self-assessment of change to his or her household having occurred since the tornado. Respondents were asked to report the level of household change on a scale ranging from 'better than before the tornados' to 'still heavily damaged from the tornados.' The second variable, *household recovery*, consisted of the respondent's rating of his or her

household's recovery on a scale of 1 to 10, with 10 representing the highest degree of recovery.

In addition to household recovery, two measures focused on the respondent's personal recovery. First, respondents were asked to rate their *quality of life change* as either 'worse,' 'about the same' or 'better' since the tornadoes. Second, to assess the extent of *return to normal* after the tornadoes, respondents were asked to rate their day to day life as 'largely back to normal,' 'almost back to normal,' 'still somewhat disrupted,' or 'still very disrupted.'

Current mental health and well-being—Participants were also screened for current mental health symptoms. Depression was screened using the Patient Health Questionnaire (PHQ)-8 (Kroenke et al., 2009) while anxiety was screened using the Generalized Anxiety Disorder (GAD)-7 (Spitzer, Kroenke, Williams, & Löwe, 2006). PTSD was screened using a seven-item scale derived from Diagnostic to Statistical Manual-IV criteria (Breslau, Peterson, Kessler, & Schultz, 1999).

Dispositional optimism—Respondents completed a short-form (4-item) version of the Life Orientation Test-Revised (LOT-R), an instrument designed to measure dispositional optimism (Scheier et al., 1994). The full-length LOT-R contains 10 items, including 4 filler questions that are not scored. To minimise the response burden of the survey instrument, the four filler items were omitted. Further, of the six items typically scored, only four were utilised in this study based on the strength of their associations with the two factors that have emerged in prior factor analysis of the LOT-R (Glaesmer et al., 2012). Specifically, Item 3 was omitted because it had the weakest association with the pessimism factor, while Item 10 was omitted because it had the weakest association with the optimism factor. In addition, an exploratory factor analysis of our own data for this subset of LOT-R items yielded a two-factor solution very similar to those reported in prior studies of the full instrument. We therefore chose to treat optimism as a construct distinct from pessimism for purposes of this study.

The four retained LOT-R items required subjects to respond on a Likert scale to the following statements: 'In uncertain times, I usually expect the best' (Item 1), 'I'm always optimistic about my future' (Item 4), 'I hardly ever expect things to go my way' (Item 7) and 'I rarely count on good things happening to me' (Item 9). The Likert scale anchors for all items in the LOT-R range from strongly agree to strongly disagree.

Control variables

Personality traits vary in the degree to which they are stable over the life course; optimism and pessimism are no exceptions. Age has been shown to influence the stability of dispositional optimism, with reduced stability among older individuals (Armbruster et al., 2015; Kotter-Grühn & Smith, 2011; Segerstrom, 2007). Several studies have also suggested that optimism and pessimism may be influenced by social support, financial resources and economic stability (Heinonen, 2006; Segerstrom, 2007), factors that can be affected by life transitions. Meanwhile, economic status itself has a significant impact on disaster recovery (Bolin, 1976; Fothergill & Peek, 2004). For these reasons, age and income were introduced

as control variables in our analysis. Respondents were asked to estimate their annual household income from all sources and place themselves into one of the following income categories: less than $15,000, $15,000 to less than $20,000, $20,000 to less than $25,000, $25,000 to less than $35,000, $35,000 to less than $50,000, $50,000 to less than $75,000 or $75,000 or more.

Regression analysis

We utilised ordinary least-squares (OLS) regression analysis to examine the moderating associations of optimism with recovery as the dependent variable. We analysed each of the four recovery variables separately. The first model for each analysis included home damage, optimism, age and income. In constructing the second model, we created dummy variables for home damage that were used to construct interaction terms between each level of home damage and the optimism measure. For the second model in each analysis, the recovery variable was set as the dependent variable in a multiple regression model with optimism, home damage, age, income and the interaction terms.

Because we consider optimism and pessimism as potentially distinct indicators, we likewise tested the moderating effect of pessimism in a separate model for each recovery variable. We utilised the same methods that we used with the optimism models but tested pessimism as the moderator. This included constructing interaction terms between home damage and pessimism, as we had with optimism in the previous models. This analysis was performed separately for each of the four recovery variables described previously.

Similarly, when testing for the moderating associations of home damage, optimism and mental health, we utilised each of the mental health variables as the dependent variable in separate analyses. The three mental health variables were likewise each entered into the regression analysis models with optimism and pessimism separately. Because large sample sizes can result in findings that are statistically but not substantively significant, we chose to set our threshold of significance at $p < .01$ and examined the standardised coefficients (β) to ensure that each coefficient falls within accepted thresholds of substantive significance (Allison, 1999).

This research project was reviewed and cleared by CDC's Institutional Review Board and the information collection process in this study received approval from the Office of Management and Budget, in accordance with the requirements of the Paperwork Reduction Act (PRA).

Results

Table 1 provides descriptive statistics for the sample population. Results show that females ($N = 2287$) were more likely to participate in the survey than males ($N = 929$). Whites ($N = 2090$) made up approximately 66% of participants, with blacks ($N = 944$) making up the next most significant percentage of respondents (30%). Other ethnic groups or those who did not report their ethnicity made up approximately 4% of the sample population. Young adults were least likely to be participants and the mean age of participants was 59.15 years old. The majority of the sample (74%) reported no home damage. Of the 829 respondents who

reported some level of damage, 58% reported minor damage, approximately 21% reported moderate damage, and 21% reported that their houses were significantly damaged/ temporarily closed (n = 79) or destroyed (n = 93). About 20% of respondents reported an annual household income of less than $15,000.

As shown in Table 2, based on responses to the standardised screening instruments, significant proportions of the sample population reported some degree of depression (35%), anxiety (26%) and/or post-traumatic stress symptomatology (40%). Since participants could report multiple mental health symptoms, these categories are not mutually exclusive. Respondents who reported depressive symptoms were more likely to report mild to moderate depressive symptoms, with under 6% reporting moderately severe or severe depression. Respondents reporting anxiety were similarly more likely to report a mild level, though nearly 12% reported experiencing moderate to severe anxiety. Forty-eight% of the sample reported at least one symptom associated with post-traumatic stress, but only 7% of the sample met the four-symptom cut-off suggestive of a PTSD diagnosis.

Finally, Table 3 provides summary statistics on the four self-reported recovery variables used in this study. A majority of the sample population (nearly 72%) reported that their household was no better off and no worse off than before the tornados. Of those who experienced a change to their family or other household members' functioning, 36.5% reported that their households were still in some degree of recovery. Conversely, about 63.5% reported that their households had returned to their pre-tornado status or were doing even better than before the disaster. Similar results were reflected in respondents' numeric ratings of household recovery. In terms of personal recovery, more than 94% of individuals in the overall sample described their quality of life three years after the tornadoes as 'about the same' or 'better' than before the storms, with less than 6% reporting a worse quality of life. About 64% of respondents reported their Return to Normal after tornado as 'fully back to normal'. Just under 6% rated their personal situation as still somewhat or very disrupted.

Dispositional optimism and recovery

Table 4 depicts the results of the regression analysis for predictors of post-disaster recovery. As Model 1 for the Quality of Life Change (personal recovery) variable indicates, home damage, optimism and age were all significant predictors of change in self reported quality of life. For Model 2, regression analysis with interaction terms was used to examine the relationship between level of damage, optimism and self-reported quality of life change. Each simple slope revealed a significant positive association between optimism and recovery, but optimism was more strongly related to quality of life change for significant levels of home damage ($p < .0001$, $\beta = .40$) than for moderate ($p < .0001$, $\beta = .28$) or minor ($p < .0001$, $\beta = .24$) levels of home damage. Hence, optimism moderates the relationship between home damage and self-reported quality of life change, with the effects being larger as home damage increases.

Similarly, Table 4 depicts the results of the regression analysis of the 'Return to Normal After tornado' (personal) recovery variable. As Model 1 indicates, home damage, optimism and income were all significant predictors of return to normalcy. For Model 2, regression analysis with interaction terms was used to examine the relationship between level of home

damage, optimism and this personal recovery variable. Each simple slope revealed a significant positive association between optimism and recovery, but optimism was more strongly related to recovery for significant levels of home damage ($p < .0001$, $\beta = .39$) than for moderate ($p < .0001$, $\beta = .30$) or minor ($p < 0\ .0001$, $\beta = .24$) levels of home damage. This analysis indicates that optimism moderates the relationship between home damage and the 'Return to Normal After tornado' recovery variable, with the effects being larger as home damage increases.

Unlike the personal recovery variables, the household recovery variables did not display significant associations with optimism. Meanwhile, pessimism showed small but significant negative correlations with the household recovery self-rating variable ($p < .0001$) and both personal recovery variables (Return to Normal After tornado): $p < .0001$; 'Quality of life change' recovery: $p < .05$). However, when a regression analysis was conducted, pessimism did not yield significant results in terms of any recovery variables. Pessimism does not appear to moderate the relationship between home damage and either personal or household recovery.

Dispositional optimism and mental health

In assessing the potential moderating relationship between optimism and mental health in this population, respondents' scores on the self-report screeners were used. Optimism was negatively associated with the level of symptomatology of depression ($p < .0001$), anxiety ($p < .0001$) and PTSD ($p < .0001$). Extent of home damage was positively associated with depressive symptoms ($p < .0001$), anxiety symptoms ($p < .0001$) and PTSD symptoms ($p < .0001$). However, a regression with interaction terms did not yield significant results at the .01 level for depression or generalised anxiety. In other words, optimism was not found to moderate the relationship between home damage and depression or home damage and anxiety.

Optimism was found to moderate the relationship between home damage and PTSD. Table 5 depicts the results of the regression analysis for predictors of mental health. As Model 1 for PTSD indicates, home damage, optimism and income were all significant predictors of PTSD symptoms. For Model 2, regression analysis with interaction terms was used to examine the relationship between these variables and PTSD symptoms. As optimism increased, the number of reported PTSD symptoms decreased. Moreover, optimism was more strongly inversely related to PTSD for significant levels of home damage ($p < .001$, $\beta = -0.24$) than for moderate levels ($p < .0001$, $\beta = -.20$) or minor levels ($p < .01$, $\beta = -.15$). This suggests that optimism moderates the relationship between home damage and self-reported PTSD symptoms, with the effects being larger as home damage increases.

Pessimism also showed significant correlations with depression ($p < .0001$), anxiety ($p < .0001$) and PTSD symptoms $p < .0001$). However, when regression analysis was performed, findings did not reach significance and pessimism did not moderate the relationship between level of home damage and any of the three mental health variables.

Discussion

Our findings are consistent with previous research that has shown a relationship between optimism and improved health outcomes. However, we find this relationship for the first time in the context of post-disaster personal recovery and well-being.

Based on our results, optimism moderates the relationship between level of home damage and personal recovery, with the effect being stronger as home damage increases. Put simply, individuals with a more optimistic outlook or disposition reported greater recovery from significant impacts of the tornadoes than those who are less optimistic. Yet while optimism was related to personal recovery and improvement in self-reported quality of life, no relationship with perceived household recovery was observed. It may be that respondents consider different factors in making an assessment of their own situation vs. an assessment of the household, since the latter includes immediate family members and sometimes other relatives living in the home. Meanwhile, pessimism does not appear to moderate the relationship between home damage and any of the recovery measures. This is consistent with research cited previously (e.g. Glaesmer et al., 2012), which found *optimism or its absence* to have a significantly stronger relationship with health outcome constructs than pessimism.

A significant negative relationship between optimism and self-reported symptoms of depression, generalised anxiety and PTSD was also found. This is also congruent with prior findings regarding optimism and mental health, particularly depression. However, optimism did not moderate the relationship between home damage and either depression or anxiety in our sample population. We know that PTSD is typically the most frequent mental health consequence of disasters (Galea, Nandi, & Vlahov, 2005). PTSD symptoms in this sample population may have more often been attributable to exposure to trauma related to the tornadoes, whereas depression and anxiety reported by respondents may have resulted from a more diverse etiology. Without baseline data, this explanation is speculative.

One of the long-standing conceptual and measurement issues in the optimism literature warrants discussion. The original conception of the LOT-R, and a number of subsequent studies, assumed that the instrument measures a single construct of optimism (Chiesi, Galli, Primi, Innocenti Borgi, & Bonacchi, 2013; Kubzansky, Kubzansky, & Maselko, 2004; Rauch, Schweizer, & Moosbrugger, 2007; Røysamb & Strype, 2002; Segerstrom, Evans, & Eisenlohr-Moul, 2011; Skogstad et al., 2014; van der Velden et al., 2007). This approach suggests that individuals range from high to low levels of optimism, with the latter end of the continuum synonymous with pessimism. However, a growing contingent has concluded that the LOT-R measures optimism and pessimism as distinct personality characteristics, based on factor-analytic studies that have shown the instrument to yield two separate factors with a modest negative correlation (Appaneal, 2012; Armbruster et al., 2015; Chang, D'Zurilla, & Maydeu-Olivares, 1994; Herzberg, Glaesmer, & Hoyer, 2006; Robinson-Whelen, Kim, MacCallum, & Kiecolt-Glaser, 1997; Wu, 2011).

At first glance, a two-factor structure (i.e. optimism and pessimism) of the LOT-R seems at odds with a 'common sense' view that these terms describe opposite poles of a single

dimension. Indeed, some have argued that the appearance of two factors may be the result of deficiencies in item wording or other psychometric artifacts of the instrument (Chiesi et al., 2013). However, adding weight to the notion of two factors is that distinct effects of optimism and pessimism have been observed. For example, Glaesmer et al. (2012) found that the *absence* of optimism was more strongly predictive of levels of depression, anxiety, pain and dissatisfaction with one's health than was the *presence* of pessimism. Similarly, in a large prospective study of primary care patients, Armbruster et al. (2015) found optimism and pessimism to be distinct factors, concluding that low levels of optimism predicted depression in younger age cohorts. In older cohorts, they found that stability and predictive accuracy were reduced, with comorbid medical problems gaining power as a predictor.

Several researchers have also pointed out that the two-factor conception borne out by factor analysis is consistent with cognitive processing theory, particularly the observation that individuals can simultaneously hold different and seemingly contradictory metacognitive beliefs (Wells, 2000). As Herzberg et al. (2006) argue,

> People might, for example, believe that having a certain degree of optimism is adaptive, but they might also believe that having a certain amount of pessimism is also adaptive (e.g. because being pessimistic about the future might help prevent disappointments).

The conceptual and methodological arguments made on both sides of the single factor vs. two-factor debate are not fully resolved, but we believe that prior findings supporting a two-factor solution are more compelling.

While optimism is defined as a disposition or 'trait-like' characteristic, recent research has explored the potential of interventions to screen for, improve, and promote the cognitive and behavioral elements that comprise it. These efforts fall within the rubric of positive psychology, which focuses on individuals' positive attributes, assets and strengths, rather than deficits. Proponents of positive psychology such as Seligman et al. (1999) have long made a case that optimism can be learned and can play an important role in the prevention of mental health difficulties. Kobau et al. (2011) has argued that increased collaboration between positive psychology and public health may serve to improve population mental health. Research suggests that positive mental health can be measured and interventions can have meaningful impact (Diener, 2009; Friedli, 2009; King, 2008; Lee Duckworth, Steen, & Seligman, 2005; Lyuobomirsky, 2008). For example, interventions have been shown to increase positive emotions and reduce the negative effect of depression across time (Cohen, 2004; Emmons & McCullough, 2003; Lyuobomirsky, 2008).

Interventions to increase optimism include teaching individuals to change their attributional style (Buchanan, 1995; Friedli, 2009; Reivich & Shatté, 2002; Seligman, 1998), increase optimistic thinking (Friedli, 2009; Seligman, 1998) and avoid excessive worry or spirals of negative thinking (Reivich & Shatté, 2002; Seligman, 1998). Interventions such as the Penn Resiliency Program (PRP) have been effectively implemented in after school programs to promote learned optimism for children between the ages of 8 and 15 in the US, the United Kingdom, Australia, China and Portugal (Gillham, Hamilton, Freres, Patton, & Gallop, 2006; Jané-Llopis, Barry, Hosman, & Patel, 2005; Seligman, Ernst, Gillham, Reivich, &

Linkins, 2009). The US Army has similarly applied resiliency training modeled after the PRP to support the mental health of soldiers (Reivich, Seligman, & McBride, 2011).

Public health has routinely targeted homes and institutions ranging from schools to workplaces to hospitals and places of worship in its mission to prevent disease, injury, and disability. These settings are also viable targets for preventive mental health programs to build the resiliency of individuals and populations, as well as interventions that can mitigate adverse mental health effects following disaster. Policy initiatives that improve the social determinants of mental health should incorporate findings and practices of positive psychology. The integration of evidence-based mental health prevention programs and interventions to 'teach' optimism have the potential to improve mental health outcomes at the population level (Friedli, 2009; Kobau et al., 2011).

Limitations

There are several important limitations to this study. Because baseline (pre-event) levels of mental health and well-being were not captured, it is not possible to separate pre-existing mental health disorders from exacerbations to new conditions arising from trauma associated with the tornadoes. Baseline mental health measurements are often unavailable or lacking. The lack of comprehensive, standardised mental health surveillance across the country is a general challenge for disaster research aiming to understand adverse mental health effects.

This study utilised telephone survey methodology. Telephone surveys have traditionally been widely used in public health research, allowing researchers to sample geographically dispersed and rural populations with less expenditure of travel time and cost. However, there is evidence dating back more than a decade that telephone surveys are less effective than they were in the past (Boland, Sweeney, Scallan, Harrington, & Staines, 2006). In this study, individuals without reliable access to a phone are likely underrepresented.

As our descriptive statistics indicate, 71.1% of the sample was female. This is not surprising, given that women are more often willing to participate in and successfully complete telephone surveys (Glass et al., 2015). The effect of overrepresentation of females in the study is unclear. Previous studies have not reported correlations between gender and optimism when other factors are controlled and gender differences in mean scores on the LOT-R are not typically observed (e.g. Herzberg et al., 2006). However, studies over the years have noted a higher prevalence of depression, anxiety and PTSD among women (Fryers et al., 2004; NIMH, 2016). The question of whether women are more prone to mental health conditions or merely more prone to admit symptoms has been considered extensively elsewhere (e.g. Rogers, 2014).

Data from this study are also limited due to its cross-sectional design and the potential recall bias of respondents, given the lag between the disaster and data collection in the affected region. With increasing time, the likelihood of intervening events confounds the attribution of effects of the disaster on current self-reported mental health, quality of life change and overall recovery. Additionally, remembering is a reconstructive process subject to attributional errors and biases (Bartlett, 1932; Ross, 1989). In particular, individuals

experiencing mental health symptoms may distort past events due to concentration difficulties, sleep impairment and other symptoms that affect cognitive processes (Southwick, Morcan, Nicolaou, & Charney, 1997; Stone et al., 2009). Norris Norris, Friedman, and Watson (2002) found that the first year following a disaster is generally the peak period for symptom manifestation and that those exposed to disasters generally improve over time, with a minority of individuals whose symptoms linger for many years. We infer that higher levels of mental health symptoms would have likely been reported if these data were collected within a year of the event.

Conclusion

This study evaluates for the first time the effect of dispositional optimism on the recovery and well-being of individuals exposed to a disaster. It also confirms previous findings linking optimism and mental health in other contexts. This work suggests the utility of screening for optimism, along with the potential for interventions to increase optimism as a means of mitigating adverse mental health effects and improving the recovery of individuals affected by disasters and other traumatic events. Future disaster research should aim to replicate and extend these findings by incorporating baseline data. Researchers should also increasingly prioritise longitudinal research over the course of recovery and pursue expedited funding and research deployment mechanisms whenever feasible, to initiate more rapid collection of data following an adverse event. Longitudinal approaches also create opportunities to assess the value of evidence-based mental health prevention programs and interventions to ‘teach’ optimism as a means to improve resiliency and recovery.

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Table 1

Selected characteristics of sample for participants living in tornado-affected areas of Mississippi and Alabama – 2011.

Characteristic	Frequency	%/Mean[b]
Gender (Female)	2287	71.1
Race (White)	2090	66.0
Race (Black)	944	29.8
Mean age (years)	NA	59.2[b]
Annual income		
Less than $15,000	530	20.1
$15,000 to less than $20,000	261	9.9
$20,000 to less than $25,000	264	10.0
$25,000 to less than $35,000	321	12.2
$35,000 to less than $50,000	349	13.3
$50,000 to less than $75,000	401	15.3
$75,000 or more	506	19.2
Self-reported extent of home damage		
Not affected at all	2365	74.1
Minor damage or closed very briefly	483	15.1
Moderate damage or closed for a short period	174	5.5
Significant damage or closed for an extended period	79	2.5
Destroyed	93	2.9

[a]Mean applies only to age.

[b]NA: Not applicable.

Table 2

Self-reported mental health symptomatology in participants living in tornado-affected areas of Mississippi and Alabama – 2011.

Symptomatology	Frequency	%
Depressive symptoms based on PHQ-8[a]		
No significant depressive symptoms	1926	65.4
Mild depressive symptoms	591	20.1
Moderate depressive symptoms	253	8.6
Moderately severe depressive symptoms	113	3.8
Severe depressive symptoms	60	2.0
Generalised anxiety disorder based on GAD-7[b]		
No significant anxiety	2282	74.1
Mild anxiety	434	14.1
Moderate anxiety	175	5.7
Severe anxiety	190	6.2
PTSD[c] *symptoms based on DSM-IV*[d]		
Number of symptoms		
0	1813	59.0
1	612	19.9
2	273	8.9
3	164	5.3
4*	86	2.8
5*	63	2.1
6*	43	1.4
7*	20	.7

*If four or more were answered with ‘yes,’ a diagnosis of PTSD was probable.

[a]Patient Health Questionnaire (PHQ)-8 (Kroenke et al., 2009).

[b]Generalised Anxiety Disorder 7 Item Scale (Spitzer et al., 2006).

[c]Post-traumatic stress disorder

[d]Diagnostic and Statistical Manual-IV (Breslau et al., 1999).

Table 3

Self-reported recovery from tornados in participants living in tornado-affected areas of Mississippi and Alabama – 2011.

Parameter	Frequency	%
Household change since tornado		
Experienced no change from before tornadoes	2264	71.7
Still very heavily damaged	27	.9
Recovering; still damaged	68	2.2
Recovering; still slightly damaged	231	7.3
Recovered; back to where it was before tornados	428	13.6
Better off than before tornadoes	138	4.4
Household level of recovery (10 = highest)		
1	77	2.7
2	7	.2
3	6	.2
4	20	.7
5	111	3.8
6	61	2.1
7	110	3.8
8	243	8.4
9	203	7.0
10	2049	71.0
Personal quality of life change after tornado		
Worse	182	5.7
About the same	2750	86.4
Better	251	7.9
Personal return to normal after tornado		
Still very disrupted	54	1.7
Still somewhat disrupted	162	5.2
Almost back to normal	379	12.2
Largely back to normal	518	16.7
Fully back to normal	1988	64.1

Table 4

Predictors of post-tornado recovery in participants living in tornado-affected areas of Mississippi and Alabama in 2011.

Predictor	Unstandardised coefficient (*b*)	*P* value
Quality of life change (model 1)		
Home damage	−.022	.0033
Optimism	.032	<.001
Age	−.016	.0005
Income	.003	.34
Change in R^2	–	<.001
R^2 (model 1) = .03[a]	–	–
Quality of life change (model 2)		
Home damage	−.231	<.001
Optimism	.0166	.004
Age	−.016	.0005
Income	.003	.31
Home damage (minor) × optimism	.046	<.001
Home damage (moderate) × optimism	.080	<.001
Home damage (significant) × optimism	.108	<.001
Change in R^2	–	<.001
R^2 (model 2) = .04[a]	–	–
Return to normal after tornado (model 1)		
	−.337	<.001
	.063	<.001
Home damage	.016	.18
	.066	<.001
Optimism	–	<.001
Age		
Income		
Change in R^2		
R^2 (model 1) = .14[a]	–	–
Return to normal after tornado (model 2)		
Home damage		
Optimism	−.902	<.001
	.023	.13
Age	.015	.22
Income		
Home damage (minor) × optimism	.066	<.001
Home damage (moderate) × optimism		
Home damage (significant) × optimism	.128	<.001
Change in R^2	.237	<.001

Predictor	Unstandardised coefficient (*b*)	*P* value
	.291	<.001
	–	<.001
R^2 (model 2) = .15[a]	–	–

Notes: Ordinary least-squared (OLS) regression analysis was used to examine the moderating associations of optimism with recovery as the dependent variable.

[a] R^2 coefficient from OLS regression analysis models reported.

Table 5

Predictors of post-disaster mental health in participants living in tornado-affected areas of Mississippi and Alabama in 2011.

Predictor	Unstandardised coefficients (*b*)	*P* value
PTSD[a] (*model 1*)		
Home damage	.336	<.001
Optimism	−.232	<.001
Age	−.043	.01
Income	−.180	<.001
Change in R^2	–	<.001
R^2 *(model 1) = .20*[b]	–	–
PTSD[a] (model 2)		
Home damage	.838	<.001
Optimism	−.201	<.001
Age	−.040	.016
Income	−.179	<.001
Home damage (minor) × optimism	−.114	.003
Home damage (moderate) × optimism	−.114	<.001
Home damage (significant) × optimism	−.256	.0006
Change in R^2	–	<.001
R^2 (model 2) = .20[b]	–	–

Notes: Ordinary least-squared (OLS) regression analysis was used to examine the moderating associations of optimism with recovery as the dependent variable.

[a]PTSD: post-traumatic stress disorder.

[b]R^2 coefficient from OLS regression analysis models reported.