

# Just World Beliefs Are Associated With Lower Levels of Metabolic Risk and Inflammation and Better Sleep After an Unfair Event

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## Abstract

This study's goal was to conduct a preliminary test of the theory that just world beliefs can buffer against negative physiological outcomes after people experience certain types of negative life events by testing associations between just world beliefs and physiological outcomes among people with different life event histories. In a sample of 247 adults ( $M_{\text{age}} = 46.01$ ; 24.31% men; 60.78% White), this research investigated the relationship between just world beliefs and metabolic symptoms, inflammation, and sleep among people who had recently experienced an unfair event, another type of negative event, or no negative event. Stronger just world beliefs correlated with lower metabolic risk, lower inflammation, and better sleep among people who had recently experienced an unfair event, but not among those in the other two event groups. These findings suggest that people's beliefs about the world may interact with their life experiences in ways that have implications for health-relevant outcomes.

By middle age, approximately 90% of people have experienced a major negative life event, such as a loved one's serious illness or being the victim of a crime (Ogle, Rubin, Bernsten, & Siegler, 2013). Although these experiences negatively impact some people's health and well-being, recent research has increasingly focused on what factors make people resilient (Bonanno, 2005; Park, 2012; Seery, 2011). In this article, we conduct a preliminary test of a theory that the beliefs that people hold about the world will interact with the life experiences they have to predict biological and behavioral measures relevant to physical health. In this preliminary study specifically, we examine associations of just world beliefs with inflammatory, metabolic, and sleep outcomes following the experience of different types of life events (i.e., unfair events, other negative events, no event).

## Acute Negative Life Events and Health

Stress increases one's risk for a variety of diseases, including cardiovascular disease, cancer, and HIV/AIDS (Cohen, Janicki-Deverts, & Miller, 2007; Schneiderman, Ironson, & Siegel, 2005; Steptoe, Hamer, & Chida, 2007). Sometimes, even a single major negative life event has implications for health, especially if the event is severe enough to trigger ongoing rumination or distress (D'Andrea, Sharma, Zelechowski, & Spinazzola, 2011). For example, people with a seriously ill

loved one or recent job loss report poorer overall health and more chronic limitations and medical conditions (Ullman & Siegel, 1996). Similarly, having a child die increases parents' risk for a heart attack years later (Li, Hansen, Mortensen, & Olsen, 2002).

These clinical outcomes may emerge out of physiological processes that are altered in response to stressful life events and that, if sustained, can have implications for chronic health problems later. For example, high levels of stress alter inflammatory processes that represent key mechanisms in the development of chronic diseases of aging, such as cardiovascular disease (Miller, Cohen, & Richey, 2002). High stress levels are also implicated in the precursors to cardiovascular disease, such as elevations in metabolic symptoms (e.g., cholesterol and obesity; Bjorntorp, 2001; Vitaliano et al., 2002). Finally, sleep is considered another physiological regulatory system (Irwin, 2002; Tononi & Cirelli, 2006) that is responsive to major stressors (Kim & Dimsdale, 2007) and has been linked to multiple chronic diseases (Harvey, 2001; Koren, Aron, Lavie, & Klein, 2002).

Hence, the present research focuses on links between major negative life experiences and three intermediary physiological

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outcomes: metabolic symptoms (e.g., cholesterol, glycosylated hemoglobin), inflammatory markers (e.g., interleukin [IL]-6, C reactive protein [CRP]), and sleep (e.g., time, efficiency) in healthy adults. These types of intermediary physiological outcomes have been found to predict subsequent risk for chronic health conditions, including depression and anxiety disorders, cardiovascular disease, cancer, and diabetes in the future (Chung et al., 2009; Harvey, 2001; Koren et al., 2002; Libby & Theroux, 2005; Wellen & Hotamisligil, 2005).

## Resilience and the Belief in a Just World

Research has identified multiple psychosocial factors that can buffer against negative life events' adverse physiological or health consequences. For example, a sense of control increases natural killer cell activity in response to an acute laboratory stressor (Sieber, Rodin, Larson, & Cummings, 1992). Similarly, optimism and meaning making are correlated with reduced symptoms, disease severity, recurrence rates, and mortality in the context of a life-threatening illness (Affleck, Tennen, Croog, & Levine, 1987; Bower, Kemeny, Taylor, & Fahey, 1998; Pakenham, 2008; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000).

However, little research has addressed how people's beliefs about the world may moderate the relationship between major negative life events and physiological or physical health outcomes. One such belief that may be important is the belief in a just world, or the view that the world tends to treat people fairly and that people get what they deserve. Just world beliefs may be particularly relevant to negative life events because they have been found to help people who are coping with negative life events to better understand these events, in part by seeing their world as orderly, controllable, and meaningful (Dalbert, 2001; Furnham, 2003; Janoff-Bulman & Frieze, 1983; Lerner, 1980; Rubin & Peplau, 1975). Such beliefs also enable people to interpret their negative experiences as more positive, to see their negative experiences as exceptions to the rule that things will go well, and to cope more effectively with stressors in order to restore their sense of themselves as capable.

One theoretical question that arises, then, is how just world beliefs might affect people's physiological responses to major negative life events. Here, there are two plausible yet competing hypotheses. The first, which is based on the assumption that beliefs can serve as a resource that help people to cope, is that people who believe in a just world will have better physiological outcomes after major negative life events. The alternative hypothesis, which is based on the assumption that a violation of one's beliefs will be detrimental, is that people who believe in a just world will have worse physiological outcomes after major negative life events.

Some research supports the idea that just world beliefs can be protective during times of adversity. Just world beliefs are associated with better mental health among those facing major negative life events, such as widespread unemployment, natural

disasters, the experience of being widowed, and other adverse circumstances (Bonanno et al., 2002; Dzuka & Dalbert, 2002; Otto, Boos, Dalbert, Schops, & Hoyer, 2006). With respect to physiological reactions to adversity, one study shows that higher just world beliefs promote a "challenge" response (i.e., strong cardiac activation, decreased peripheral vascular resistance) rather than a "threat" response (i.e., less cardiac activation, increased peripheral vascular resistance) to an acute laboratory stressor (Tomaka & Blascovich, 1994). At the same time, however, the violation of just world beliefs—which might occur when one experiences a major negative event—can be aversive (Janoff-Bulman, 2010). The experience of having one's beliefs violated is associated with higher blood pressure and can give rise to a "threat" response rather than a "challenge" response (Eliezer, Townsend, Sawyer, Major, & Mendes, 2011; Townsend, Major, Sawyer, & Mendes, 2010).

## Type of Event

Negative life events that happen to people can have different characteristics to them. One type of negative event that may be most relevant to just world beliefs is events that are unfair. These would include events that involve the violation of basic principles of fairness, such as events characterized by inequality (e.g., of opportunity or outcome in life), by the violation of some standard of what is right or acceptable, or by people not getting what they deserve. Among people who have experienced such an event, just world beliefs could have either of the relationships described above with physiological outcomes. On one hand, they might predict better outcomes if they helped people to cope. On the other hand, they might predict worse outcomes if the difficulty of having one's beliefs violated gave rise to negative physiological responses.

Some research supports the hypothesis that higher just world beliefs will be correlated with better physiological outcomes. This hypothesis is based on the assumption that the just world beliefs can be a resource that helps people cope. There is a great deal of evidence that, when possible, people maintain their beliefs even in the face of evidence that contradicts them (Anderson & Lindsey, 1998; Bastardi, Uhlmann, & Ross, 2011; Festinger, 1957; Kunda, 1990; Lord, Ross, & Lepper, 1979; Ross & Lepper, 1998). In fact, when people encounter evidence or have experiences that threaten a belief, they may invoke or strengthen the belief as they seek out evidence to restore it (Kay, Whitson, Gaucher, & Galinsky, 2009; Laurin, Kay, & Moscovitch, 2008; Stephens, Fryberg, Markus, & Hamedani, 2013). There is evidence of this process with just world beliefs, which people maintain by reframing information and experiences in a belief-consistent manner (Hafer & Begue, 2005; Lerner, 1980). Perhaps as a result, just world beliefs are very stable over time (Janoff-Bulman, 2010; Park & Blumberg, 2002).

People whose just world beliefs remain intact as they experience an unfair event may have these beliefs to draw on as a way of making more positive attributions (e.g., of focusing on how

their experience is not as unfair as it could have been), finding meaning that offers a reason or purpose for the unfair negative event, or otherwise coping more effectively (Hafer & Correy, 1999; Janoff-Bulman, 2010; Janoff-Bulman & Frieze, 1983; Park, 2010; Park, Edmondson, Fenster, & Blank, 2008; Taylor, Wood, & Lichtman, 1983; Tomaka & Blascovich, 1994). Perhaps as a result of these processes, just world beliefs predict lower depression and anxiety levels when people have experiences that might be characterized as unfair (e.g., surviving a natural disaster; Otto et al., 2006) and higher self-esteem when people remember events that provoke anger (an emotion elicited by injustice) but not other negative events (Dalbert, 2002). The same protective qualities that buffer against poor psychological outcomes may also do so for physiological or health outcomes (Taylor, 1983; Taylor et al., 2000).

However, a separate literature—one that highlights the negative physiological consequences of belief-contradicting experiences—supports the opposite hypothesis, namely, that just world beliefs will predict worse physiological profiles among those who have experienced an unfair event. While no research has examined the physiological or health consequences of just world belief violation, studies do find that people with low self-esteem report more illnesses and symptoms if they report experiencing more positive life events (i.e., events that are inconsistent with their views of themselves; Brown & McGill, 1989; Shimizu & Pelham, 2004). Similarly, people who endorse system-justifying beliefs (e.g., the view that success stems from hard work or that inequality is justified) have higher blood pressure when they report experiencing high levels of discrimination (Eliezer et al., 2011) and exhibit a “threat” rather than a “challenge” response (i.e., less cardiac activation, increased peripheral vascular resistance) after experiencing discrimination in the lab (Townsend et al., 2010). Unfair experiences might be similarly stressful and thus predict worse physiological or health outcomes for those who believe in a just world.

## Study Overview

The present research involves a preliminary investigation of the hypothesis that the beliefs that people hold about the world will moderate their physiological responses to major negative life events. As a first-step test of the theory, we conducted a correlational study using a community sample of adults, in which we assessed just world beliefs, conducted life stress interviews, drew blood to measure metabolic symptoms and inflammation, and tracked sleep outcomes. We compared people who had had one of three types of experiences in the past 6 months: no major negative life event, a major negative event that was coded as having unfair characteristics, or another type of major negative life event. We predicted that just world beliefs would have a significant relationship to physiological profiles among people who had recently experienced an unfair negative event. We tested two competing hypotheses as to the direction of this relationship: (a) that just world beliefs would be associated with better

physiological outcomes in those who had experienced an unfair negative event, based on the assumption that they would serve as resources to help people cope, or (b) that just world beliefs would be associated with worse physiological outcomes in those who had experienced an unfair negative event, based on the assumption that their violation would be stressful.

## METHOD

### Participants

These data were drawn from a larger study on psychosocial factors and health in families. Two hundred sixty-one families were recruited through public schools, newspaper advertisements, and community postings. The participants in the present analyses were the parents in this sample. Participants were healthy, with no history of chronic medical or psychiatric disorders, and no acute illness within the past 2 weeks. A subset of participants ( $N = 200$ ) participated in an ancillary sleep study (begun after the larger study had started) and provided sleep data for 1 week via actigraphy. Participants who were included in the sleep analyses were older ( $M_{\text{age}} = 46.44$ ) than those who were not ( $M_{\text{age}} = 44.40$ ),  $t(246) = 2.47$ ,  $p = .01$ , but these two groups did not differ in gender, ethnicity, or just world belief scores, all  $ps > .23$ . This comparison was conducted after the additional participants mentioned below were excluded.

Six participants (three who completed the ancillary sleep study) did not complete the Belief in a Just World Scale, and eight participants (four who completed the ancillary sleep study) experienced a negative event that was related to their own health (i.e., they were injured/sick or underwent a major medical procedure). A major negative life event involving a medical procedure, an injury, or an illness has the potential to directly impact physiological measures (apart from the stressfulness of the event) for months afterward. We therefore did not include these participants in these analyses. Thus, the final sample was 247 ( $M_{\text{age}} = 46.01$ ; 24.31% men; 60.78% White) for the metabolic and inflammation composites analyses and 193 ( $M_{\text{age}} = 46.69$ ; 24.31% men; 60.78% White) for the sleep analyses. The disproportionate number of women in the sample reflects the fact that mothers were more likely than fathers to come to the lab with their children.

### Procedure

During an initial lab visit, participants reported on their just world beliefs and were interviewed about negative life events that they had experienced recently. They also underwent a blood draw, and their body mass index (BMI) and blood pressure were assessed. For a week following the lab visit, participants who completed the ancillary sleep study wore an Actiwatch to measure their sleep.

**Negative Events.** Negative events were measured as part of the UCLA Life Stress Interview (Hammen, 1991). This is a

semistructured interview that covers stress over the past 6 months in the domains of family relationships, friendships, work, and home life. Trained interviewers ask open-ended questions to gather information about both acute and chronic stress over the past 6 months. Acute stressors (i.e., specific events with discrete starting and ending points) obtained during this interview served as our measure of negative events. As part of establishing reliability, a team of interviewers was trained to code chronic stress in the domains of family relationships, friendships, work, and home life. Our team of interviewers demonstrated high reliability (interclass correlations ranged from .87 to .96). However, in keeping with the original interview procedures (Hammen, Ellicott, Gitlin, & Jamison, 1989; Hammen, Marks, Mayol, & deMayo, 1985), acute events were coded by the entire group of trained interviewers during consensus meetings. For each acute negative life event mentioned by participants, the interviewer described the event and its consequences to the rest of the team, and then the team (excluding the person who conducted the interview) discussed and rated the event on a scale ranging from 1 (*no long-term impact*) to 5 (*severe long-term impact*), taking into account the context in which the event occurred (e.g., death of a family member has a higher impact if the participant was close and saw the family member frequently).

We considered major negative acute events as anything rated as 2.5 or higher, indicating events that had moderate or higher impact. This follows the convention of previous work and reflects the finding that the acute events most likely to influence physical and mental health are those that are moderate to severe (Brown, Harris, & Hepworth, 1995; Hammen, Henry, & Daley, 2000; Marin, Chen, Munch, & Miller, 2009; Murphy, Slavich, Chen, & Miller, 2015; Vrshek-Schallhorn et al., 2013).

**Fair Versus Unfair Negative Events.** We next categorized negative events into those that were (a) unfair or (b) other negative events (including both events that were relatively fair and relatively neutral on a fairness dimension). We categorized these events objectively, rather than relying on participants' subjective impressions of their unfairness, because subjective impressions can be affected by participants' psychological states and may vary depending on what types of anchors participants use (e.g., what they consider to be the most fair or unfair events one might experience; McQuaid et al., 1992; Wagner, Abela, & Bronzina, 2006). To categorize events, we drew on existing conceptions of fairness in the research literature and also had an independent sample of people rate the various types of events experienced by our participants on how fair or unfair they were seen as being. While scholars offer a variety of definitions of fairness, things that are fair often have the characteristics of being equitable for everyone (e.g., in opportunity or outcome); minimizing harm to others; fitting in with what is agreed upon as right, acceptable, or standard; and involving people getting what they deserve (Kolm, 1996; Lerner, 1980; Rawls, 1999). While fairness may overlap with other concepts such as control, they are not identical (e.g., fairness could come from others, and one might have

little control over that). We focused on fairness specifically because it is the dimension that most directly relates to just world beliefs.

The types of negative life events experienced by our participants included events such as the serious or life-threatening injury or illness of a loved one, conflicts with friends and family members, being fired from one's job (for reasons other than poor performance), and being the victim of or threatened by a crime. Although past work has shown that the experience of discrimination can interact with belief systems to predict physiological outcomes (Eliezer et al., 2011; Townsend et al., 2010), the events reported by our participants did not include any discrimination events.

For negative life events, we created a coding scheme in which those events involving the violation of one or more conceptualizations of fairness were classified as unfair. These included events such as being the victim of or threatened by crime, assault, or abuse; an ex-partner not paying legally mandated child support; serious, life-threatening illnesses/injuries of younger people or pets (given that the opportunity to live a life that is of a typical length is an outcome afforded to most people); and being fired from a job for reasons other than poor performance. The rest we categorized as other negative events (including both fair and neutral events). This other negative event category included events such as interpersonal conflicts that did not involve violence or abuse, home repairs or construction, the participant or a loved one being punished for doing something wrong, and the serious or life-threatening illness or injury of an older person.

To test whether classifications of fairness could be rated reliably by others, we conducted a pilot study in which participants ( $n = 16$ ) rated each type of event on the extent to which most people would see it as fair or unfair if someone around them were experiencing it, on a scale ranging from 1 (*most would see as fair*) to 7 (*most would see as unfair*). The events that fell into our unfair coding were rated by participants as significantly above the midpoint of the scale;  $M$ s ranged from 5.78 to 6.13,  $t(15)$ s ranged from 3.45 to 8.69, and  $p$ s ranged from .004 to  $< .001$ . The events that fell into our other negative events coding were rated as significantly below the midpoint of the scale— $M$ s ranged from 1.56 to 3.25,  $t(15)$ s ranged from  $-9.46$  to  $-2.32$ , and  $p$ s ranged from  $< .001$  to .04—or were equal to the midpoint of the scale:  $M$ s ranged from 3.50 to 4.13,  $t(15)$ s ranged from  $-1.46$  to .57, and  $p$ s ranged from .16 to .82.

Separate coders (the first and second authors, who listened to de-identified interview tapes and hence were blind to participant information about just world belief scores or physiological data) then used the classification scheme to code all acute negative events for whether they were unfair or other negative events. The coders were highly reliable ( $\kappa = 1.0$ ), and the events in the two groups (unfair vs. other negative events) did not differ in how negative they were,  $t(167) = .95$ ,  $p = .35$ . Eleven participants had both an unfair and another negative event and were placed into the unfair event category. Overall, 52.44% of participants were classified as having experienced no major negative

**Table 1** Descriptive Statistics for Analyses With Metabolic and Inflammation ( $N = 247$ ) and Sleep ( $N = 193$ ) Outcomes

	<i>N</i>	No Event <i>M</i> ( <i>SD</i> )	Other Event <i>M</i> ( <i>SD</i> )	Unfair Event <i>M</i> ( <i>SD</i> )	<i>F</i> or $\chi^2$	<i>p</i>
Age (years)	247	46.20 (5.20)	45.66 (6.21)	46.00 (5.62)	0.21	.81
Gender (% men)	247	25.38	22.39	26.00	0.27	.87
Ethnicity (% White)	247	58.46	59.71	66.00	0.87	.65
Just world beliefs	247	76.44 (10.66)	74.25 (9.47)	73.25 (9.76)	2.18	.12
BMI (kg/m <sup>2</sup> )	246	25.66 (4.74)	25.00 (4.49)	25.35 (4.33)	0.47	.63
Cholesterol (mmol/L)	245	4.82 (0.93)	4.77 (1.13)	4.96 (1.43)	0.47	.63
HbA1C (%)	244	5.45 (0.36)	5.45 (0.31)	5.38 (0.40)	0.71	.50
IL-6 (pg/ml)	245	1.86 (2.40)	1.56 (2.06)	1.20 (0.83)	1.91	.15
CRP (mg/L)	244	1.75 (2.71)	1.33 (1.98)	1.14 (2.44)	1.32	.27
IL-1RA (pg/mL)	245	358.66 (259.10)	358.68 (227.46)	332.03 (159.72)	0.26	.77
MIF (pg/mL)	245	2901.57 (9256.09)	2851.26 (7997.23)	4733.61 (12374.19)	0.73	.48
Time slept (hr.)	193	6.82 (1.25)	6.69 (1.07)	7.26 (0.83)	2.66	.07
Sleep onset (min.)	192	27.72 (22.21)	22.98 (18.52)	22.56 (17.79)	1.29	.28
Sleep efficiency (%)	192	83.06 (9.98)	84.77 (6.69)	86.57 (4.26)	2.24	.11

Note. JW = just world; BMI = body mass index; HbA1C = glycosylated hemoglobin; IL-6 = interleukin 6; CRP = C-reactive protein; IL-1RA = interleukin 1 receptor antagonist; MIF = macrophage migration inhibitory factor.

event, 20.34% as having experienced an unfair negative event, and 27.24% as having experienced another type of negative event.

**Belief in a Just World.** The Belief in a Just World Scale (Rubin & Peplau, 1975) asked participants to rate their agreement with 20 items (e.g., “People who get lucky breaks have usually earned their good fortune”) on a scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Cronbach’s alpha was .66, and removal of any individual item did not change the reliability. Responses were summed, with higher values indicating stronger just world beliefs.

**Metabolic Composite.** The metabolic composite consisted of the mean of standardized scores of body mass index (BMI), cholesterol, and glycosylated hemoglobin (HbA1c). BMI was obtained by dividing participants’ weight in kilograms by their height in meters squared. Blood samples for total cholesterol and HbA1c were tested in the Clinical Chemistry lab at St. Paul’s Hospital (Vancouver, BC, Canada). Serum samples for cholesterol testing were collected in serum separator tubes (SSTs; Becton-Dickinson, Oakville, Ontario, Canada), and cholesterol was measured in a Hitachi 911 instrument (Kyowa Medex, Japan) using standard enzymatic techniques (inter-assay CV = 0.9%). HbA1c samples were collected in EDTA-containing Vacutainer tubes (Becton-Dickinson, Oakville, Ontario, Canada), and HbA1c was measured with an ion exchange high-performance liquid chromatography technique (biorad, DIAMAT).

**Inflammation Composite.** The inflammation composite was a mean of the standardized scores of four inflammatory markers: interleukin 6 (IL-6), C-reactive protein (CRP), interleukin 1 receptor antagonist (IL-1RA), and macrophage migration inhibitory factor (MIF). IL-6 was measured using a high-sensitivity ELISA kit (R&D Systems, Minneapolis, MN; intra-assay CV < 10%; detec-

tion threshold = .04 pg/ml). CRP was measured using a high-sensitivity, chemiluminescent technique on an IMMULITE 2000 (Diagnostic Products Corporation, Los Angeles, CA; inter-assay CV = 2.2%; detection threshold = .20 mg/L). IL-1RA was measured using a high-sensitivity ELISA kit (R&D Systems, Minneapolis, MN; intra-assay CV < 10%; detection threshold = 18.3 pg/mL). MIF was measured using a high-sensitivity ELISA kit (R&D Systems, Minneapolis, MN; intra-assay CV < 10%; detection threshold = 31.2 pg/mL).

**Sleep.** For 1 week after their lab visit, participants wore an Actiwatch (MiniMitter Co., Boulder, CO), an ambulatory wristwatch, on the nondominant arm at all times, including while showering. The Actiwatch measures gross motor movement via a sensor that generates a voltage when the Actiwatch senses acceleration. The Actiwatch is an accurate, objective (preferable to self-report), and noninvasive method of objectively measuring sleep that has been shown to be comparable to the “gold standard” method for measuring sleep, polysomnography obtained in a sleep lab (Kushida, Chang, Gadkary, Guilleminault, Carrillo, & Dement, 2001; Sadeh, Hauri, Kripke, & Lavie, 1995). The Actiwatch software was used to generate multiple measures: onset latency (time between getting into bed and falling asleep), time (total seconds of sleep during the sleep period), and efficiency (percentage of time between sleep onset and offset during which the participant was asleep). These three scores were standardized and averaged to create a composite score indexing sleep quality, with lower scores indicating better sleep.

**Covariates.** Analyses controlled for gender, age, and ethnicity.<sup>1</sup>

## RESULTS

We first compared the mean levels of the predictor, control, and outcome variables among people who had experienced no event,

**Table 2** Correlations Among Primary Variables

	Age	Gender	Ethnicity	Just World Beliefs	BMI	Cholesterol	HbA1C	IL-6	CRP	IL-1RA	MIF	Time Slept	Sleep Onset	Sleep Efficiency
Age														
Gender (0 = men, 1 = women)	-0.169***													
Ethnicity (0 = not White, 1 = White)	0.151*	-0.002												
Just world beliefs	0.076	-0.02	-0.071											
BMI	0.012	-0.188**	0.117+	0.024										
Cholesterol	0.064	-0.139*	-0.044	0.113	0.150*									
HbA1C	0.190***	-0.108+	-0.098	0.054	0.102+	0.197**								
IL-6	-0.008	0.063	-0.069	-0.009	0.236***	0.093	0.104+							
CRP	-0.027	0.045	0.095	0.109+	0.386***	0.074	0.117+	0.296***						
IL-1RA	-0.078	-0.069	0.176**	-0.072	0.513***	0.108+	0.158*	0.165**	0.293**					
MIF	0.062	-0.049	0.037	-0.089	0.066	0.047	-0.012	-0.049	-0.065	0.112+				
Time slept	0.082	0.143*	0.085	-0.018	-0.199**	-0.061	-0.104	0.037	-0.048	-0.244***	0.055			
Sleep onset	0.054	-0.076	0.020	-0.048	0.112+	-0.023	-0.008	0.07	-0.058	0.068	0.001	-0.275***		
Sleep efficiency	0.007	0.141*	0.101	0.046	-0.275***	0.013	-0.092	-0.044	0.060	-0.257***	0.047	.653***	-0.622***	

Note. BMI = body mass index; HbA1C = glycosylated hemoglobin; IL-6 = interleukin 6; CRP = C-reactive protein; IL-1RA = interleukin 1 receptor antagonist; MIF = macrophage migration inhibitory factor.  
 +*p* < .10. \**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

an event with characteristics coded as “unjust,” or an “other” negative event, after excluding ineligible participants. There were no significant differences. Details of these and other descriptive analyses are presented in Table 1. In addition, correlations among all the primary variables in the study are reported in Table 2.

We first tested whether just world beliefs predicted better outcomes among people, regardless of what kind of event they had experienced. Multiple hierarchical linear regressions were conducted separately for each outcome. Demographic variables (age, gender, and ethnicity) were entered in Step 1, followed by just world beliefs in Step 2. Just world beliefs did not predict any outcomes, all *ps* > .22.

### Unfair Event Versus No Event

To test whether just world beliefs predicted outcomes specifically for those who had experienced an event coded as unjust compared to those who had experienced no event, we conducted multiple hierarchical linear regressions. Demographic variables (age, gender, and ethnicity) were entered in Step 1, followed by event type (no event = 0, unfair event = 1) and just world beliefs in Step 2, and then the interaction between just world beliefs and event type in Step 3. See Table 3 for details on these analyses.

Significant Event × Just World Belief interactions emerged for both the metabolic composite, *b* = -0.32, *SE* = 0.11, *t*(172) = -2.91, *p* = .004, and the inflammation composite, *b* = -0.23, *SE* = 0.10, *t*(173) = -2.24, *p* = .03, but not for the sleep composite, *b* = 0.19, *SE* = 0.20, *t*(141) = .93, *p* = .35.

Simple slope analyses revealed that among those who had experienced an unfair event, just world beliefs predicted lower metabolic risk, *b* = -0.21, *SE* = 0.10, *t*(172) = -2.11, *p* = .03, and lower inflammation levels, *b* = -0.21, *SE* = 0.09, *t*(173) = -2.32, *p* = .02. Unexpectedly, among those who had experienced no event, just world beliefs predicted worse metabolic profiles, *b* = 0.11, *SE* = 0.06, *t*(172) = 1.99, *p* = .05. There was no relationship between just world beliefs and the inflammation composite in this group, *p* = .66.

### Unfair Event Versus Other Negative Event

To test whether just world beliefs predicted outcomes more strongly for those who had experienced an event coded as unjust compared to those who had experienced another type of negative event, we conducted multiple hierarchical linear regressions as described above, except that only people experiencing another type of negative event (coded as 0) or an unjust negative event (coded as 1) were included. See Table 3 for details on these analyses.

Significant Event Type × Just World Belief interactions emerged for the metabolic composite, *b* = -0.30, *SE* = 0.13, *t*(110) = -2.24, *p* = .03, the inflammation composite,

**Table 3** Multiple Regression Analyses

Metabolic Composite						
	Panel A: Unfair Event vs. No Event			Panel B: Unfair Event vs. Other Event		
	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)
Gender	−0.44 (0.11)***	−0.44 (0.11)***	−0.44 (0.11)***	−0.37 (0.16)*	−0.38 (0.16)*	−0.32 (0.16)*
Ethnicity	−0.15 (0.10)	−0.15 (0.10)	−0.13 (0.10)	0.07 (0.14)	0.07 (0.14)	0.07 (0.14)
Age	0.10 (0.05)*	0.09 (0.05) <sup>+</sup>	0.09 (0.05)*	0.02 (0.07)	0.02 (0.07)	0.01 (0.07)
Just world beliefs		0.03 (0.05)	0.11 (0.06)*		−0.03 (0.07)	0.11 (0.09)
Event type		−0.02 (0.11)	−0.07 (0.11)		−0.01 (0.13)	−0.01 (0.13)
JWB × Event Type			−0.32 (0.11)**			−0.30 (0.13)*
R <sup>2</sup> change		0	0.04**		0	0.04*

Inflammation Composite						
	Unfair Event vs. No Event			Unfair Event vs. Other Event		
	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)
Gender	−0.09 (0.10)	−0.09 (0.10)	−0.08 (0.10)	0.02 (0.12)	0.01 (0.13)	0.06 (0.13)
Ethnicity	0.13 (0.09)	0.13 (0.09)	0.14 (0.09)	0.11 (0.11)	0.10 (0.11)	0.10 (0.11)
Age	−0.02 (0.05)	−0.02 (0.05)	−0.02 (0.05)	−0.01 (0.05)	−0.004 (0.05)	−0.01 (0.05)
Just world beliefs		−0.03 (0.05)	0.02 (0.05)		−0.07 (0.05)	0.05 (0.07)
Event type		−0.15 (0.10)	−0.18 (0.10) <sup>+</sup>		−0.06 (0.10)	−0.05 (0.10)
JWB × Event Type			−0.23 (0.10)*			−0.25 (0.10)*
R <sup>2</sup> change		0.01	0.03*		0.02	0.05*

Sleep Composite						
	Unfair Event vs. No Event			Unfair Event vs. Other Event		
	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)	Model 1 <i>b</i> (SE)	Model 2 <i>b</i> (SE)	Model 3 <i>b</i> (SE)
Gender	0.14 (0.17)	0.14 (0.17)	0.14 (0.17)	0.41 (0.17)*	0.41 (0.17)*	0.37 (0.16)*
Ethnicity	−0.01 (0.15)	−0.01 (0.15)	−0.02 (0.15)	0.27 (0.14) <sup>+</sup>	0.25 (0.15) <sup>+</sup>	0.21 (0.14)
Age	0.05 (0.07)	0.04 (0.07)	0.05 (0.07)	−0.03 (0.07)	−0.03 (0.07)	−0.03 (0.07)
Just world beliefs		0.10 (0.07)	0.07 (0.08)		0.02 (0.07)	−0.13 (0.09)
Event type		0.41 (0.18)*	0.45 (0.18)*		0.23 (0.14)	0.25 (0.13) <sup>+</sup>
JWB × Event Type			0.19 (0.20)			0.35 (0.13)*
R <sup>2</sup> change		0.04*	0.01		0.03	0.07*

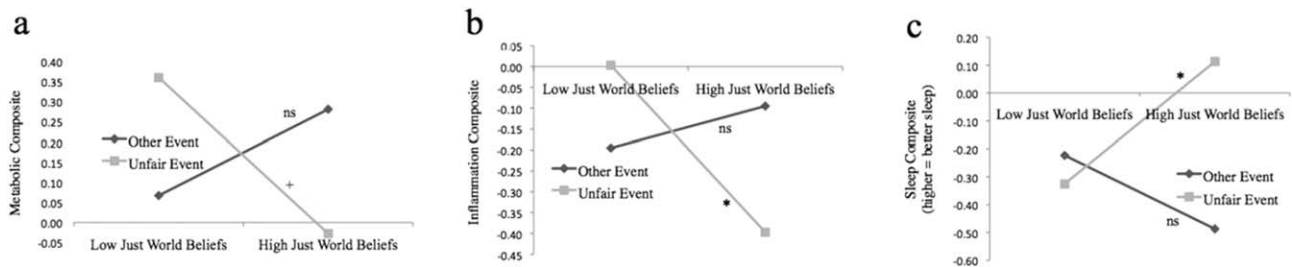
Note. The table shows regression coefficients for the analyses predicting the metabolic composite, inflammation composite, and sleep composite. Regression coefficients for analyses comparing those who experienced unfair events to those who experienced no negative event are on the left, and regression coefficients for analyses comparing those who experienced an unfair event to those who experienced another type of negative event are on the right. Demographic variables (gender, ethnicity, and age) were entered in Model 1, followed by just world beliefs and event type (unfair event vs. no negative event or unfair event vs. another type of negative event) in Model 2, followed by the interaction between just world beliefs and event type in Model 3.

<sup>+</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

$b = -0.25$ ,  $SE = 0.10$ ,  $t(109) = -2.42$ ,  $p = .02$ , and the sleep composite,  $b = 0.35$ ,  $SE = 0.13$ ,  $t(70) = 2.62$ ,  $p = .01$ .

Simple slope analyses showed that just world beliefs predicted better physiological profiles among those who had experienced an unfair event,  $b = -0.19$ ,  $SE = 0.10$ ,  $t(110) = -1.96$ ,  $p = .052$  for the metabolic composite,  $b = -0.20$ ,  $SE = 0.08$ ,  $t(109) = -2.66$ ,  $p = .01$  for the inflammation composite, and  $b = 0.22$ ,  $SE = 0.10$ ,  $t(70) = 2.17$ ,  $p = .03$  for the sleep composite. The simple slopes for those experiencing another event were not significant, all  $ps > .13$ . See Figure 1.

**Other Negative Event Versus No Event.** Finally, although we did not expect them to differ, we tested whether just world beliefs predicted outcomes more strongly for those who had experienced no negative event compared to those who had experienced another type of negative event. We conducted multiple hierarchical linear regressions as described above, except that only people experiencing no negative event (coded as 0) or another type of negative (i.e., not unjust, coded as 1) were included. Just world beliefs and event type (no negative event vs. other negative event) did not interact to predict metabolic risk ( $p = .97$ ), inflammation ( $p = .73$ ), or sleep ( $p = .14$ ).



**Figure 1** Just world beliefs predict lower metabolic risk (Panel A), lower inflammation (Panel B), and better sleep (Panel C) among those who have experienced an unfair event but not another type of negative event. Analyses control for age, gender, and ethnicity. \* $p < .05$ . + $p < .10$ .

## DISCUSSION

This study provides evidence that believing in a just world is correlated with lower inflammation and metabolic risk levels among people who have experienced an event that can be characterized as unfair, but not among people who have experienced another type of negative life event or no negative event. Furthermore, believing in a just world is correlated with better sleep patterns after an unfair negative event but not after another type of negative event. These findings build on previous research to suggest that just world beliefs can protect individuals from not only detrimental psychological but also detrimental physiological outcomes. This study is among the first to assess just world beliefs and physiological outcomes after different types of real-world events and to show that these effects emerge specifically among people who have experienced unfair events. Thus, this research provides preliminary evidence in support of the theory that just world beliefs can buffer people who experience an unfair negative life event from detrimental physiological outcomes. However, it must be noted that because this study was correlational and involved a single time point assessment, neither causality nor directionality is certain. For example, it is also possible that unfair events change people's just world beliefs, or that people cope with unfair events in a manner that both fosters just world beliefs and facilitates better physiological outcomes.

The finding that beliefs interact with type of life event to predict physiological outcomes may explain why many, but not all, studies on physiological responses to negative life events find evidence of negative outcomes (D'Andrea et al., 2011; Lavie, 2001; Miller, Sutherland, Hutchison, & Alexander, 2001; Tochigi et al., 2002). Negative physiological and health outcomes may only emerge for some people and with certain events.

One explanation for the findings for unfair events is that just world beliefs may enable people to interpret their experiences and interact with their environment in a more adaptive manner after such an experience. For instance, people who believe in a just world might focus on the fairer or more positive aspects of the event (e.g., the recovery period rather than the accident itself) or believe that things will eventually work out fairly (e.g., that the perpetrator of a crime will eventually be caught). Such interpretations could reduce the stress of the unfair experience, which could in turn have implications for physiological responses and potentially for clinical health down the line (Cohen et al., 2007).

Furthermore, in order to maintain their belief that they are good people despite their unfair experiences, those who believe in a just world might cope in a manner that restores their sense of themselves as capable (e.g., engaging in positive health behaviors, seeking out social support) and also promotes better physiological profiles. Finally, believing in a just world may promote meaning making, optimism, or a sense of control, all of which predict better health (Janoff-Bulman, 2010; Janoff-Bulman & Frieze, 1983; Park, 2010; Sutton & Winnard, 2007; Taylor et al., 2000).

In contrast, people who do not believe in a just world may not have this belief to draw on to help make sense of their unfair experience or understand when and why bad things might happen. Consequently, they might ruminate more or worry that another unfair negative event will befall them (Dalbert, 1997), a response that predicts worse blood pressure recovery after an acute stressor (Glynn, Christenfeld, & Gerin, 2002). Alternatively, we should note that because just world beliefs were measured after the experience of the negative event, it is possible that the experience of a major unfair negative life event may have changed some individuals' just world beliefs.

### Beliefs and Other Negative Events

Our results also show just world beliefs were associated with people's physiological profiles after unfair events but not after other negative events. One explanation for this is that as people try to make sense of negative experiences, they tend to invoke and reaffirm the belief systems that are most relevant (Laurin, Kay, & Moscovitch, 2008; Rutjens & Loseman, 2010). For people who have experienced other types of negative events, just world beliefs may be less salient. People who experience other types of negative life events might invoke other belief systems (i.e., the belief system that was more relevant to that specific type of event, such as sense of control if they experienced an event that threatened this belief), which might then correlate more strongly with their physiological responses.

### Responses to Events With the Potential to Contradict Beliefs

Though correlational, our findings are consistent with and suggest the protective role that belief systems such as the belief in a



just world may play in the face of certain types of negative life events. These results contrast with others that find negative health and physiological consequences of experiences that contradict one's beliefs (Brown & McGill, 1989; Eliezer et al., 2011; Shimizu & Pelham, 2004; Townsend et al., 2010). One explanation for these divergent findings is that the methodology of previous studies made them more likely to capture consequences that occur when beliefs are in fact violated. In contrast, the design of the present study may have been more likely to capture how beliefs (particularly if maintained) can serve as resources. That is, previous work has used manipulations specifically designed to create the experience of belief violation (Townsend et al., 2010) or has assessed the repeated experience of belief-violating events (Shimizu & Pelham, 2004), and these studies have tended to find negative physiological or health effects, suggesting that an actual violation of one's beliefs may have different consequences than beliefs that are perhaps stable even in the face of unfair events.

## LIMITATIONS AND FUTURE DIRECTIONS

We have shown that just world beliefs correlate with better metabolic profiles, lower levels of inflammation, and better sleep outcomes after an unfair event but were not able to test the causal direction of these effects. Retrospective assessments of negative life events are typical in community studies, as it is difficult to anticipate who will be experiencing major negative life events in the future. Furthermore, experimental designs would be problematic ethically, as we could not reasonably assign people to experience real-world major negative life events. However, other research has suggested that just world beliefs are very stable and can help people who are coping with difficult circumstances to see their world as orderly, controllable, and meaningful (Dalbert, 2001; Furnham, 2003; Janoff-Bulman, 2010; Janoff-Bulman & Frieze, 1983; Lerner, 1980; Park & Blumberg, 2002; Rubin & Peplau, 1975). Consequently, we suggest that it is possible that our observed association between just world beliefs and better physiological profiles after an unfair event existed because just world beliefs helped to foster more adaptive physiological profiles. However, it is also possible that negative life events shape people's just world beliefs, and we were not able to disentangle this alternative possibility given the cross-sectional nature of this study. It is also possible that physiological profiles might somehow shape people's perceptions of the world. In addition, other third variables (e.g., perceived control) may exist that are related to both just world beliefs and physiological profiles, and they might explain the associations that we found.

Because participants could not ethically be assigned to experience unfair events or other types of major negative events in their real lives, the present research was correlational and hence could not test the causal direction of relationships among events, beliefs, and physiology. Furthermore, as just world beliefs were

measured after the negative life event experience, we could not tell whether participants who reported high just world beliefs were those who had always maintained high just world beliefs or whether the experience of negative life events shaped their just world beliefs. Future research could attempt to investigate these questions in longitudinal studies that assess just world beliefs initially, and then follow study participants to see what kinds of life events happen to them and what subsequent physiological outcomes they experience. Long-term longitudinal studies could also track whether participants developed depression and anxiety disorders, cardiovascular disease, cancer, and diabetes (Chung et al., 2009; Harvey, 2001; Koren et al., 2002; Libby & Theroux, 2005; Wellen & Hotamisligil, 2005) or other illnesses for which the physiological profiles measured here indicate greater risk. Finally, future work might experimentally manipulate whether people are asked to recall different types of negative events in their own lives or manipulate the salience of just world beliefs among people who have recently experienced different types of negative events.

An additional limitation concerns our classification of life events. We had coders categorize them based on whether the event was, broadly, unfair or another type of negative event. Of course, for any general description of an event, there might be particular details that make it more or less fair. In addition, we did not obtain participants' subjective perceptions of the fairness of an event. Future research could explore both of these dimensions of events and test their associations with physiological outcomes.

Finally, we note that we defined fairness broadly, drawing on a number of different conceptualizations of justice. The measure of just world beliefs that we used (the Belief in a Just World Scale; Rubin & Peplau, 1975) includes a range of items but focuses largely on just outcomes (e.g., people having a reputation they deserve, being punished for wrongdoing). Research on the psychology of justice has distinguished between procedural justice—the idea that procedures, such as those for dispute resolution, are fair—and distributive justice—the idea that resource distribution or outcomes are fair (Lind & Tyler, 1988). The belief in a procedurally just world and the belief in a distributively just world are distinct (Lucas, Alexander, Firestone, & LeBreton, 2007). In addition, other research on the belief in a just world has distinguished between beliefs about whether the world is just for oneself or for others (Lipkus, Dalbert, & Siegler, 1996). The scale we used here does not differentiate among these dimensions. Future research could test how these more nuanced aspects of just world beliefs are related to physiological outcomes after unfair events versus other types of life events.

In sum, the present research shows that, in addition to the well-documented mental health benefits, higher just world beliefs are also associated with lower levels of metabolic risk and inflammation when people experience unfair events but not other negative events or no negative event. In addition, higher just world beliefs are associated with better objectively measured sleep when people have experienced unfair events but not other types of negative events. Though the study is limited

because of its cross-sectional and observational nature, these findings are consistent with the idea that just world beliefs may play a role in protecting against the physiological responses that have been linked to stressful life events. Further down the line, they suggest the possibility that individual beliefs could interact with people's life experiences to predict cardiovascular and other diseases that have been linked to metabolic and inflammatory profiles in adults.

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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Note

1. The analyses reported in the text of the article control for age, gender, and ethnicity. However, without these covariates, type of event (unfair negative event vs. no negative event) still interacts with just world beliefs to predict inflammation ( $p = .004$ ) and metabolic risk ( $p = .03$ ). Similarly, type of event (unfair event vs. other negative event) still interacts with just world beliefs to predict inflammation ( $p = .009$ ), metabolic risk ( $p = .02$ ), and sleep ( $p = .004$ ).

## References

- Affleck, G., Tennen, H., Croog, S., & Levine, S. (1987). Causal attribution, perceived benefits, and morbidity after a heart attack: An eight-year study. *Journal of Consulting and Clinical Psychology, 55*, 29–35.
- Anderson, C. A., & Lindsey, J. J. (1998). The development, perseverance, and change of naïve theories. *Social Cognition, 16*, 8–30.
- Bastardi, A., Uhlmann, E. L., & Ross, L. (2011). Wishful thinking, belief, desire, and the motivated evaluation of scientific evidence. *Psychological Science, 22*, 731–732.
- Bjorntorp, P. (2001). Do stress reactions cause abdominal obesity and comorbidities? *Obesity Reviews, 2*, 73–86.
- Bonnano, G. A. (2005). Resilience in the face of potential trauma. *Current Directions in Psychological Science, 14*, 135–138.
- Bonanno, G. A., Wortman, C. B., Lehman, D. R., Tweed, R. G., Haring, M., Sonnega, J., et al. (2002). Resilience to loss and chronic grief: A prospective study from preloss to 18-months postloss. *Journal of Personality and Social Psychology, 83*, 1150–1164.
- Bower, J. E., Kemeny, M. E., Taylor, S. E., & Fahey, J. L. (1998). Cognitive processing, discovery of meaning, CD4 decline, and AIDS-related mortality among bereaved HIV-seropositive men. *Journal of Consulting and Clinical Psychology, 66*, 979–986.
- Brown, G. W., Harris, T. O., & Hepworth, C. (1995). Loss, humiliation, and entrapment among women developing depression: A patient and non-patient comparison. *Psychological Medicine, 25*, 7–21.
- Brown, J. D., & McGill, K. L. (1989). The cost of good fortune: When positive events produce negative health consequences. *Journal of Personality and Social Psychology, 57*, 1103–1110.
- Chung, H. Y., Cesari, M., Anton, S., Marzetti, E., Giovannini, S., Seo, A. Y., et al. (2009). Molecular inflammation: Underpinnings of aging and age-related diseases. *Ageing Research Reviews, 8*, 18–30.
- Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *Journal of the American Medical Association, 298*, 1685–1687.
- Dalbert, C. (1997). Coping with an unjust fate: The case of structural unemployment. *Social Justice Research, 10*, 175–189.
- Dalbert, C. (2001). *The justice motive as a personal resource: Dealing with challenges and critical life events*. New York: Plenum Press.
- Dalbert, C. G. (2002). Beliefs in a just world as a buffer against anger. *Social Justice Research, 15*, 123–145.
- D'Andrea, W., Sharma, R., Zelechowski, A. D., & Spinazzola, J. (2011). Physical health problems after single trauma exposure: When stress takes root in the body. *Journal of the American Psychiatric Nurses Association, 17*, 378–392.
- Dzuka, J., & Dalbert, C. (2002). Mental health and personality of Slovak unemployed adolescents: The impact of belief in a just world. *Journal of Applied Social Psychology, 32*, 732–757.
- Eliezer, D., Townsend, S. S. M., Sawyer, P. J., Major, B., & Mendes, W. B. (2011). System-justifying beliefs moderate the relationship between perceived discrimination and resting blood pressure. *Social Cognition, 29*, 303–321.
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row Peterson.
- Furnham, A. (2003). Belief in a just world: Research progress over the past decade. *Personality and Individual Differences, 34*, 795–817.
- Glynn, L. M., Christenfeld, N., & Gerin, W. (2002). The role of rumination in recovery from reactivity: Cardiovascular consequences of emotional states. *Psychosomatic Medicine, 64*, 714–724.
- Hafer, C. L., & Begue, L. (2005). Experimental research on just-world theory: Problems, developments, and future challenges. *Psychological Bulletin, 131*, 128–167.
- Hafer, C. L., & Corey, B. L. (1999). Mediators of the relation between beliefs in a just world and emotional responses to negative outcomes. *Social Justice Research, 12*, 189–204.
- Hammen, C. (1991). Generation of stress in the course of unipolar depression. *Journal of Abnormal Psychology, 100*, 555–561.
- Hammen, C., Ellicott, A., Gitlin, M., & Jamison, K. R. (1989). Sociotropy/autonomy and vulnerability to specific life events in patients with unipolar depression and bipolar disorders. *Journal of Abnormal Psychology, 98*, 154–160.
- Hammen, C., Henry, R., & Daley, S. E. (2000). Depression and sensitization to stressors among young women as a function of childhood adversity. *Journal of Consulting and Clinical Psychology, 68*, 782–787.

- Hammen, C., Marks, T., Mayol, A., & deMayo, R. (1985). Depressive self-schemas, life stress, and vulnerability to depression. *Journal of Abnormal Psychology, 94*, 308–319.
- Harvey, A. G. (2001). Insomnia: Symptom or diagnosis? *Clinical Psychology Review, 21*, 1037–1059.
- Irwin, M. (2002). Effects of sleep and sleep loss on immunity and cytokines. *Brain, Behavior, and Immunity, 16*, 503–512.
- Janoff-Bulman, R. (2010). *Shattered assumptions: Towards a new psychology of trauma*. New York: Free Press.
- Janoff-Bulman, R., & Frieze, I. H. (1983). A theoretical perspective for understanding reactions to victimization. *Journal of Social Issues, 39*, 1–18.
- Kay, A. C., Whitson, J. A., Gaucher, D., & Galinsky, A. D. (2009). Compensatory control: Achieving order through the mind, our institutions, and the heavens. *Current Directions in Psychological Science, 18*, 264–268.
- Kim, E. J., & Dimsdale, J. E. (2007). The effect of psychosocial stress on sleep: A review of polysomnographic evidence. *Behavioral Sleep Medicine, 5*, 256–278.
- Kolm, S.-C. (Ed.). (1996). *Modern theories of justice*. Cambridge, MA: MIT Press.
- Koren, D., Arnon, I., Lavie, P., & Klein, E. (2002). Sleep complaints as early predictors of posttraumatic stress disorder: A 1-year prospective study of injured survivors of motor vehicle accidents. *American Journal of Psychiatry, 159*, 855–857.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*, 480–498.
- Kushida, C. A., Chang, A., Gadkary, C., Guilleminault, C., Carrillo, O., & Dement, W. C. (2001). Comparison of actigraphic, polysomnographic, and subjective assessment of sleep parameters in sleep-disordered patients. *Sleep Medicine, 2*, 389–396.
- Laurin, K., Kay, A. C., & Moscovitch, D. A. (2008). On the belief in God: Towards an understanding of the emotional substrates of compensatory control. *Journal of Experimental Social Psychology, 44*, 1559–1562.
- Lavie, P. (2001). Sleep disturbances in the wake of traumatic events. *New England Journal of Medicine, 345*, 1825–1832.
- Lerner, M. (1980). *The belief in a just world: A fundamental delusion*. New York: Plenum Press.
- Li, J., Hansen, D., Mortensen, P. B., & Olsen, J. (2002). Myocardial infarction in parents who lost a child. *Circulation, 106*, 1634–1639.
- Libby, P., & Theroux, P. (2005). Pathophysiology of coronary artery disease. *Circulation, 111*, 3481–3488.
- Lind, E. A., & Tyler, T. R. (1988). *The social psychology of procedural justice*. New York: Plenum Press.
- Lipkus, I. M., Dalbert, C., & Siegler, I. (1996). The importance of distinguishing the belief in a just world for self versus others: Implications for psychological well-being. *Personality and Social Psychology Bulletin, 22*, 666–677.
- Lord, C. G., Ross, L., & Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology, 37*, 2098–2109.
- Lucas, T., Alexander, S., Firestone, I., & LeBreton, J. M. (2007). Development and initial validation of a procedural and distributive justice world measure. *Personality and Individual Differences, 43*, 71–82.
- Marin, T. J., Chen, E., Munch, J. A., & Miller, G. E. (2009). Double-exposure to acute stress and chronic family stress is associated with immune changes in children with asthma. *Psychosomatic Medicine, 71*, 378–384.
- McQuaid, J. R., Monroe, S. M., Roberts, J. R., Johnson, S. L., Garamoni, G. L., Kupfer, D. J., et al. (1992). Toward the standardization of life stress assessment: Definitional discrepancies and inconsistencies in methods. *Stress Medicine, 8*, 47–56.
- Miller, G. E., Cohen, S., & Richey, A. K. (2002). Chronic psychological stress and the regulation of pro-inflammatory cytokines: A glucocorticoid-resistance model. *Health Psychology, 21*, 531–541.
- Miller, R. J., Sutherland, A. G., Hutchison, J. D., & Alexander, D. A. (2001). C-reactive protein and interleukin 6 receptor in post-traumatic stress disorder: A pilot study. *Cytokine, 13*, 253–255.
- Murphy, M. L. M., Slavich, G. M., Chen, E., & Miller, G. E. (2015). Targeted rejection predicts decreased anti-inflammatory gene expression and increased symptom severity in youth with asthma. *Psychological Science, 26*, 111–121.
- Ogle, C. M., Rubin, D. C., Bernsten, D., & Siegler, I. C. (2013). The frequency and impact of exposure to potentially traumatic events over the life course. *Clinical Psychological Science, 1*, 426–434.
- Otto, K., Boos, A., Dalbert, C., Schops, D., & Hoyer, J. (2006). Post-traumatic symptoms, depression, and anxiety of flood victims: The impact of the belief in a just world. *Personality and Individual Differences, 40*, 1075–1084.
- Pakenham, K. I. (2008). Making sense of illness or disability: The nature of sense making in multiple sclerosis (MS). *Journal of Health Psychology, 13*, 93–105.
- Park, C. L. (2010). Making sense of the meaning literature: An integrative review of meaning making and its effects on adjustment to stressful life events. *Psychological Bulletin, 136*, 257–301.
- Park, C. L. (2012). Meaning, spirituality, and growth: Protective and resilience factors in health and illness. In A. Baum, T. A. Revenson, & J. Singer (Eds.), *Handbook of health psychology* (pp. 405–429). New York: Psychology Press.
- Park, C. L., & Blumberg, C. J. (2002). Disclosing trauma through writing: Testing the meaning-making hypothesis. *Cognitive Therapy and Research, 26*, 597–616.
- Park, C. L., Edmondson, D., Fenster, J. R., & Blank, T. O. (2008). Meaning making and psychological adjustment following cancer: The mediating roles of growth, life meaning, and restored just-world beliefs. *Journal of Consulting and Clinical Psychology, 76*, 863–875.
- Rawls, J. (1999). *A theory of justice* (rev. ed.). Cambridge, MA: Belknap.
- Ross, L., & Lepper, M. R. (1980). The perseverance of beliefs: Empirical and normative considerations. In R. A. Shweder & D. Fiske (Eds.), *New directions for methodology of behavioral science: Fallible judgment in behavioral research* (pp. 17–36). San Francisco: Jossey-Bass.
- Rubin, Z., & Peplau, L. A. (1975). Who believes in a just world? *Journal of Social Issues, 31*, 265–289.

- Rutjens, B. T., & Loseman, A. (2010). The society-supporting self: System justification and cultural worldview defense as different forms of self-regulation. *Group Processes and Intergroup Relations*, **13**, 241–250.
- Sadeh, A., Hauri, P. J., Kripke, D. F., & Lavie, P. (1995). The role of actigraphy in the evaluation of sleep disorders. *Sleep*, **18**, 288–302.
- Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology*, **1**, 607–628.
- Seery, M. D. (2011). Resilience: A silver lining to experiencing adverse life events? *Current Directions in Psychological Science*, **20**, 390–394.
- Shimizu, M., & Pelham, B. W. (2004). The unconscious cost of good fortune: Implicit and explicit self-esteem, positive life events, and health. *Health Psychology*, **23**, 101–105.
- Sieber, W. J., Rodin, J., Larson, L., Ortega, S., & Cummings, N. (1992). Modulation of human natural killer cell activity by exposure to uncontrollable stress. *Brain, Behavior, and Immunity*, **6**, 141–156.
- Stephens, N. M., Fryberg, S. A., Markus, H. M., & Hamedani, M. G. (2013). Chilean earthquake as an act of God? The experience of extreme hardship predicts religious meaning-making. *Journal of Cross-Cultural Psychology*, **44**, 606–619.
- Stephens, A., Hamer, M., & Chida, Y. (2007). The effects of acute psychological stress on circulating inflammatory factors in humans: A review and meta-analysis. *Brain, Behavior, and Immunity*, **21**, 901–912.
- Sutton, R. M., & Winnard, E. J. (2007). Looking ahead through the lenses of justice: The relevance of just-world beliefs to intentions and confidence in the future. *British Journal of Social Psychology*, **46**, 649–666.
- Taylor, S. E. (1983). Adjustment to threatening events: A theory of cognitive adaptation. *American Psychologist*, **38**, 1161–1173.
- Taylor, S. E., Kemeny, M. E., Reed, G. M., Bower, J. E., & Gruenewald, T. L. (2000). Psychological resources, positive illusions, and health. *American Psychologist*, **55**, 99–109.
- Taylor, S. E., Wood, J. V., & Lichtman, R. R. (1983). It could be worse: Selective evaluation as a response to victimization. *Journal of Social Issues*, **39**, 19–40.
- Tochigi, M., Umekage, T., Otani, T., Kato, T., Iwanami, A., Asukai, N., et al. (2002). Serum cholesterol, uric acid and cholinesterase in victims of the Tokyo subway sarin poisoning: A relation with post-traumatic stress disorder. *Neuroscience Research*, **44**, 267–272.
- Tomaka, J., & Blascovich, J. (1994). Effects of justice beliefs on cognitive appraisal of and subjective, physiological, and behavioral responses to potential stress. *Journal of Personality and Social Psychology*, **67**, 732–740.
- Tononi, G., & Cirelli, C. (2006). Sleep function and homeostasis. *Sleep Medicine Reviews*, **10**, 49–62.
- Townsend, S. S. M., Major, B., Sawyer, P. J., & Mendes, W. B. (2010). Can the absence of prejudice be more threatening than its presence? It depends on one's worldview. *Journal of Personality and Social Psychology*, **99**, 933–947.
- Ullman, S. E., & Siegel, J. M. (1996). Traumatic events and physical health in a community sample. *Journal of Traumatic Stress*, **9**, 703–720.
- Vitaliano, P., Scanlan, J., Zhang, J., Savage, M., Hirsch, I., & Siegler, I. C. (2002). A path model of chronic stress, the metabolic syndrome, and coronary heart disease. *Psychosomatic Medicine*, **64**, 418–435.
- Vrshek-Schallhorn, S., Doane, L. D., Mineka, S., Zinbarg, R. E., Craske, M. G., & Adam, E. K. (2013). The cortisol awakening response predicts major depression: Predictive stability over a four year follow-up and effect of depression history. *Psychological Medicine*, **43**, 483–493.
- Wagner, C., Abela, J. R. Z., & Bronzina, K. (2006). A comparison of stress measures in children and adolescents: A self-report checklist versus an objectively rated interview. *Journal of Psychopathology and Behavioral Assessment*, **28**, 251–261.
- Wellen, K. E., & Hotamisligil, G. S. (2005). Inflammation, stress, and diabetes. *Journal of Clinical Investigation*, **115**, 1111–1119.