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Optimism and well-being: a prospective multi-method and multi-dimensional examination of optimism as a resilience factor following the occurrence of stressful life events

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ABSTRACT
Optimism has been conceptualised variously as positive expectations (PE) for the future , optimistic attributions , illusion of control , and self-enhancing biases. Relatively little research has examined these multiple dimensions of optimism in relation to psychological and physical health. The current study assessed the multi-dimensional nature of optimism within a prospective vulnerability-stress framework. Initial principal component analyses revealed the following dimensions: PEs, Inferential Style (IS), Sense of Invulnerability (SI), and Overconfidence (O). Prospective follow-up analyses demonstrated that PE was associated with fewer depressive episodes and moderated the effect of stressful life events on depressive symptoms. SI also moderated the effect of life stress on anxiety symptoms. Generally, our findings indicated that optimism is a multifaceted construct and not all forms of optimism have the same effects on well-being. Specifically, our findings indicted that PE may be the most relevant to depression, whereas SI may be the most relevant to anxiety.

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Optimism; depression; anxiety; stressful life events; resilience

Optimism is a multifaceted construct that has been variously defined in the empirical literature as positive expectancies for the future (Scheier & Carver, 1985), a positive inferential style (IS) (Peterson & Seligman, 1984), beliefs in personal control (Alloy & Abramson, 1979), and self-enhancing views relative to others (Weinstein, 1980). More broadly, optimism has been negatively associated with a wide variety of physical and mental health outcomes such as coronary heart disease (e.g. Tindale et al., 2009) and mortality (Seligman, 2008). Similarly, optimism has been linked to several psychiatric disorders such as depression (Carver & Gaines, 1987).

Despite the attention directed to addressing trait-like and situational aspects of optimism (Armor & Taylor, 1997), relatively little consideration has been given to the relation between the multiple conceptualisations of optimism and their relationship to psychological and physical well-being. Thus, in the present study, we assessed a multi-method conceptualisation of optimism using factor analysis and examined optimism's components as predictors of various mental and physical health outcomes.

Dispositional optimism as positive expectancies for the future

One of the more prominent characterisations of optimism is a positive expectancy for the future (Carver & Scheier, 2014; Scheier & Carver, 1985), or a relatively stable expectation that one will experience favourable rather than unfavourable outcomes in the future. This *dispositional optimism* is associated with lower levels of postpartum depression (Carver & Gaines, 1987)

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and lower depressive symptoms in children (Ey et al., 2005). Research on physical health also corroborates the beneficial effects of dispositional optimism. For example, dispositionally optimistic college students reported fewer minor illness symptoms during stressful times than did pessimistic students (Aspinwall & Taylor, 1992; Scheier & Carver, 1985, Study 3). Aspinwall and Taylor (1992) found that optimism was indirectly associated with physical illness through better adaptation to stressors. This is consistent with the body of literature suggesting that stress is associated with decreased immune response (see Segerstrom & Miller, 2004 for review) and optimism might reduce the negative effect that stress has on the immune response.

Explanatory optimism as attributions for events

Optimism also has been described as a positive IS for negative life events, that is, the opposite of the negative IS featured in the hopelessness theory of depression (Abramson, Metalsky, & Alloy, 1989). According to the hopelessness theory, individuals who tend to attribute negative events to stable and global causes, and to infer negative self-characteristics and consequences, have a pessimistic explanatory (also called cognitive or inferential) style that places them at risk for depression (Alloy et al., 2006). In contrast, individuals who attribute negative events to unstable and specific causes, and do not infer negative self-characteristics and long-term consequences, may be viewed as possessing an optimistic explanatory style (Peterson & Seligman, 1984). Pessimistic and optimistic explanatory style are two extremes measured using the same scale (e.g. Cognitive Style Questionnaire, Haeffel et al., 2008) ranging from temporary and specific (i.e. optimistic explanatory style) to stable and global (i.e. pessimistic explanatory style) attributions. So, rather than two orthogonal measures, pessimistic and optimistic explanatory style represent the same construct and the use of either term is contingent upon the context of the study (e.g. if the study is on mental health risk, the scale is coded to reflect pessimism).

There is considerable evidence linking a negative IS, particularly in response to a stressful event, with mental health issues. This includes first onset of depression (Alloy et al., 2006; Haeffel et al., 2008), mania and hypomania (Francis-Raniere, Alloy, & Abramson, 2006), and suicidal ideation (Abramson et al., 1998). Compared to their less optimistic counterparts, individuals with an optimistic explanatory style tend to experience less physical illness (Peterson & Seligman, 1984) and live longer (Seligman, 2008).

Optimism as illusion of control

A third definition of optimism relates to the observation that healthy individuals typically overestimate the degree of control that they have over a given situation, whereas depressed individuals tend to give more accurate ratings of the control they have over a given situation, especially situations that are self-relevant (i.e. depressive realism; Alloy & Abramson, 1979). Indeed, people often believe that they exert an influence on outcomes that are chance-determined, and therefore, completely outside their control. Additionally, this illusion of control appears to possess adaptive qualities, being negatively associated with depression. Relative to non-depressed counterparts, depressed individuals tend not to overestimate the extent of their personal control, but rather seem to have more modest self-appraisals (Alloy & Clements, 1992).

Inconsistencies within research on depressive realism have been widely discussed (see Moore & Fresco, 2012). Generally speaking, whereas this optimistic phenomenon has been demonstrated in some studies, especially those using contingency judgment or gambling paradigms (e.g. Alloy & Abramson, 1979), other studies have failed to find such an effect (e.g. Moore & Fresco, 2007). According to the meta-analysis by Moore and Fresco (2012), the inconsistent findings regarding depressive realism are generally contingent on the study design. They found that the strongest depressive realism effects were found in studies that use paradigms that did not have an objective standard of reality and used self-report measures of depressive symptoms.

Optimism as self-enhancing biases

Another conceptualisation of optimism stems from studies on self-enhancing biases, the pervasive tendency to judge oneself (and one's circumstance) positively relative to others. Healthy individuals generally tend to form self-flattering appraisals, discounting negative characteristics, and attending more to positive ones (Alloy & Ahrens, 1987). Furthermore, several studies have shown that people tend to evaluate themselves more favourably than others (e.g. Kruger & Dunning, 1999). This phenomenon has

been referred to as *unrealistic optimism* (Weinstein, 1980). This self-enhancing bias extends to individuals' predictions of the likelihood of different events in their own and others' futures (Alloy & Ahrens, 1987). That is, in what has been termed *unique invulnerability* (Perloff & Fetzer, 1986), healthy individuals tend to underestimate the personal risk of adverse outcomes (Perloff & Fetzer, 1986; Weinstein, 1980). In summary, optimistic individuals expect more positive and fewer negative events in the future for themselves relative to others. In contrast, those currently depressed or with low self-esteem are more likely to form even-handed or self-deprecating appraisals (Alloy & Ahrens, 1987), suggesting perhaps that this self-enhancing bias is associated with psychological well-being (Alloy & Ahrens, 1987). The findings on self-enhancing or unrealistic optimism are inconsistent, as several studies find negative effects. For example, smokers who exhibit unrealistic optimism underestimate the likelihood of getting cancer, leading to decreased likelihood of quitting smoking (Dillard, McCaul, & Klein, 2006).

In general, despite the exceptions noted above, multiple lines of research appear to converge on the findings that optimism is characteristic of psychologically healthy individuals, negatively associated with depression, and may moderate risk for psychological and physical illness. Conversely, pessimism seems to serve as a vulnerability factor for psychopathology and physical illness. In addition to documenting the associations between optimism and physical or mental health outcomes, researchers also have assessed the manner in which optimism may moderate the relation between life stress and relevant health outcomes. Just as negative inferential tendencies may worsen the deleterious effects of stressful life events within a vulnerability-stress framework (Abramson et al., 1989), optimism may operate as a buffer against life stress in a similarly interactive manner. For example, optimism has been found to buffer the effects of life stress on depression (Alloy & Clements, 1992).

Limitations in the extant literature

It also should be noted that several limitations characterise much of the extant literature in this area. Specifically, most studies rely on a single measure of optimism, reflecting one aspect of this broad construct. Thus, relatively little consideration has been given to the relative contributions of different dimensions of optimism as moderating factors of risk for mental and physical illness. Although much attention has been devoted individually to IS, illusions of control, self-enhancing biases, and positive expectations (PE) for the future in relation to well-being, studies simultaneously examining the unique effects of multiple facets of optimism in a comprehensive and integrative manner are lacking. Such an approach may help elucidate the specific aspects of this broad construct that are uniquely predictive of physical and psychological health outcomes. Several studies assessing positive expectancy for the future and positive ISs have found the two to be only modestly associated (Carver, Scheier, & Segerstrom, 2010).

Second, much of the existing literature is constrained by a heavy reliance on self-report methodology, often employing a single measure of optimism. A related concern is the absence of stress-resilience studies featuring interview-based assessments of stressful life events. Instead, research in this area has consistently relied on self-report questionnaires (i.e. life events checklists), which are relatively more susceptible to respondents' subjective or idiosyncratic interpretations and less reflective of actual relative to perceived stressors. Mood-congruent memory or reporting bias may be a particular concern if depression were the principal outcome of interest. For these reasons, interview-based measures have come to be viewed as the gold standard in research on life stress.

Finally, and paralleling the need for more studies to include a consideration of multiple dimensions of optimism, most research assessing the relation of this construct with psychological well-being have focussed exclusively on depression. Thus, comparatively little is known regarding the specificity of the relationship between optimism and depression; it is unclear to what degree this construct is similarly related to other forms of psychopathology. It is worth noting within this context that several studies on anxiety disorders provide preliminary evidence that optimism may be negatively associated with anxiety as well (Miranda & Mennin, 2007).

The present study

The specific aim of the present study is to address these limitations through a multi-method examination of several conceptualisations of optimism. That is, using four self-report measures and 12 performance-based indicators, our objectives were to examine the

factor structure of optimism and assess the prospective impact of optimism on psychological and physical health outcomes within a stress-resilience model. As a first step towards this goal, we conducted a principal components analysis (PCA) to determine the number and types of distinct facets of optimism underlying the 16 indicators of optimism. We then confirmed the PCA with a confirmatory factor analysis (CFA).

We also examined how the derived dimensions of optimism interact with negative life events occurring within a six-month follow-up period to predict depression and anxiety, as well as physical complaints. Because the prospective sample was relatively small, we consider these analyses largely exploratory in nature. We hypothesised that the optimism dimensions would be negatively associated with depression, anxiety, and physical problems. Furthermore, we hypothesised that optimism would buffer the effects of negative life events in predicting depression, anxiety, and physical complaints, such that the relationship between negative life events and depression, anxiety, and physical complaints would be weakened among individuals with greater levels of optimism. Our aim in conducting these analyses was to examine which optimism factors predicted anxiety, depression, and physical illness and which factors buffered the risk for anxiety, depression, and physical illness conferred by stress. These analyses were not an explicit test of discriminant validity because we would expect the optimism constructs to be independent, but still overlapping, constructs.

Method

Participants

Participants consisted of undergraduates recruited in five cohorts from introductory psychology classes at a major university in the northeastern United States. At Time 1, participants ($n = 464$, 76% female) were an average of 19.5 years old. The composition of the sample was 43% Caucasian, 34% African American, 12% Asian American, 3% Hispanic, and 7% Other.

We invited participants from the fifth cohort to participate in the longitudinal follow-up phase of the study. At Time 2, participants ($n = 96$, 82% female) were 39% Caucasian, 36% African American, 10% Asian American, 4% Hispanic, and 10% Other. A series of preliminary analyses was conducted to determine if the subgroup that participated in the prospective phase of the study differed significantly from the overall Time 1 sample in demographic characteristics, and is thus representative of the Time 1 sample as a whole. No significant differences emerged in a series of t-tests comparing the subgroup to the larger overall sample.

Procedure

Data collection occurred during the Fall and Spring semesters across several academic years. Time 1 data were collected over several semesters from Fall of 1998 to Fall of 2000. Time 2 data were collected between late Fall 2000 and early Spring 2001. All data collection occurred during individual, in-lab sessions. Participants were compensated in extra course credit.

Time 1

After giving consent, participants completed tasks in the follow order: (1) a conversation task and measures relevant to this task (i.e. Post-Interaction Impressions Questionnaire, Evaluative Consequences Scale, and Self-Perception Questionnaire measure; discussed in detail below), (2) a computerised illusion-of-control task and measures relevant to this task (i.e. Judgment of Control Scale and Expectancy of Control Scale; also described below), (3) a dice betting game, and (4) an event prediction task. After these tasks, participants completed self-report measures of optimism, as well as baseline depression and anxiety symptoms.

Time 2

The subset of participants that participated in the six-month prospective phase of the study completed tasks in the following order: (1) a life events checklist (i.e. Life Events Scale) to assess the occurrence of stressful events since Time 1, (2) measures of depression and anxiety symptoms (the interviewer reviewed the life events checklist while participants completed these measures), (3) a follow-up interview to collect more detail about the life events endorsed on the checklist (i.e. Life Events Interview), and (4) a clinical interview (i.e. Schedule for Affective Disorders and Schizophrenia) to determine the presence of clinical depression and physical illness present at Time 1 or during the follow-up period. Including measures of depression at both the symptom and diagnosis level allowed us to examine possible specificity to symptoms versus diagnoses. An advanced clinical psychology doctoral student conducted both interviews given during this session.

Measures of optimism[1]

The *Beck Hopelessness Scale* (BHS; Beck, Weissman, Lester, & Trexler, 1974) is a 20-item self-report measure of hopelessness. Respondents circle "true" or "false" to items that assess negative expectancies for the future (e.g. "My future seems dark to me"). Total scores can range from 0 to 20, with lower scores indicating lower levels of pessimism. The BHS has demonstrated good internal consistency (Cronbach's $\alpha = .93$; Beck et al., 1974).

The *Revised Life Orientation Test* (LOT-R; Scheier, Carver, & Bridges, 1994) is a 10-item questionnaire. Items are rated on a 5-point Likert scale from 0 ("strongly disagree") to 4 ("strongly agree"). Scores are obtained by summing the responses on three positively and three negatively valenced items. The LOT-R has adequate predictive and discriminant validity, strong internal reliability (Cronbach's $\alpha = .82$; Scheier & Carver, 1992), and a test–retest reliability of .79 (Scheier et al., 1994).

The *Cognitive Style Questionnaire* (CSQ; Haeffel et al., 2008) is used to assess individuals' tendency to make internal, global, and stable attributions, and to infer positive or negative consequences and characteristics about themselves following the occurrence of a positive or negative life event. Participants were asked to read 24 hypothetical events (12 positive and 12 negative events), with equal numbers in interpersonal and achievement domains, and to imagine that those events happened to them. Participants then were asked to identify the primary cause of the event if it happened to them, and to answer questions (on 7-point Likert scales) about the likely cause and consequences of each hypothetical event. Specifically, causes were rated on dimensions of internality (degree to which the event is caused by the participant), stability (degree to which the cause is stable over time), and globality (degree to which the cause is widespread across situations). Finally, participants also rated on 7-point Likert scales the consequences and self-implications of the event. Composite scores for positive and negative events were calculated separately using scores on the globality, stability, consequences, and self-implication dimensions. The CSQ has exhibited high internal consistency in many previous studies, often as high as $\alpha = .95$ or above for negative events (See Haeffel, et al., 2008). There is also evidence of good one year test–retest reliability ($r = .79$ and .80 for positive and negative events, respectively, Alloy et al., 2006).

The *Event Questionnaire* (EQ; Crocker, Alloy & Kayne, 1988) is comprised of 24 statements written in the second person that describe 12 positive and 12 negative events (e.g. "You are selected to become a member of an organisation that you wanted to join") equally divided into interpersonally and achievement-oriented domains. For each item, participants were asked to rate the likelihood of the event happening to: a) themselves, and b) a same-sexed peer in both the next three months and over the course of their lifetimes. Two indicators of optimism were generated by calculating the difference between ratings of self and others for positive events for three months (EQ positive 1) and lifetime (EQ positive 2), respectively. The difference between self- and other-ratings for negative events for three months (EQ negative 1) and lifetime (EQ negative 2), respectively, yielded two additional indicators of optimism. Higher scores for positive events, and lower scores for negative ones, are taken to reflect greater self-favouring biases. The EQ has previously demonstrated adequate internal consistency ($\alpha = .90$ and .87 for ratings of self and others for positive events, respectively, and $\alpha = .87$ and .85 for ratings of self and others for negative events, respectively; Crocker et al., 1988).

Self-enhancing biases

A conversation task based on Lewinsohn, Mischel, Chaplin, and Barton (1980) was used in the present study to assess optimistic self-enhancing biases associated with interpersonal relations. Participants completed a 10-minute conversation with a confederate. They were informed that the purpose of this task was to study the acquaintance process, and they were permitted to discuss any topic except the study itself. Confederates were trained to wait for the participant to initiate the conversation, at which point they were allowed to talk with them freely. Based on this interaction, the participants and confederate were asked separately to complete the Post-Interaction Impressions Questionnaire (PIIQ; Siegel & Alloy, 1990) and the Evaluative Consequences Scale (EC; Siegel & Alloy, 1990). In addition, the participant completed the Self-Perception Questionnaire (SP; Siegel & Alloy, 1990).

The SP is a 36-item measure of personal attributes on a 9-point scale. Example traits include creative/uncreative and apathetic/interested. The PIIQ is a version of the SP containing the same traits, but adapted for judgment of others. The Target-rating-the-Perceiver

form (PIIQ-A) is used by participants to rate the confederate's attributes, whereas the Perceiver-rating-the-Target form (PIIQ-B) is used by confederates to rate participants. Using the SP and PIIQ, two different scores of self-enhancing biases for personal characteristics were calculated: the difference between the participant's self-rating and their rating of the confederate (SP-PIIQA), and the difference between the participant's self-rating and the confederate's rating of them (SP-PIIQB). In both cases, positive scores indicated self-enhancing biases. The SP has demonstrated adequate internal consistency ($\alpha = .75$; Siegel & Alloy, 1990).

Mirroring the SP, two versions of the EC completed by the participant assessed their self-impressions during their interaction (EC-PrP) and their ratings of the confederate (EC-PrC), respectively. Specifically, in the EC-PrP, the participant completed a series of Likert-scale items indicating their impression of the confederate's interest and view of them. In the EC-PrC, the participant rated their interest in and impression of the confederate. A third version (EC-CrP) provided the confederate's impression of the participant. Two different scores were then calculated: the difference between the EC-PrP and EC-PrC (ECA) and between EC-PrP and EC-CrP (ECB). Again, in both cases, higher scores indicated higher self-enhancing biases. The EC has been found to have high internal consistency ($\alpha = .88$; Siegel & Alloy, 1990).

Illusion of control. Alloy and Abramson's (1979) non-contingent-win judgment-of-control task was also used as an indicator of the illusion of control. This computerised task consisted of 40 trials of 3 seconds each. The onset of each trial is signalled by a tone, after which the participant may choose to press or not press the mouse button. The participant received a quarter for each trial ending with a square appearing on the monitor, and no money for trials ending with a blank monitor. Participants were informed that the task was controllable, with some trial and error required to determine the optimal strategy for producing the desired result. In truth, however, the squares randomly appeared on 50% of the trials, resulting in earnings of $5 for all participants. Before starting the task, participants rated on a 100-point scale (the Expectancy of Control scale) the extent to which they expected to influence the outcome of this task. Upon completion of the task, participants again completed a 100-point scale (the Judgment of Control scale) indicating the degree to which they believe their responses influenced the outcome. Higher scores indicated greater illusion of control.

Illusion of control also was assessed with a dice game based on a paradigm developed by Golin, Terrell, and Johnson (1977). Dice rolls of 2, 3, 4, 9, 10, 11, and 12 were considered wins, reflecting a chance-determined probability of winning of .44. Participants were permitted to bet up to half of their earlier earnings on each of two trials. When participants rolled a winning number, they earned the amount betted, when they rolled a losing number, they paid back to the experiment the amount betted. After deciding their bet amount, they rated their confidence in winning on an 11-point scale, with higher scores reflecting greater confidence. Higher average amount bet and confidence ratings, respectively, indicated greater expectancy of success. Participants won or lost the bet depending on the outcome of each trial.

Measures of negative life events

The Life Events Scale (LES) and Life Events Interview (LEI; Safford, Alloy, Abramson, & Crossfield, 2007) are a combination of questionnaire and semi-structured interview designed to assess the occurrence of stressful life events spanning a wide range of content domains of particular relevance to college students (e.g. school, family, relationships, finances). Respondents were asked to indicate on the LES whether or not each event occurred during the 6-month prospective phase of the study, and to indicate the frequency with which each event occurred. Following completion of the LES, participants were interviewed with the LEI. The LEI served as a reliability and validity check on the LES, as it allowed for life events to be more objectively identified in order to reduce subjective report biases. The LEI includes criteria for event definition and a priori probes to help the interviewer determine whether reported events on the LES meet the event definition criteria. It also allows for obtaining additional information regarding the nature and context in which the event occurred. Any event that did not meet the event definition criteria was disqualified, as were events that started or occurred before Time 1. The LEI yields a continuous count of stressful events that occurred during the study period. The LES and LEI have been found to have good reliability and validity (Safford et al., 2007).

Outcome measures

Beck Depression Inventory (BDI; Beck, Steer, & Garbin, 1988). The BDI is a 21-item self-report measure of depression symptomatology over the past two weeks. Participants rated the occurrence of each symptom using a 4-point Likert scale ranging from 0 to 3. Total scores range from 0 to 63, with higher scores indicating greater severity of depressive symptoms. The BDI has demonstrated high internal consistency (Cronbach's $\alpha = .81$ to .86), construct validity, good retest reliability, and convergent validity with other measures of depression (see Beck et al., 1988).

Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). The BAI is a 21-item self-report measure of symptoms of anxiety. Individuals are asked to record how much they have been bothered by a symptom during the past week. Each item is rated on a 4-point Likert scale ranging from "not at all" (equal to 0) to "severely—I could barely stand it" (equal to 3). The total score ranges from 0 to 63. The scale has high internal consistency ($\alpha = .92$) and test–retest reliability of .75 (Beck et al., 1988).

Expanded Schedule for Affective Disorders and Schizophrenia-Change interview (exp-SADS-C; Spitzer & Endicott, 1978). The exp-SADS-C is a semi-structured diagnostic interview designed to assess the occurrence of psychopathology. The SADS-C was expanded to allow for assignment of *DSM-IV* diagnoses. The depression module was administered to ascertain the presence of depressive episodes occurring over the course of the study. The physical illness module was administered to ascertain the occurrence of several medical conditions. Participants were presented with a list of conditions and were asked to indicate which conditions had caused them problems over the previous six months. This checklist included a range of minor to major medical conditions such as allergies, mononucleosis, migraines, diabetes, hypoglycaemia, indigestion, and dizziness. This expanded version of the SADS-C has previously demonstrated excellent inter-rater reliability (kappa > .90; Alloy et al., 2006).

Procedure

At Time 1, participants completed the conversation task, computerised illusion of control task, and the dice roll task, as well as relevant measures for each task. Participants also completed self-report measures of optimism (BHS, LOT-R, CSQ, and EQ), as well as baseline depression (BDI) and anxiety symptoms (BAI). The subset of participants that participated in the six-month prospective phase of the study completed the BDI and BAI at Time 2. They were also administered the SADS-C to determine the presence of clinical depression and complaints of physical illness present at Time 1 or during the follow-up period. Including measures of depression at both the symptom and diagnosis level allowed us to examine possible specificity to symptoms versus diagnoses. Finally, the LES and LEI were used to assess the occurrence of negative life events in the six months between Time 1 and Time 2. An advanced clinical psychology doctoral student conducted all clinical interviews (i.e. LEI, SADS-C).

Results

Descriptives

Given the increased risk of Type I error when conducting multiple comparisons, we utilised a Benjamini–Hochberg correction (Benjamini & Hochberg, 1995) to adjust our p-values for all correlation and regression analyses. Table 1 presents the intercorrelations, means, and standard deviations for all optimism variables at Time 1

Principal components analysis

We then submitted the indicators of optimism to principal components analyses (PCA) with an oblique (promax) rotation so as to extract the greatest number of interpretably distinct dimensions of optimism. An examination of the eigenvalues of the unrotated factors indicated a levelling off in the scree plot after the third factor, suggesting that three was the minimum number of factors to retain. Based on parallel analysis, the maximum number of factors that could be extracted was six.

Accordingly, we first extracted six components. This model accounted for 64% of the total variance. However, substantial overlap was observed among the factors, with four variables having loadings over |.30| on multiple factors, rendering this model less than amenable to interpretation. We then examined three-, four-, and five-factor models. A five-factor solution explained 57% of the common variance, but also had considerable overlap among factors, with three variables loading substantially on multiple

Table 1. Means, standard deviations, and correlations between optimism variables.

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BHS	2.06	3.35	–														
2. LOT-R	14.81	4.61	−.61**	–													
3. CSQ positive	5.04	0.77	−.07	.14*	–												
4. CSQ negative	4.39	1.58	.14*	−.12*	.35***	–											
5. EQ positive 2	−16.28	22.73	−.26**	.29***	.22**	.01	–										
6. EQ positive 1	0.32	8.75	−.15**	.23***	−.08	−.55***	.41***	–									
7. EQ negative 2	−12.35	12.38	.19**	−.18**	−.08	.09	.02	−.02	–								
8. EQ negative 1	−4.87	8.81	.21***	−.15**	−.16**	.01	.04	.22**	.66***	–							
9. Expectation of control	46.49	19.25	−.11	.09	.11	.08	.18**	.14**	−.07	−.07	–						
10. Judgement of control	55.28	26.93	−.05	.05	.08	.07	.01	.07	−.08	−.06	.29***	–					
11. Dice task average confidence	5.46	1.91	−.11	.10	.01	−.04	.04	.05	−.17**	−.14**	.20**	.04	–				
12. Dice task average Bet	0.80	0.95	.01	−.03	.01	−.05	.01	−.03	−.02	.03	−.01	−.04	.10	–			
13. ECA	−0.01	0.56	−.27**	.25***	.11	−.06	.26***	.13*	−.19***	−.22**	.15**	.14**	.08	−.09	–		
14. SP-PIIQA	0.07	0.99	−.33***	.31***	.21**	−.07	.35***	.15*	−.15*	−.21**	.07	.06	.05	.01	.54***	–	
15. ECB	0.95	0.95	−.08	.14*	.01	<.01	.08	.05	−.19**	−.12*	.15*	.11	.11	.01	.19*	<.01	–
16. SP-PIIQB	0.64	1.30	.21**	.27**	.14*	−.17**	.19**	.19**	−.22**	−.19**	.13*	.12*	.04	.07	.15*	.40***	.57***

Note:
*$p < .05$.
**$p < .01$.
***$p < .001$.
(Benjamini–Hochberg corrected); BHS = Beck Hopelessness Scale; LOT-R = Revised Life Orientation Test; CSQ = Cognitive Style Questionnaire; EQ positive/negative 1 = EQ difference score for positive/negative events over three months; EQ positive/negative 2 = EQ difference score for positive/negative events over lifetime; ECA = Conversation task difference score for domain functioning (rating for self minus rating for confederate); ECB = Conversation task difference score for domain functioning (rating for self minus confederate's rating); SP-PIIQA = Conversation task difference score for personality characteristics (rating for self minus rating for confederate); SP-PIIQB = Conversation task difference score for personality characteristics (rating for self minus confederate's rating)

Table 2. Factor structure of optimism measures.

	PEs	IS	SI	Overconfidence
BHS	**−.640**	.145	.186	−.167
LOT-R	**.684**	−.120	−.093	.265
CSQ positive	.331	**.615**	−.011	.151
CSQ negative	−.171	**.873**	−.048	−.135
EQ positive 2	**.654**	.042	**.327**	.319
EQ positive 1	**.428**	**−.642**	**.433**	.259
EQ negative 2	−.197	.078	**.786**	−.241
EQ negative 1	−.198	−.162	**.854**	−.152
Expectancy of control	.191	.266	.057	**.469**
Judgement of control	.019	.204	.080	.267
Dice task average confidence	.111	−.053	−.143	**.335**
Dice task average bet	−.046	−.095	.085	.122
ECA	**.603**	.032	−.121	.094
SP-PIIQA	**.707**	.046	−.145	.134
ECB	.056	−.061	−.152	**.769**
SP-PIIQB	**.332**	−.144	−.186	**.769**

Note: Factor loadings of |.30| are indicated in bold; BHS = Beck Hopelessness Scale; LOT-R = Revised Life Orientation Test; CSQ = Cognitive Style Questionnaire; EQ positive/negative 1 = EQ difference score for positive/negative events over three months; EQ positive/negative 2 = EQ difference score for positive/negative events over lifetime; ECA = Conversation task difference score for domain functioning (rating for self minus rating for confederate); ECB = Conversation task difference score for domain functioning (rating for self minus confederate's rating); SP-PIIQA = Conversation task difference score for personality characteristics (rating for self minus rating for confederate); SP-PIIQB = Conversation task difference score for personality characteristics (rating for self minus confederate's rating).

factors. In contrast, a three-factor model explained 41% of the total variance, with 25% of the optimism variables failing to load highly on any component, and one variable loading on two factors. A four-factor solution accounted for 49% of the common variance, with only one variable loading significantly on two factors (EQ positive 1) and another two failing to load at all (judgement of control and dice task average bet). Thus, the four-factor model appeared superior to the alternative solutions examined. Table 2 reports the factor loadings for this four-factor solution. Variables that loaded highly on the first factor, labelled PEs, were hopefulness, LOT-R, EQ positive 2, ECA, and SP-PIIQA. The second factor, IS, consisted of three variables with salient loadings: CSQ positive, CSQ negative, EQ positive 1. A third factor, labelled Sense of Invulnerability (SI), was defined by EQ negative 2 and EQ negative 1. Finally, the fourth factor, Overconfidence, was composed of expectancy of control, ECB, dice task average confidence, and SP-PIIQB.

Confirmatory factor analysis

To confirm the factor structure found in the PCA, we conducted a CFA in Mplus version 7.0. We started with the model as indicated in the PCA and then trimmed non-significant paths and added additional paths based upon the modification indices function. The initial CFA results indicated that we should remove the cross-loadings for EQ positive 1 and leave only the one factor loading. Additionally, examination of modification indices suggested that several covariances were added (see Figure 1). According to commonly accepted conventions (e.g. $\chi 2/df < 3$, CFI close to 1, RMSEA near .06; Hu & Bentler, 1999), the CFA had acceptable fit ($\chi^2_{[df=63]} = 177.98$ $p < .001$; $\chi^2/df = 2.81$, CFI = 0 .92, RMSEA = .06). It should be noted that the standardised factor loading just above 1 for CSQ negative, although rare, is not problematic when highly correlated variables are loaded onto the same latent construct (Deegan, 1978).

We also conducted CFAs on the three-, five-, and six-factor models in order to verify the findings from the PCA that the four-factor model was superior. The three-factor model had poorer fit than the four-factor model (RMSEA = .15) and not all variables loaded on to the three-factor model (both dice task variables and judgment of control). The five- and six-factor models failed to converge due to Heywood cases (i.e. negative residual variances), suggesting a misspecified model (Dillon, Kumar, & Mulani, 1987).

Prospective analyses

Table 3 presents correlations for depression, anxiety, complaints of physical illness, and stressful life events for the prospectively followed subsample. It also presents the correlations among the component scores and between the component scores and outcomes.

Prospective relation to depression

To assess whether any of the optimism dimensions prospectively predicted depressive symptomatology or MDD, we conducted a series of separate hierarchical regression analyses for each optimism dimension. Linear regression was employed for analyses where depressive symptoms served as the criterion variable, whereas logistic regression was used in analyses where the occurrence of MDD during the follow-up period served as the dependent variable. In regression analyses with depressive symptoms as the outcome variable, Time 2 depressive symptomatology was regressed onto its Time 1 equivalent, treated as a covariate, and the optimism dimension

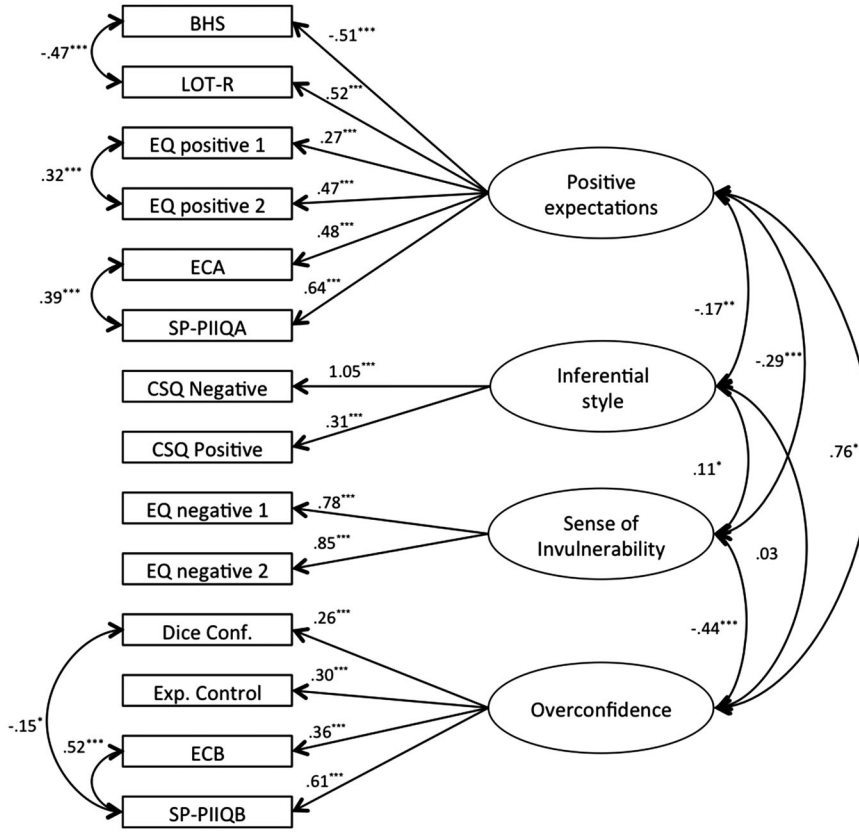

Figure 1. Confirmatory factor analysis.
Note: *** $p < .001$, ** $p < .01$, * $p < .05$; BHS = Beck Hopelessness Scale; LOT-R = Revised Life Orientation Test; CSQ = Cognitive Style Questionnaire; EQ positive/negative 1 = EQ difference score for positive/negative events over three months; EQ positive/negative 2 = EQ difference score for positive/negative events over lifetime; ECA = Conversation task difference score for domain functioning (rating for self minus rating for confederate); ECB = Conversation task difference score for domain functioning (rating for self minus confederate's rating); SP-PIIQA = Conversation task difference score for personality characteristics (rating for self minus rating for confederate); SP-PIIQB = Conversation task difference score for personality characteristics (rating for self minus confederate's rating). For clarity purposes, the following covariances are not displayed: EQ positive 1<-> EQ negative 1 ($r = .34$, $p < .001$), ECB with SP-PIIQA ($r = .39$, $p < .001$).

Table 3. Means, standard deviations, and correlations between depression, anxiety, physical health, and stressful life events.

	M/%	SD	1	2	3	4	5	6	7	8	9	10	11
Component scores													
1. PE	0.09	0.99	–										
2. AS	−0.12	0.70	.08	–									
3. SI	−0.10	0.98	−.03	−.05	–								
4. OC	0.06	0.92	.17	.01	−.23*	–							
Covariates and outcomes													
5. BAI—Baseline	7.54	7.42	−.32**	.18	.00	−.22	–						
6. BAI—6 months	5.13	5.48	−.02	.10	−.05	−.12	.42	–					
7. BDI— Baseline	3.2%	–	−.02*	.20	.01	−.06	.47	.70	–				
8. BDI—6 months	12.6%	–	−.23	.05	.07	−.15	.59	.63	.43***	–			
9. MDD—Baseline	5.41	5.74	.06	−.08	.07	−.02	.03	.02	.05	.01	–		
10. MDD—6 months	5.43	7.15	−.09	.04	.19	−.11	.36	.07	.06	.15	.48***	–	
11. Physical illness	1.09	1.11	.09	−.07	.20	.03	.06	.28	.48***	.60***	−.01	.25*	–
12. Stressful life events	7.87	4.71	.01	.05	.08	−.05	.30	.46	.69***	.62***	.07	.07	.42***

Note:
*$p < .05$.
**$p < .01$.
***$p < .001$.
(Benjamini–Hochberg corrected); PE = Positive Expectations, IS = Inferential Style, SI = Sense of Invulnerability, O = Overconfidence, SLE = Stressful Life Events, BDI = Beck Depression Inventory; MDD = Major Depressive Disorder; BAI = Beck Anxiety Inventory.

Table 4. Main effects of optimism dimensions and interaction with stressful life events in predicting depressive symptoms and clinical depression.

	Prediction of depressive symptoms					Prediction of major depressive disorder				
	B	S.E.	*t*	f^2		B	S.E.	Wald	OR	95% CI
Main effect of optimism dimension										
PE	−1.464	.513	−2.852**	.09	PE	−.811	.338	5.746*	.444	.229–.863
IS	−.173	.779	−.223	–	IS	.149	.519	.083	1.161	.420–3.214
SI	.127	.255	.497	–	SI	.279	.198	1.993	1.322	.897–1.949
O	−.198	.163	−1.21	–	O	−.104	.114	.828	.902	.721–1.127
Interaction between optimism dimension and stressful life events										
PE x SLE	−.258	.124	−2.090*	.05	PE x SLE	−.071	.104	.469	.931	.760–1.141
IS x SLE	−.083	.178	−.464	–	IS x SLE	.083	.129	.413	1.086	.844–1.399
SI x SLE	−.125	.235	−.529	–	SI x SLE	.024	.140	.030	1.025	.779–1.348
O x SLE	.128	.197	.648	–	O x SLE	.032	.132	.061	1.033	.798–1.338

Note:
*$p < .05$.
**$p < .01$.
***$p < .001$.
(Benjamini–Hochberg corrected); PE = Positive Expectations, IS = Inferential Style, SI = Sense of Invulnerability, O = Overconfidence, SLE = Stressful Life Events

of interest. In the logistic regression analyses, Time 2 MDD was similarly regressed onto its Time 1 equivalent and the optimism dimension of interest. As detailed in Table 4, only PEs prospectively predicted depressive symptomatology at Time 2 after controlling for baseline depressive symptoms. PEs similarly predicted the prospective onset of MDD after controlling for MDD at baseline. In both cases, higher scores on this optimism dimension were associated with reduced depression symptoms and diagnoses.

To examine whether the optimism dimensions buffered the effects of stressful life events on depression symptoms, we conducted a series of linear regression analyses with Time 2 depression symptoms regressed onto its equivalent at baseline, the optimism dimension of interest, stressful life events occurring during the longitudinal phase, and the interaction between the optimism dimension and stressful events. Similarly, a set of logistic regression analyses was conducted with Time 2 MDD regressed onto its Time 1 equivalent, the optimism dimension of interest, prospective stressful life events, and the interaction between optimism and stress. As illustrated in Figure 2, PEs interacted with stressful life events to predict depressive symptomatology (see also Table 4). The relationship between stressful events and depressive symptoms was significant at low levels (−1 SD) of PE scores ($b = 0.78$, $t(10) = 4.69$, $p < .001$), but not at high levels of positive expectations ($b = 0.25$, $t(8) = 1.78$, $p = .08$). No other significant interactions were observed.

Prospective relation to anxiety

In assessing whether the optimism dimensions prospectively predicted anxiety symptoms above and beyond what may be accounted for by baseline anxiety, we conducted a set of linear regression analyses with Time 2 anxiety symptoms regressed onto each optimism dimension, controlling for baseline anxiety symptomatology. As detailed in Table 5, no significant main effects were observed.

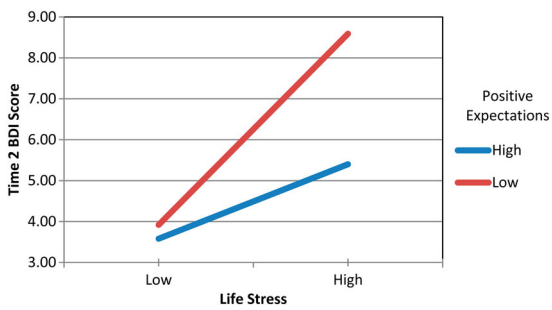

Figure 2. Interaction between positive expectations and stressful life events in prospectively predicting depressive symptomatology.

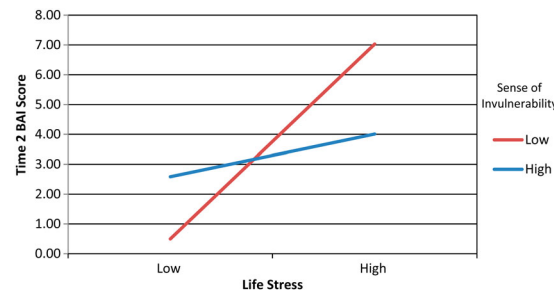

Figure 3. Interaction between SI and stressful life events in prospectively predicting anxiety symptomatology.

Table 5. Main effects of optimism dimensions and interaction with stressful life events in predicting anxiety symptoms and physical complaints.

	Prediction of anxiety symptoms					Prediction of physical complaints		
	B	S.E.	*t*	f^2		B	S.E.	*Wald*
Main effect of optimism dimension								
PE	1.385	.766	1.808	–	PE	.039	.036	1.17
IS	.073	1.032	.071	–	IS	−.051	.045	1.27
SI	−.235	.319	−.733	–	SI	.117	.050	5.53***
O	−.120	.230	−.520	–	O	.020	.031	.434
Interaction between optimism dimension and stressful life events								
PE × SLE	.392	.177	2.218*	.06	PE × SLE	−.049	.031	2.50
IS × SLE	−.025	.242	−.102	–	IS × SLE	−.049	.055	0.80
SI × SLE	−1.277	.292	−4.374***	.22	SI × SLE	−.009	.032	0.07
O × SLE	−.195	.276	−.706	.08	O × SLE	−.019	.032	.340

Note:
*$p < .05$.
**$p < .01$.
***$p < .001$.
(Benjamini–Hochberg corrected); PE = Positive Expectations, IS = Inferential Style, SI = Sense of Invulnerability, O = Overconfidence, SLE = Stressful Life Events

A series of regression analyses was conducted to determine whether any of the optimism dimensions moderated the effect of stressful life events on anxiety symptomatology. These analyses were identical to the previous set, except anxiety symptoms were used instead of depression symptoms. SI interacted with stressful life events occurring during the longitudinal phase of the study to predict anxiety symptomatology at follow-up (Table 5). As illustrated in Figure 3, the relationship between stressful events and anxiety symptoms was significant at low levels (−1 SD) of SI scores ($b = 0.41$, $t(12) = 4.81$, $p < .001$), but not at high levels of SI ($b = 0.001$, $t(11) = 1.78$, $p = .98$).

Prospective relation to complaints of physical illness

To test whether the optimism dimensions was prospectively associated with the number of complaints of physical illness, we ran a series of analyses with physical illness at Time 2 regressed onto each optimism dimension. Because physical illness was a count variable, we utilised the SPSS Generalised Linear Models function to specify a Poisson model. As no participants reported any physical complaints at baseline, this variable was not entered as a covariate in any of the regression models. SI was the only significant predictor (Table 5), with higher scores on this dimension being prospectively associated with greater number of complaints of physical illness. We also ran a set of Poisson regression analyses to assess whether the optimism dimensions interacted with stressful life events to predict the number of complaints of physical illness at Time 2. No significant interactions were observed (Table 5).

Discussion

The ameliorating effects of optimism on a wide variety of psychological and physical health outcomes have been the subject of much empirical study (see Carver et al., 2010). Optimism is a broad construct, however, and has been variously operationalised in the literature, limiting generalisability and comparisons across studies. By conducting a PCA with 16 optimism variables, utilising a multi-method approach and reflecting multiple theoretical definitions of this construct, we sought to provide a comprehensive assessment of this multi-dimensional phenomenon. A four-factor solution was obtained, the derived dimensions consisting of (a) PEs (i.e. the view that one's future will be positive and that one's general situation or character is better than others'), (b) IS (i.e. a predisposition towards generating attributions that are internal, global, and stable for positive events and negative inferences about the self and future implications), (c) SI (i.e. the belief that negative outcomes are more likely to occur to others than to oneself), and (d) Overconfidence (i.e. the tendency to overestimate one's abilities and positive traits relative to reality).

We find partial support for prospective relationships between different conceptualisations and mental and physical health outcomes. The PEs dimension was prospectively associated with reduced risk for onset of MDD and lower levels of depressive symptoms, even after controlling for initial depressive episodes and symptoms, respectively. Counter to our hypothesis, SI prospectively predicted *greater* physical complaints.

Some support was found for a stress-resilience model of optimism; several dimensions of optimism were found to moderate the relation between prospective life stress and depression and anxiety. Specifically, SI buffered the effect of high life stress on anxiety symptomatology and PEs buffered the effect of high levels of life stress on depressive symptoms.

Collectively, the findings provide support for the conceptualisation of optimism as a multifaceted construct. The relation between optimism and psychological and physical health outcomes appears complex, with marked differences worth noting between the four optimism dimensions. That the PEs dimension appeared most consistently associated with lower depression symptoms and lower risk for MDD is congruent with past research finding this aspect of optimism to be less characteristic of patients with MDD than with generalised anxiety disorder (GAD) and other psychiatric conditions (Beck, Wenzel, Riskind, Brown, & Steer, 2006). Optimism as defined by positive expectations similarly has been linked with lower depression symptoms in children (Ey et al., 2005). Our findings are also congruent with the sizable body of literature linking negative expectations about the future (i.e. hopelessness) with increases in depressive symptoms and diagnosable episodes (e.g. Alloy, Abramson, Grant & Liu, 2009).

It is surprising, but understandable that the IS dimension did not predict depression. It may be that our study was underpowered to detect small effects. Additionally, in response to patterns of inconsistent findings on the relationship between IS and depression in many previous studies, Abela and Sarin (2002) suggest that an individual's most negative IS component (i.e. globality, stability, consequences, and self-implication) is a better predictor of depression than the overall construct of IS. Thus, although IS represented a latent construct with strong indicators, the best predictor of depression in our sample may have been the most severe component of negative IS.

Our findings pertaining to the SI dimension are interesting in that this dimension was associated with both decreased risk for anxiety symptoms in the presence of high life stress and greater risk for physical health symptoms. These findings are not inconsistent with the recognition that in some contexts this construct may actually be detrimental and pessimism may confer some benefits (Carver et al., 2010). It may be that individuals who hold to a belief that negative outcomes are more likely to occur to others than to themselves are less likely to worry or attend to plausible threats to their well-being (i.e. lower anxiety), but, as a consequence, also place themselves at greater risk for negative physical health outcomes (perhaps because they don't feel the need to engage in health promoting behaviours). Consistent with this possibility, some past work has indicated an association between this construct and risk-taking behaviours (Ravert et al., 2009; but also see Cohn, Macfarlane, Yanez, & Imai, 1995).

Also worth mentioning is that with the exception of SI, the other optimism dimensions generally were poor at predicting physical health outcomes, a finding that contrasts with previous research (e.g. Peterson, 2000). These divergent findings may be in part a result of different operationalisations of the construct of optimism across studies. A more likely explanation may relate to the specific measure of physical complaints used in the current study. That is, the medical history section of the SADS-C, although it includes some relatively common ailments (e.g. allergies and mononucleosis), consists mostly of severe health concerns that may be relatively less likely to occur in our sample within a six-month period (e.g. cancer and lupus).

The current findings must be interpreted within the context of the study limitations. In particular, the subset of the original sample invited for the prospective phase of the study was fairly small ($n = 96$). Thus, as noted earlier, we frame our prospective findings as exploratory and replication of these findings is needed. Relatedly, our ability to detect significance of small effects was necessarily limited, particularly for MDD and interaction analyses. Indeed, in our examinations of the pattern of interactions found to be significant, the effect sizes of resultant analyses ranged from $f^2 = .18$ to .53 (i.e. medium to large). The small prospective sample also precluded examination of the relation between optimism dimensions and clinically significant anxiety. That past studies have documented an association between low optimism and social anxiety disorder (Taylor & Wald, 2003) suggests that this is an area warranting further investigation.

Finally, also unclear are the potential mechanisms through which the various dimensions of optimism exert their effects on psychological and physical well-being. One possibility for future study is that optimism not only buffers the effects of life stress on health outcomes, but may increase the rates of positive events and decrease the occurrence of negative ones (Liu & Alloy, 2010). To the degree positive life experiences provide resilience to psychological or physical health problems, and conversely, to the extent that stressful

life events increase risk for these same negative outcomes, these potential mechanistic pathways may help to account for the beneficial effects often associated with optimism. In support of this possibility, there is some research indicating that optimists may act in a manner that ensures outcomes consistent with their optimistic beliefs in a manner not dissimilar to a self-fulfilling prophecy (Carver et al., 2010). Similarly, and in light of current results, it would be important to examine whether a reverse pattern holds for optimism as characterised by a SI, with higher rates of negative life events and lower levels of positive ones being prospectively associated with this variable.

Note

1. We report nearly all of the variables included in this study's original data collection. The only other data that were collected but are not reported were a measure of coping styles and additional measures of anxiety and depression symptoms. No participants' data were excluded. Our sample size was determined by selecting an ample number of participants for factor analysis (>300; Comfrey & Lee, 1992).

Disclosure statement

No potential conflict of interest was reported by the authors.

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