Dispositional Optimism and Cardiovascular Reactivity Accompanying Anger and Sadness in Young Adults

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Abstract

Background Dispositional optimism, a generalized expectation for positive outcomes, appears to promote physical health and well-being, including positive effects on cardiovascular disease outcomes. Mechanisms may involve adaptive responses to psychological stressors that dampen their physiological impact.

Purpose This study investigated (i) whether individual differences in optimism are associated with attenuated cardiovascular reactivity (CVR); (ii) whether the CVR moderating effect of optimism differs for two stress emotions, anger and sadness; and (iii) whether separate measures of optimism and pessimism, and the more commonly used measure that combines them, differ in their relationships with CVR.

Methods The Life Orientation Test–Revised (LOT-R) was used to provide an overall dispositional optimism score and subscale scores separately assessing optimism and pessimism. These predictors were examined in relation to cardiovascular responses evoked by a stressful autobiographical recall task. Task instructions were manipulated within subjects to produce anger and sadness. CVR measures were systolic and diastolic blood pressure (SBP and DBP) and heart rate (HR).

Results Dispositional optimism was inversely associated with SBP and HR (but not DBP) elevations while participants related both anger- and sadness-inducing events. There was some indication that these associations were stronger for sadness than for anger, and that the LOT-R optimism subscale was a better predictor of CVR than its pessimism subscale.

Conclusions These findings add to the understanding of health-promoting effects of dispositional optimism by addressing relationships of optimism and pessimism with cardiovascular concomitants of anger and sadness that are thought to contribute to heart disease.

Keywords Optimism • Pessimism • Stress • Emotion • Cardiovascular reactivity

Dispositional Optimism and Cardiovascular Risk: Rationale and Mechanisms

Psychological stress appears to promote cardiovascular disease (CVD) [1]. Potential explanatory mechanisms include sympathetic adrenomedullary (SAM) system effects on cardiovascular reactivity (CVR) to stressors [2]. Psychological factors that may influence CVR to stressors include dispositional optimism, a generalized expectation for positive outcomes that appears associated with lower relative risk for CVD [3, 4]. This study examined the relationship between optimism and stress-related CVR in healthy young adults.

Dispositional Optimism and Cardiovascular Risk: Rationale and Mechanisms

Research implicating dispositional optimism as a cardioprotective factor [4–12] is expanding. Optimism has predicted lower relative CVD risk independently of depression, anxiety, hostility, and/or neuroticism [8, 10–12], and also may influence CVD risk indirectly, through its association with these and other psychosocial factors [3, 13–16]. Although not definitive, evidence for cardioprotective effects of optimism is promising and addresses the need to identify additional predictors to account more fully for the incidence of CVD [2].

Individual differences in positive versus negative expectations are thought to reflect adaptive processes that shape self-regulation in response to psychological threat [5]. This may account for relationships between
optimism and adjustment to health threats associated with CVD and other medical problems [4, 5]. Similar processes may link dispositional optimism to biological responses to stressors that promote CVD. Evidence for this would complement epidemiologic findings in building a case for a causal effect of optimism on CVD.

A few studies have examined dispositional optimism in relation to biochemical markers, such as cortisol [17, 18] and measures of inflammation and endothelial dysfunction [19]. A greater number have examined blood pressure (BP) and heart rate (HR) [18, 20–28], which likely have special relevance for CVD [2]. However, findings published to date have been mixed.

The present study followed an approach taken in two studies that reported lower CVR among more optimistic subjects [18, 22]. Both required participants to engage in personal reflection and then self-presentation via a speaking task. Emotion elicitation via recollection and disclosure of personal information, particularly involving recent stressful experiences, has proved effective in a number of psychophysiological studies [22, 29–32]. This may reflect the impact of personal involvement and self-referent affective responses.

Dispositional Optimism and Negative Emotions: Anger Versus Sadness

To our knowledge, no study has examined the relationship of dispositional optimism to CVR accompanying different negative emotions. Although subject to disagreement in the emotion field, there is evidence that discrete emotions can be distinguished neurally [33] and in terms of their psychological and peripheral physiological impact [34]. Anger and sadness were chosen in this study because of their relationship to psychosocial factors that appear to increase CVD risk, such as hostility and aggressiveness in the case of anger, and depression in the case of sadness [2]. Previous research has indicated an inverse association of optimism with self-report measures of negative affect [35–41]. However, most studies involved current or trait affect measures, rather than affect provoked by a stressor, and self-reported emotional states are frequently dissociated with concomitant physiologic activity. This leaves open the question of optimism’s association with CVR induced during states of anger and sadness.

The present study employed an autobiographical recall task to evoke these emotions. It might be hypothesized that relatively optimistic individuals have more positive appraisals and cope more effectively in response to stressful situations involving all negative emotions, leading to generally lower CVR [8]. However, although anger and sadness are both negatively valenced, unlike sadness, anger is associated with preparation for active coping as a means of attaining thwarted goals or to respond to an aggressor [16, 42, 43]. The active, engaged coping style of more optimistic individuals may include responses that are assertive, even confrontational [44]. This suggests a competing hypothesis, in which optimism is less effective in dampening CVR during a state of anger than that associated with sadness, or even leads to greater CVR in an anger-arousing situation, by comparison with the CVR of less optimistic individuals.

Dispositional Optimism: One Dimension or Two?

Optimism entails the expectation that favorable outcomes are likely and unfavorable ones are unlikely. The Life Orientation Test–Revised (LOT-R), the most commonly used measure of dispositional optimism [14], therefore includes items about both positive and negative expectations. However, the two sets of items typically show significant independence [45]. Therefore, it has been recommended that both total LOT-R scores and separate optimism and pessimism scores warrant study [14].

There are reports indicating that optimism subscale scores are more strongly related to CVD [5] and other health outcomes [46], than are pessimism subscale scores. However, the opposite pattern has been observed as well [47]. Differential effects for these measures also have been obtained for negative affect [47] and biological measures [19, 22, 48]. The available findings, therefore, lend support to continued use of optimism and pessimism subscales, in addition to overall LOT-R scores, as we did in the current study.

Method

Participants

Participants were 113 undergraduates, of whom 57 (50.4%) were female. They ranged in age from 18 to 24 (M = 18.7, SD = 1.03). One (0.9%) identified as “American Indian/Alaskan Native,” 38 (33.6%) as “Asian/Pacific Islander,” 6 (5.3%) as “Black/African American,” 52 (46.0%) as “White,” and 16 (14.2%) as “Other.” Fourteen (12.4%) separately identified as “Hispanic/Latino.” All were enrolled in General Psychology and received course credit for participating. The institutional review board at Rutgers University approved this research.

Measures

LOT-R scales

The LOT-R [14] includes three positively worded items (e.g., “In uncertain times, I usually expect the best”) and three negatively worded items (e.g., “If something can go wrong for me, it will”) to which participants respond using a 5-point scale (0 = strongly disagree, 4 = strongly agree).
The total optimism–pessimism score is computed by reverse-keying negatively worded items before summing all responses. Optimism and pessimism subscale scores are computed by summing responses to positively and negatively worded items separately. Internal consistency of all three scales is good [14]. Temporal stability is adequate [14] although not always as high as that of other dispositional constructs [49]. Evidence of predictive validity with respect to health outcomes and of psychological construct validity was cited earlier [3, 5, 15]. Of particular relevance to this study is psychometric evidence of the distinctiveness of the optimism and pessimism [45] and the possibility that they have different associations with adaptive outcomes such as CVD [5].

Other self-report measures
A health survey was used to identify participants with medical conditions or using medications that might alter cardiovascular functioning (none were reported). Participants rated their current levels of anger and sadness on 5-point scales (1 = not at all, 5 = extremely) following an initial resting baseline period and immediately after the anger and sadness versions of the recall task (see below). Technical difficulties interfered with affect measurement for two subjects (both female), reducing sample size to 111 for anger and sadness ratings. After each recall condition, participants provided a brief description of the event they had spoken about and categorized it into one of seven domains (e.g., work/school, relationships).

Cardiovascular measures
Measures of systolic and diastolic blood pressure (SBP and DBP) and HR were acquired with a DINAMAP Pro 100 (GE) monitor. BP (in millimeters of mercury [mmHg]) was determined oscillometrically, and HR (in beats per minute [bpm]) was measured based on pressure pulses. Readings were obtained at 60-s intervals during the initial 8-min rest period, and baseline measures of SBP, DBP, and HR were computed as the mean of the last two readings. BP and HR were also recorded at 60-s intervals during the recall task.

Procedure
Participants were instructed to abstain from caffeine, nicotine, alcohol, other drugs, and exercise for at least 2 hr prior to the session. After obtaining informed consent, questionnaires were administered by a PC. The experimenter then placed an inflatable cuff on the participant’s nondominant arm, baseline BP and HR were recorded, and then the recall task began. As in previous research [29, 50, 51], this task was designed to activate memories of a recent emotional event. In the anger condition, participants were instructed to recall a life event in last 6 months that caused anger. Instructions for the sadness condition were identical, except they asked participants to recall an event that caused them to feel depressed. Notwithstanding use of the term depressed, we refer to this as a sadness condition because it was intended to induce sad or depressed affect, not a state or condition of depression in any clinical sense.

During a 2-min task preparation period, participants were asked to re-experience thoughts, feelings, and sensations that happened during the event, to recreate mentally what transpired, and to prepare to describe it aloud. The task is itself stressful, and it also reactivates a prior stressful experience, analogous to naturally occurring rumination [52]. The focus on sensory and motor cues was based on previous research on the psychophysiology of emotional imagery [50]. In the ensuing 3-min task period, speaking was required to take advantage of its ability to amplify affect and its physiological concomitants [53, 54]. Task measures of BP and HR were averaged together. Anger and sadness conditions were counterbalanced with an 8-min recovery period in between. After each, participants again provided anger and sadness ratings.

Statistical Analysis
Hypotheses were evaluated using mixed-model regression analysis. Dependent measures were change-scores computed with reference to initial baseline values. Main effects and interactions involving continuous LOT-R scores were estimated using linear regression and reported as unstandardized beta (B) coefficients [55]. Because it might produce extremely high levels of colinearity, or even singularity, LOT-R total scores and the LOT-R optimism and pessimism subscale scores were not included all together in the same analysis. Instead, two models were estimated for each dependent measure: The first included only LOT-R total scores, and the second, with those removed, included both optimism and pessimism subscale scores. As in previous CVR studies [22, 30, 32, 56, 57], initial baseline values were included in the model. This yields statistical tests analogous to those of analysis of covariance in that they are independent of baseline [58] and identical to those generated when the same approach is used to adjust absolute task values for baselines [59, 60]. Baseline-adjusted change-scores are readily interpretable as they are on the same scale and order of magnitude as unadjusted change-scores. The mixed-model framework also estimated effects for categorical predictors representing between- (i.e., gender) and within-subject (i.e., anger vs. sadness) factors. Significant interactions were explicated by simple effects analysis [55]. Effect sizes were quantified using Cohen’s $d$ for categorical predictors [61] and the squared semi-partial correlation coefficient ($r^2$), for continuous predictors [55].
Results

LOT-R Scores

The full LOT-R scale and its optimism and pessimism subscales showed adequate internal consistency (Cronbach’s $\alpha = .84, .73$, and .80, respectively). An $r = -.61$ indicated that the two subscales had both overlapping and independent variance components (see Table 1).

Descriptions of Stressful Events

Two judges independently reviewed responses to the open-ended questions that asked participants to describe the events they had recalled. In only seven instances did a participant use the same event for both anger and sadness conditions, with anger and sadness described as originating from different aspects or time points within the same stressful episode.

Categorization of events differed between emotions ($p = .034$). Anger events were more likely to be related to friendship, $n = 29$ versus 12 for sadness (25.7% vs. 10.6%), $p = .012$, or to roommates, $n = 9$, versus 1 (8.0% vs. 0.9%), $p = .006$. Sadness events were more likely to be related to family, $n = 47$ versus 30 for anger (41.6% vs. 26.5%), $p = .014$. Proportions for romance, occupation, academics, or “other” did not differ between emotions.

Multinomial regression analyses estimated relationships of LOT-R scores and gender to the types of events that participants recalled. One analysis employed overall LOT-R scores; in the other, those were removed and optimism and pessimism subscale scores were used instead. The only significant effect was that participants with higher LOT-R total scores reported more roommate-related events in the anger condition than did those with lower scores, $p = .008$.

Affect Ratings

Baseline affect, LOT-R scores, and gender

Correlations between LOT-R scores and baseline affect ratings are presented in Table 1. There was a significant correlation between pessimism subscales and baseline anger ($r = .19$), and a pattern of relationships linking LOT-R total and optimism and pessimism subscale scores in expected directions with baseline sadness ($rs = -.40, -.31, and .39$). Men and women did not differ on LOT-R scores or baseline affect.

Effects of the experimental manipulation on affect ratings

Paired-samples $t$-tests showed that each version of the task had the intended effect: Anger ratings were higher following the anger task ($M = 2.33, SD = 1.22$) than following baseline ($M = 1.85, SD = 0.85$), $t(110) = 4.08, d = .39, p < .001$, but anger ratings in the sadness condition ($M = 1.68, SD = 0.85$) did not differ from baseline, $t(110) = 1.72, p = .081$. Similarly, sadness ratings were higher following the sadness task ($M = 2.68, SD = 1.18$) than following baseline ($M = 2.05, SD = 0.90$), $t(110) = 5.03, d = .48, p < .0001$, whereas sadness ratings for the anger condition ($M = 1.66, SD = 0.93$) were lower than for baseline, $t(110) = 3.67, p = .001$.

LOT-R scores and affective responses to the recall task

Mixed-model analyses were conducted first using LOT-R total scores and then using both optimism and pessimism subscale scores simultaneously. Initial analysis of anger change-scores yielded a main effect for emotion, $F(1/106) = 42.95, d = .62, p = .0001$. As expected, the significant elevation from baseline anger ratings following the induction of anger ($M = +0.49$), described in the preceding section, represented a greater increase in anger than that in the sadness condition ($M = -0.16$). Also as expected, there was an inverse association between

Table 1  Correlation Between LOT-R Scales and Baseline Affect and Cardiovascular Variables

<table>
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<tr>
<td>2</td>
<td>LOT-R optimism</td>
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<td>-.91**</td>
<td>- .61**</td>
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<tr>
<td>3</td>
<td>LOT-R pessimism</td>
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<td>- .10</td>
<td>.19*</td>
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<td>4</td>
<td>Anger baseline</td>
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<tr>
<td>5</td>
<td>Sadness baseline</td>
<td>- .03</td>
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<td>SBP baseline</td>
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<td>7</td>
<td>DBP baseline</td>
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<td>8</td>
<td>HR baseline</td>
<td>.19*</td>
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$N = 113$, except for correlations involving anger and sadness ratings, where $N = 111$. LOT-R Life Orientation Test–Revised; SBP systolic blood pressure; DBP diastolic blood pressure; HR heart rate.

*p < .05. **p < .01.
baseline anger and anger change-scores, \( p = .0001 \). All remaining effects, involving emotion, gender, LOT-R total scores, and their interactions, were nonsignificant (\( ps \geq .23 \)).

When the separate, LOT-R optimism and pessimism subscale scores were used instead of LOT-R total scores, the main effects of emotion and baseline anger ratings were duplicated and once again there were no gender effects. There was also a significant interaction between emotion and optimism subscale scores, \( B = .0979, F(1/106) = 4.09, p = .04 \). Simple effects analysis indicated that a positive relationship of optimism with anger elevations was significant in the anger condition, \( B = .124, s r^2 = .0445, p = .028 \). Adjusting for baseline, mean increases in anger for more compared with less optimistic subjects (LOT-R Optimism subscale scores ± 1 SD from the mean) were +0.81 and +0.16, respectively. There was no effect of optimism subscale scores in the sadness condition, \( B = .026, s r^2 = .0031, p = .481 \), adjusted \( M_s = -0.09 \) and -0.23, nor was the pessimism subscale or any other term in the model significant (\( ps \geq .087 \)).

The analysis of sadness change-scores also yielded a main effect for emotion, \( F(1/106) = 71.85, d = .80, p < .0001 \). As expected, the significant elevation from baseline sadness ratings to those obtained following the induction of sadness (\( M = +0.63 \)) represented a greater increase than was seen in the anger condition (\( M = -0.39 \)). The expected inverse relationship between baseline sadness ratings and task-related sadness change-scores was significant, \( p < .001 \). There was also a main effect for LOT-R total scores, \( B = .0484, F(1/106) = 5.67, s r^2 = .0296, p = .021 \), indicating a positive association with task-related increases in sadness ratings across anger and sadness conditions. Adjusting for baseline and averaging across anger and sadness (as there was no interaction with the emotion manipulation), mean increases in sadness for more compared with less optimistic subjects (LOT-R total scores ± 1 SD from the mean) were +0.317 and -0.08, respectively. There were no other significant effects (\( ps \geq .151 \)).

Analysis of sadness using separate optimism and pessimism subscale scores instead of LOT-R total scores duplicated the significant main effects for baseline and emotion and nonsignificant gender-related terms. There were neither main effects nor interactions involving the LOT-R optimism and pessimism subscales (\( ps \geq .383 \)).

Cardiovascular Activity

Baseline cardiovascular measures

Table 1 displays correlations between baseline cardiovascular measures, LOT-R scales, and baseline affect. Neither SBP nor DBP baselines were related to any LOT-R or affect variable. There were small associations of LOT-R total (\( r = .19 \)) and optimism subscale scores (\( r = .23 \)) with HR baselines, as well as between some of the cardiovascular baseline measures. Cardiovascular and affect baselines were unrelated. Men had higher baseline SBP than women, adjusted \( M_s = 114.8 \) and 105.2 mmHg, \( t(111) = 5.62, p < .001 \). There were no significant gender effects for DBP or HR baselines (\( ps \geq .451 \)).

LOT-R scores, gender, and CVR to the recall task

Change-scores reflecting elevations in SBP, DBP, and HR produced by the anger and sadness versions of the recall task were analyzed using the same mixed-model approach that was used for affect ratings. In the initial analysis of SBP change-scores, which made use of LOT-R total scores, there was a significant gender effect, \( F(1/108) = 4.08, d = .40, p = .041 \). Men showed greater SBP elevations than women across both anger and sadness conditions, adjusted \( M_s \) (in mmHg) = +9.60 and +6.73. There were larger SBP elevations among participants with lower baselines but this was not significant (\( p = .072 \)), nor were main effects for emotion and LOT-R total scores, or the interactions between gender, emotion, and the full LOT-R (\( ps \geq .16 \)).

In the analysis of SBP change-scores using the LOT-R subscales, instead of its total score, gender and baseline effects reported above were duplicated. In addition, there was a main effect for the optimism subscale, \( B = -0.6456, F(1/108) = 5.02, s r^2 = .0408, p = .032 \). More optimistic subjects showed smaller SBP elevations than less optimistic subjects across both anger and sadness conditions. Averaging across anger and sadness (as there was no interaction with the emotion manipulation), adjusted \( M_s \) (in mmHg) = +6.42 and +9.91 (LOT-R Optimism subscale scores ± 1 SD from the mean). Main effects of emotion and the LOT-R pessimism subscale, and all interactions, were nonsignificant, \( ps \geq .22 \).

Analysis of DBP change-scores, whether involving LOT-R total or subscale scores, yielded only a significant main effect indicating larger DBP elevations among participants with lower DBP baselines, \( p = .043 \). No other main effects or interactions were significant, \( ps \geq .23 \).

The initial analysis of HR change-scores yielded a significant main effect for LOT-R total scores, \( B = -0.3025, F(1/108) = 4.82, s r^2 = .0392, p = .031 \), and a near-significant main effect for emotion, \( F(1/108) = 3.54, p = .062 \). These main effects were qualified by a LOT-R × Emotion interaction, \( B = 0.2024, F(1/108) = 4.12, p = .044 \). As shown in Fig. 1, higher overall LOT-R scores were associated with smaller HR elevations for both emotions, but the effect was somewhat stronger for sadness compared with anger. Simple effects analysis indicated that the impact of dispositional optimism
was statistically significant in the sadness condition, $B = -0.31, s^2 = 0.0660, p = 0.02$, but not in the anger condition, $B = -0.093, s^2 = 0.0071, p = 0.33$. There were larger HR elevations among participants with lower HR baselines, but neither this ($p = 0.68$) nor any of the remaining terms ($ps ≥ 0.36$) were significant.

In the analysis of HR change-scores involving the LOT-R optimism and pessimism subscales instead of LOT-R total scores, there was a significant main effect for optimism, $B = -0.6825, F(1/108) = 4.44, s^2 = 0.0353, p = 0.045$. Neither the main effect of emotion ($p = 0.22$) nor the Optimism × Emotion interaction was significant, though the latter approached significance at $p = 0.065$. The latter reflected a pattern identical to that seen for the full LOT-R, with higher optimism subscale scores associated with smaller HR elevations for both emotions but to a somewhat greater degree for sadness. Adjusted $M_s$ (in bpm) = +4.82 and +8.36 in the sadness condition and +6.02 and +7.26 in the anger condition (LOT-R Optimism subscale scores ± 1 SD from the mean). Simple effects analysis indicated that the optimism subscale was significantly associated with lower HR reactivity in the sadness condition, $B = -0.705, s^2 = 0.0590, p = 0.021$, but not in the anger condition, $B = -0.216, s^2 = 0.0066, p = 0.37$. Once again, HR elevations were larger among participants with lower HR baselines, but this was not a significant effect, $p = 0.10$, nor were any of the remaining terms significant, including those involving the LOT-R pessimism subscale, $ps ≥ 0.321$.

Cardiovascular recovery

Additional analyses were conducted to determine whether the LOT-R total and optimism and pessimism subscale scores predicted cardiovascular recovery. Recovery was quantified using change-scores computed by subtracting initial cardiovascular baseline values from the average of the last two readings obtained during the rest periods that followed the anger and sadness versions of the task. Initial cardiovascular baselines, gender, and change-scores for the corresponding version of the task also were included so that recovery was assessed independently of these factors. These analyses showed no statistically significant effects of any LOT-R score on any of the CVR recovery measures, all $ps ≥ 0.24$.

Discussion

Findings of this study suggest that dispositional optimism modulates CVR to stressors. Evidence was somewhat stronger for a recall task designed to induce sadness than for one designed to produce anger, and for the LOT-R optimism subscale compared with its pessimism subscale. Further evaluation of the hypotheses that guided this study may lend coherence to research on the pathophysiological basis of optimism’s possible cardio-protective effect.

Cardiovascular Reactivity

There were significant relationships between dispositional optimism and CVR to an autobiographical recall/speaking task. Overall LOT-R scores were not related to SBP or DBP reactivity. However, they were inversely associated with HR elevations in both anger and sadness conditions, with an interaction and simple effects tests indicating statistical significance only for sadness. By contrast, higher optimism subscale scores were associated with smaller SBP elevations for both anger and sadness, and this was not qualified by an interaction. Optimism subscale scores also were associated with smaller HR elevations. Here the interaction with the emotion factor approached significance, and the (inverse) simple effect of optimism on HR reactivity was significant for sadness, but not for anger. As with LOT-R total scores, neither subscale score was related to DBP reactivity, and pessimism subscale scores showed no relationships with any cardiovascular measure. Overall, significant relationships of LOT-R scores to CVR were small-to-mod-erate in magnitude, accounting uniquely for 4%–7% of the variance. This compares favorably with the statistically significant effect size of $r = 0.081$ obtained for Type A behaviors and CVR when data were aggregated across 244 studies [62]. Few studies have examined biological correlates of dispositional optimism, and the findings have been inconsistent [17–19, 48, 63]. However, results of the present study agree with evidence that, in response to the Trier Social Stress Task, LOT-R optimism subscale scores (but
not pessimism scores) are inversely associated with HR reactivity [18]. The present study conceptually replicates these HR effects using a different self-referent speaking task, and extends them to SBP. It also extends evidence that LOT-R optimism subscale scores predict attenuated BP during anticipation of and recovery from still another self-disclosing speaking task [22]. In addition, an inverse association of optimism with laboratory-based SBP elevations complements findings for ambulatory BP [48, 63]. Cardiovascular activity captured during the course of subjects’ everyday activities, like that which accompanies autobiographical speaking tasks, may reflect personal relevance and associated emotional responses.

By contrast, at least two previous studies have reported evidence of stronger physiologic responses to a stressor among more optimistic individuals [20, 28]. One [28] involved electrodermal and salivary cortisol measures, which are often dissociated from cardiovascular activity [64, 65]. While the other [20] reported a positive association between optimism and SBP reactivity, it preselected a relatively small sample of participants based on extreme LOT-R scores. Perhaps most importantly, physiologic activity was provoked in both studies via performance challenge. As Nes and colleagues [28] suggest, the engaged coping style associated with optimism may in some situations lead to greater physiologic activity concomitant with effortful, goal-related activity. This possibility points to the need to examine the effects of stressors that are diverse in personal relevance and associated emotional responses.

Research on CVR [64, 66] provides a basis for hypothesizing that modulating effects of optimism on SBP and HR reactivity reflect less pronounced increases in SAM influences on the heart and vasculature. Less beta-adrenergic stimulation may explain smaller increases in SBP (via inotropic/myocardial action) and HR (via chronotropic/sinoatrial action), with the latter also possibly reflecting parasympathetic tone. Effects on alpha-adrenergically-mediated SAM activity and consequent vasoconstriction-driven increases in peripheral resistance do not appear to have been involved given the absence of significant findings for DBP, although it is also possible they occurred but were offset by vasodilatory effects of increased beta-adrenergic activity in the vascular beds serving skeletal muscles [64]. Unlike a previous study [22], we found no associations of dispositional optimism with measures of cardiovascular recovery following task administration. Methodological variations that might account for this discrepancy include the relative potency of the tasks in producing initial CVR and length of recovery periods. Whatever the explanation, it is worth reiterating that that initial SBP and HR reactivity to the recall task may reflect processes implicated in progression of CVD [2].

The Anger-Sadness Manipulation and Affect Ratings

Beyond the relationship to CVR and possible role of personal relevance, this is to our knowledge the first study to assess differential effects of optimism on CVR to anger and sadness inductions. Findings pointing to a stronger modulating effect on cardiovascular responses to the sadness compared with the anger condition may inform the investigation of the role of dispositional optimism in moderating the impact on health of different types of stressful events and conditions [67]. It is curious, therefore, that LOT-R scores were positively associated with self-reported affective responses to the task. Higher LOT-R total scores were associated with greater increases in sadness ratings following both sadness and anger versions of the task. Higher optimism subscale scores were positively related to increases in anger ratings following the anger version of the task but not the sadness version. These effects were small in magnitude, representing 3%–4% unique variance explained, and accounted for much less variance than the inverse associations between optimism and baseline sadness, which accounted for 12%–16% of the variance. It also should be borne in mind that, because more optimistic subjects gave lower sadness ratings for the baseline condition, the result of their greater increases was to bring them to about the same level of sadness as less optimistic subjects, rather than to a higher one. Nevertheless, as optimism clearly was not associated with greater reductions in anger or sadness, results for affective responses to the task are discordant with those showing that optimism modulated CVR.

The pattern observed among more optimistic subjects in the present study—increased self-reported affect in apparent excess of physiologic elevations—has been linked to coping styles characterized as approach-oriented [68]. These often are contrasted with a pattern in which physiologic responding is apparently in excess of self-reported negative affect, which has been associated with an avoidant (e.g., ‘repressive’) style of coping. Whether the approach-oriented coping style discussed in previous research on verbal-autonomic discordance bears a relationship to the approach-oriented coping style associated with dispositional optimism [3, 5, 15] is an open question. Regarding the present study, it should be borne in mind that CVR was assessed during whereas affect ratings were obtained after the task period. Methodological considerations also include limitations of self-report measures (e.g., social desirability) and differences in the response latency, duration, and functions (e.g., social-communicative vs. metabolic)
served by verbal and biological indicators of emotion/stress. Theoretically, it should be recognized that cognitive appraisal, coping, subjective affect, and CVR do not likely have linear, sequential relationships with one another [69]. Whether differences in their relationships with dispositional optimism are meaningful is an interesting question for future research.

The LOT-R and Its Subscales

The LOT-R optimism subscale appeared to capture the components of dispositional optimism that modulated CVR in this study. The pessimism subscale did not contribute in this regard. This suggests that the presence of positive expectations, rather than relative absence of negative ones, acted to attenuate CVR. It is possible that negative expectations were not relevant to CVR because, irrespective of LOT-R scores, task instructions led to negative cognitive appraisals such as would be associated with stressful events that provoked either anger (e.g., goal frustration, a demeaning offense) or sadness (e.g., loss, failure). On the other hand, more optimistic subjects may have had anger- and sadness-related memories that also incorporated positive features, such as eventual resolution of the stressful situation or even a benefit of some kind. Examination of these possibilities, for example, via content analysis, might shed light on the psychological processes underling CVR dampening in more optimistic individuals.

Limitations and Implications

Limitations of this study include the need for replication in older, more diverse populations, using different types of stressors, with additional physiological measures. Regarding the task, it may be of interest to determine whether optimism is related to stress-related vocal expression and other emotional behaviors that may influence CVR. In considering the modest effect sizes that were observed, it is relevant to note that they reflect only the magnitude of a single instance of CVR. Duration and frequency of CVR episodes, about which much less is known, may multiply their impact [70]. Magnitude of effects aside, CVR research may help to identify the protective components of optimism and to characterize the types of stressors whose impact they may moderate. In research on Type A behavior, suggestions about the key role of its anger-related components emerged at about the same time in both epidemiological [71] work and studies of CVR [72]. Although an association between optimism and CVR does not, itself, imply disease risk, converging evidence involving disease endpoints and markers for pathogenic mechanisms helps to build a causal model.

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Compliance with Ethical Standards

Authors’ Statement of Conflict of Interest and Adherence to Ethical Standards

The authors declare that they do not have any conflict of interest.

Authors’ Contributions

All the listed authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; drafting and/or critically revising the article for important intellectual content; and they gave final approval of the version to be published.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

References


