

Rumination Mediates the Prospective Effect of Low Self-Esteem on Depression:

A Five-Wave Longitudinal Study

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Abstract

Previous research supports the vulnerability model of low self-esteem and depression, which states that low self-esteem operates as a prospective risk factor for depression. However, it is unclear which processes mediate the effect of low self-esteem. To test for the mediating effect of rumination, the authors used longitudinal mediation models, which included exclusively prospective effects and controlled for autoregressive effects of the constructs. Data came from 663 individuals (aged 16 to 62 years), who were assessed 5 times over an 8-month period. The results indicated that low self-esteem predicted subsequent rumination, which in turn predicted subsequent depression, and that rumination partially mediated the prospective effect of low self-esteem on depression. These findings held for both men and women, and for both affective-cognitive and somatic symptoms of depression. Future studies should test for the mediating effects of additional intrapersonal and interpersonal processes.

Keywords: self-esteem, rumination, depression, longitudinal mediation analysis

Rumination Mediates the Prospective Effect of Low Self-Esteem on Depression:
A Five-Wave Longitudinal Study

A growing body of research suggests that low self-esteem is a risk factor for the development of depression (e.g., Kernis et al., 1998; Orth, Robins, & Roberts, 2008; Orth, Robins, Trzesniewski, Maes, & Schmitt, 2009; Roberts & Monroe, 1992; Sowislo & Orth, 2011). In these studies, which used longitudinal designs and controlled for prior levels of the constructs, low self-esteem—which is defined as “a person’s appraisal of his or her value” (Leary & Baumeister, 2000, p. 2)—prospectively predicted changes in the level of depression. Overall, the evidence supports the vulnerability model, which states that low self-esteem is a diathesis exerting causal influence in the onset and maintenance of depression (e.g., Beck, 1967; Metalsky, Joiner, Hardin, & Abramson, 1993). Research findings suggest that the vulnerability model holds for men and women (Orth et al., 2008; Orth, Robins, Trzesniewski et al., 2009; Sowislo & Orth, 2011), for all age groups from adolescence to old age (Orth, Robins, Trzesniewski et al., 2009), for different measures of self-esteem and depression (Sowislo & Orth, 2011), for affective-cognitive and somatic symptoms of depression (Orth, Robins, Trzesniewski et al., 2009), and after controlling for content overlap between self-esteem and depression scales (Orth et al., 2008; Orth, Robins, Trzesniewski et al., 2009).¹

An alternative model of the relation between low self-esteem and depression is the scar model, which states that low self-esteem is an outcome rather than a cause of depression, because episodes of depression may leave permanent scars in the self-concept of the individual (cf. Coyne, Gallo, Klinkman, & Calarco, 1998; Rohde, Lewinsohn, & Seeley, 1990; Shahar & Davidson, 2003; for an overview of the scar and vulnerability model see Zeigler-Hill, 2011). It is important to note that the vulnerability model and the scar model are not mutually exclusive because both processes (i.e., low self-esteem contributing to depression and depression eroding

self-esteem) might operate simultaneously. Yet, the extant literature speaks against the scar model (cf. Ormel, Oldehinkel, & Vollebergh, 2004; Orth, Robins, & Meier, 2009; Orth et al., 2008; Orth, Robins, Trzesniewski et al., 2009; Sowislo & Orth, 2011; but see Shahar & Davidson, 2003).

Given that the available evidence supports the vulnerability model of low self-esteem and depression, one of the next logical steps in this field is to examine the mediating mechanisms. At present, almost nothing is known about which processes mediate the hypothesized influence of low self-esteem on depression. In three independent studies, Orth, Robins, and Meier (2009) tested for the mediating effect of stressful events; that is, does low self-esteem lead to depression because individuals with low self-esteem are more prone to experiencing stressful events, which in turn contributes to depression? However, the results did not support this mediation hypothesis (Orth, Robins, & Meier, 2009). We know of no other study that has tested for mediation of the effect of low self-esteem on depression. Therefore, the goal of the present research is to advance the field by testing a theoretically derived mediation hypothesis, specifically, by testing whether rumination is a mechanism that accounts for the vulnerability effect of low self-esteem on depression. In the following sections, we discuss the links included in the hypothesized causal chain.

The Link Between Low Self-Esteem and Rumination

Prior research has largely neglected the question of whether low self-esteem is a factor of rumination. Rumination has been defined as “recurrent thinking ... about the self prompted by threats, losses, or injustices to the self” (Trapnell & Campbell, 1999, p. 292) and as “the process of thinking perseveratively about one’s feelings and problems” (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008, p. 400). Only cross-sectional evidence on the relation between self-esteem and rumination is available, suggesting that self-esteem is negatively correlated with rumination

(Ciesla & Roberts, 2002, 2007; Joireman, 2004; Luyckx et al., 2008), with correlations ranging from $-.37$ to $-.56$. However, even though the cross-sectional findings are in line with our hypothesis that low self-esteem contributes to rumination, longitudinal or experimental study designs are required to draw conclusions about the hypothesized effect of low self-esteem on rumination.

Despite the lack of empirical research, there are several reasons why low self-esteem might increase ruminative tendencies. First, individuals with low self-esteem likely experience more negative affect when thinking about themselves (for the relation between self-esteem and negative affect see, e.g., Orth, Robins, & Widaman, in press; Watson, Suls, & Haig, 2002) and consequently might be motivated to suppress self-related thoughts, which has the ironic effect of increasing ruminative tendencies (Wegner, Schneider, Carter, & White, 1987; Wenzlaff & Wegner, 2000). Second, individuals with low self-esteem tend to conceal their subjectively perceived bad qualities from others (Cameron, Holmes, & Vorauer, 2009; Dolgin, Meyer, & Schwartz, 1991) and research suggests that nondisclosure elicits rumination (Gold & Wegner, 1995). Third, low self-esteem indicates—from the subjective perspective of the individual—that one's relational value is low and that the fundamental need for belongingness is threatened (Leary & Baumeister, 2000; Leary & Downs, 1995). Given that perceived threats to the satisfaction of a fundamental need elicit and maintain rumination (Gold & Wegner, 1995; Martin & Tesser, 1996), persistent low self-esteem may cause negative self-related thoughts to repeatedly enter the individual's focus of attention by intrusive rumination. Fourth, Cambron, Acitelli, and Pettit (2009; see also Mezulis & Funasaki, 2009) hypothesized that unstable self-esteem—which is associated with low self-esteem (Meier, Orth, Denissen, & Kühnel, in press; Okada, 2010)—leads individuals to ruminate about the causes and consequences of their instability.

The Link Between Rumination and Depression

In contrast to the link between low self-esteem and rumination, the link between rumination and depression has been studied extensively, in particular within the framework of the response styles theory (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008).² According to this theory, rumination maintains and exacerbates depressive mood and is a risk factor for the onset of depressive disorders (e.g., Nolen-Hoeksema, 1991). The hypothesized mechanism is that individuals, when ruminating, focus on possible causes and consequences of their depressive feelings without engaging in active problem solving. Thus, although the individual might assume he or she is getting closer to a solution by thoroughly thinking through his or her problem, rumination frequently impedes a solution because the individual remains passive (Nolen-Hoeksema et al., 2008).

Numerous prospective studies have documented that a ruminative response style predicts increases in depression (Abela, Brozina, & Haigh, 2002; Nolan, Roberts, & Gotlib, 1998; Nolen-Hoeksema, 1991, 2000; Nolen-Hoeksema, Larson, & Grayson, 1999; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Schwartz & Koenig, 1996; see also Rood, Roelofs, Bögels, Nolen-Hoeksema, & Schouten, 2009). A meta-analysis by Mor and Winquist (2002), which summarized correlational and experimental data on the relation between self-focused attention and negative affect, confirmed the strong association between rumination and depression and suggested a reciprocal causal relation between the constructs.

The Present Research

In this research, we tested whether rumination mediates the vulnerability effect of low self-esteem on depression. The analyses were based on longitudinal data for two reasons. First, mediation hypotheses are hypotheses about causal processes (e.g., MacKinnon, Fairchild, & Fritz, 2007; Shrout & Bolger, 2002) and such processes require time to unfold (Cole & Maxwell,

2003; Gollob & Reichardt, 1987; 1991). Although longitudinal analyses cannot provide evidence for causality when the study design is nonexperimental, longitudinal data allow for testing models that include assumptions about the temporal sequence of predictor, mediator, and outcome (Cole & Maxwell, 2003). In contrast, mediation tests with cross-sectional data imply the assumption that causal effects are instantaneous, which is problematic on logical grounds (Selig & Preacher, 2009). Second, longitudinal mediation analyses avoid statistical biases inherent in cross-sectional mediation analyses. Maxwell and Cole (2007) have shown that only under specific conditions, which are almost never fulfilled, do cross-sectional tests of mediation yield the same results as longitudinal tests; if the conditions are not fulfilled, then cross-sectional tests are biased and the effect size of the bias may be large. It is possible that cross-sectional tests suggest that mediation is present, even when in the true (longitudinal) model the mediation effect is zero; moreover, it is possible that cross-sectional tests do not find evidence for mediation, although in the true model complete mediation occurs (Maxwell & Cole, 2007).

An important issue in longitudinal designs is the selection of an appropriate time interval between measurements (Collins, 2006; Selig & Preacher, 2009). As discussed by Selig and Preacher (2009), the time intervals must be long enough for prospective effects to occur, but not too long so that the prospective effects have already disappeared. In this research, we used five waves of measurement at two-month intervals. The study design therefore allowed us (a) to examine prospective effects between the constructs across relatively short time intervals (e.g., the two-month interval from Time 1 to Time 2), and (b) to examine the overall effects across the longer time span covered by the study (i.e., the eight-month period from Time 1 to Time 5).

Method

We collected the data using a Web-based German-language longitudinal survey, which included five assessments at two-month intervals. The participants were recruited (a) with the

help of a group of Master's degree students who advertised the study as broadly as possible among their friends, neighbors, coworkers, etc., (b) by advertising the study on the Internet, and (c) by word of mouth (the sample characteristics of participants, which are reported below, suggest that the recruitment procedure resulted in a relatively heterogeneous sample). On the website of the study, participants received information on the purpose and procedure of the study and were informed that their data would be treated as strictly confidential. Participants were asked to provide an e-mail address at which they could receive e-mails containing individual links to subsequent assessments.

Participants

The sample consisted of 663 individuals (51% female). Data on study variables were available for 663 individuals at Time 1, 525 individuals at Time 2, 461 individuals at Time 3, 398 individuals at Time 4, and 376 individuals at Time 5. Mean age of participants was 32.4 years ($SD = 10.5$, range = 16 to 62). Twenty-three percent were married, 45% were unmarried but in a close relationship, 28% were single, and 4% were divorced or widowed. Nine percent had completed the obligatory 9 school years or less, 52% had completed secondary education (approx. 12 years), 14% had a Bachelor's degree, 23% had a Master's degree, and 2% had a doctoral degree. Ninety-six percent lived in Switzerland, 3% in Germany, and 1% in other countries.

Measures

Self-esteem. Self-esteem was assessed with the 10-item Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965; for the German version see Von Collani & Herzberg, 2003) the most commonly used and well-validated measure of global self-esteem (Robins, Hendin, & Trzesniewski, 2001). Responses were measured on a 5-point scale ranging from 1 (*strongly*

disagree) to 5 (*strongly agree*). The alpha reliability of the RSE was .88 at Time 1, .89 at Time 2, .90 at Time 3, .90 at Time 4, and .90 at Time 5.

Rumination. Rumination was assessed with the rumination subscale of the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999). We used the 8-item short form provided by Trapnell (2009). Example items are “Sometimes it is hard for me to shut off thoughts about myself” and “I don’t waste time re-thinking things that are over and done with” (reverse-scored). Responses were measured on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The alpha reliability was .84 at Time 1, .83 at Time 2, .84 at Time 3, .84 at Time 4, and .83 at Time 5.

Depression. Depression was assessed with the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977; for the German version see Hautzinger & Bailer, 1993). The CES-D is a frequently used 20-item self-report measure for the assessment of depressive symptoms in nonclinical, subclinical, and clinical populations, and its validity has been repeatedly confirmed (Eaton, Smith, Ybarra, Muntaner, & Tien, 2004). Participants were instructed to assess how frequently they had experienced each symptom within the preceding 30 days. Responses were measured on a 4-point scale (0 = *rarely or none of the time*, 1 = *some or a little of the time*, 2 = *occasionally or a moderate amount of time*, 3 = *most or all of the time*). The alpha reliability of the CES-D was .89 at all five waves. On the basis of the recommended cutoff value of 23 (Hautzinger & Bailer, 1993), 11%, 9%, 9%, 10%, and 11% of participants at Times 1 to 5, respectively, exhibited a clinically relevant level of depressive symptoms.

Statistical Analyses

The analyses were conducted using the Mplus 6 program (Muthén & Muthén, 2010). To deal with missing values, we employed full-information maximum likelihood estimation to fit models directly to the raw data, which produces less biased and more reliable results compared

with conventional methods of dealing with missing data, such as listwise or pairwise deletion (Allison, 2003; Schafer & Graham, 2002).

Model fit was assessed by the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root-mean-square error of approximation (RMSEA), based on the recommendations of Hu and Bentler (1999) and MacCallum and Austin (2000). Good fit is indicated by values greater than or equal to .95 for CFI and TLI, and less than or equal to .06 for RMSEA (Hu & Bentler, 1999). To test for differences in model fit, we used the test of small differences in fit recommended by MacCallum, Browne, and Cai (2006, Program C). For these tests, statistical power was high, with values above .99 (MacCallum et al., 2006, Program D).

Results

Table 1 shows the means, standard deviations, and intercorrelations of the measures used. Men and women differed significantly in the mean levels of the measures: Averaged across the five waves of measurement, men reported higher self-esteem ($d = 0.20, p < .05$), less rumination ($d = -0.30, p < .05$), and less depression ($d = -0.22, p < .05$) than women. For the structural equation models, we used item parcels as indicators because they produce more reliable latent variables than individual items by reducing random error and thereby increase the reliability of the structural coefficients of the model (Little, Cunningham, Shahar, & Widaman, 2002). For each construct (i.e., self-esteem, rumination, and depression) we aggregated the items into three parcels, using the random assignment technique (Little et al., 2002).

Bivariate Analyses

In the first part of the analyses, we tested whether the data support the vulnerability model, the scar model, a reciprocal effects model, or none of the models, by examining the bivariate cross-lagged relations between self-esteem and depression. We compared the fit of two measurement models. In the first measurement model, we freely estimated the factor loadings for

10 latent variables measuring self-esteem and depression at Time 1 to Time 5 (Model 1); all factors were correlated with each other and the uniquenesses of individual indicators were correlated over time to account for consistency in indicator-specific variance (Cole & Maxwell, 2003). The fit of the first measurement model was good (see Table 2). The second measurement model was identical to the first, except that we constrained the factor loadings of each indicator to be equal across time (Model 2). If the constrained model does not fit worse than the unconstrained model, then the constraints are empirically justified and ensure that the latent constructs have the same meaning across time (i.e., metric invariance; Schmitt & Kuljanin, 2008). Models 1 and 2 did not differ significantly in fit. Consequently, we favored the more parsimonious Model 2 and retained the longitudinal constraints on factor loadings in the subsequent analyses.

Next, we tested the fit of two structural cross-lagged models. In cross-lagged models, a latent variable at Time 2 is predicted by the same variable at Time 1 (the autoregressor) and the other latent variable at Time 1. The cross-lagged paths indicate the effect of one variable on the other, after controlling for the stability of the variables over time (Finkel, 1995). We accounted for variance due to measurement occasion by cross-sectionally correlating the disturbances of the corresponding factors (cf. Cole & Maxwell, 2003). In the first cross-lagged model (Model 3), all structural coefficients were freely estimated. Model fit was good (Table 2). In the second cross-lagged model (Model 4), we constrained the structural parameters (stability coefficients and cross-lagged coefficients) to be equal across all four time intervals. If the constrained model does not fit worse than the unconstrained model, then the constraints are empirically justified and increase the precision and generalizability of the structural parameters. The difference in fit between Models 3 and 4 was nonsignificant. Consequently, we favored the more parsimonious Model 4 and retained the longitudinal constraints on structural coefficients in the subsequent

analyses. Figure 1 shows the standardized values for the coefficients in Model 4. The stability coefficients ranged from .85 to .92 for self-esteem and from .64 to .66 for depression (all $ps < .05$).³ All paths from self-esteem to depression were significant (range = -.16 to -.17, all $ps < .05$), whereas none of the paths from depression to self-esteem were significant (all four coefficients = -.01, *ns*). In sum, the bivariate analyses indicate that low self-esteem predicted subsequent levels of depression, but not that depression predicted subsequent levels of self-esteem. Thus, the findings of the present research support the vulnerability model but not the scar model of low self-esteem and depression, consistent with findings of most previous studies (e.g., Orth et al., 2008; Orth, Robins, Trzesniewski et al., 2009; Roberts & Monroe, 1992; Sowislo & Orth, 2011; but see Shahar & Davidson, 2003).

Mediation Analyses

Then we examined whether rumination mediated the prospective effect of low self-esteem on depression. Figure 2 provides a generic illustration of the model used, following the recommendations by Cole and Maxwell (2003). Because the magnitude of the mediating effect can vary depending on the chosen interval between assessments and because mediation effects may accumulate across multiple intervals, we examined the overall direct and indirect effect from self-esteem at Time 1 to depression at Time 5 (Cole & Maxwell, 2003). Figure 2A shows the paths involved in the overall direct effect (i.e., all paths from self-esteem at Time 1 to depression at Time 5 that do not pass through rumination at any wave) and Figure 2B shows the paths involved in the overall indirect effect (i.e., all paths from self-esteem at Time 1 to depression at Time 5 that pass through rumination at least once).⁴

Before examining the overall direct and indirect effect, we tested the measurement and structural model using the same procedures as in the bivariate analyses reported above. In the first measurement model, the loadings were freely estimated (Model 5) and in the second

measurement model the loadings were longitudinally constrained to ensure measurement invariance (Model 6). The fit of both measurement models was good (see Table 2) and the difference in fit was nonsignificant, leading us to retain the longitudinal constraints on factor loadings in the subsequent analyses. Then, we tested two structural models, one in which the structural coefficients were freely estimated (Model 7) and one in which they were constrained to be equal over time (Model 8). Both models fit the data well (see Table 2) and the difference in fit was nonsignificant, leading us to retain the longitudinal constraints on structural coefficients (i.e., Model 8). The structural coefficients for Model 8 are presented in Figure 3 with standardized values. The stability coefficients ranged from .85 to .91 for self-esteem, from .70 to .72 for rumination, and from .59 to .60 for depression (all $ps < .05$). A consistent pattern emerged for the paths involved in the longitudinal mediation: All paths from self-esteem to rumination were significant (range = -.10 to -.11, all $ps < .05$), as well as all paths from rumination to depression (all four coefficients = .09, all $ps < .05$). Moreover, there were also significant direct effects from self-esteem to depression (range = -.14 to -.15, all $ps < .05$). In contrast, most paths in the direction opposite to the vulnerability model were nonsignificant (i.e., the paths from depression to self-esteem and the paths from depression to rumination) or, if significant, very small (i.e., the paths from rumination to self-esteem).

To control for content overlap between the measures of self-esteem and depression, we repeated the analyses after omitting two items from the CES-D that are conceptually related to self-esteem (“I felt that I was just as good as other people” and “I thought my life had been a failure”). The results for the 18-item CES-D were virtually the same as for the full 20-item scale: When using the 18-item CES-D, no coefficient was altered by more than .01. As a consequence, we kept using the original full 20-item scale in the subsequent analyses. We also tested for gender differences in the structural coefficients, using a multiple-group analysis. A model allowing for

different coefficients for male and female participants did not significantly improve model fit, relative to a model with constraints across gender, indicating that the structural coefficients did not significantly differ for men and women. For both male and female participants, the estimates of the structural coefficients were similar to the estimates for the total sample.

We then turned to examining the total effect, the overall direct effect, and the overall indirect effect of self-esteem at Time 1 on depression at Time 5 (see Figure 2). The standardized estimates were $-.273$ for the total effect, $-.241$ for the overall direct effect, and $-.032$ for the overall indirect effect. To test for statistical significance of the overall indirect effect, we used the phantom variable approach (e.g., Cheung, 2007).⁵ In the model, we included a phantom variable that loaded on one observed variable, but that was zero-correlated with all other variables in the model. Because the variance of the phantom variable is fixed to zero, its inclusion does not alter any other model coefficient and does not contribute to model fit (Cheung, 2007). The loading of the phantom variable can be used as a placeholder for estimating effects of interest such as an indirect effect. We constrained the loading of the phantom variable to be equal to the overall indirect effect as illustrated in Figure 2B (using the model constraint command available in Mplus). Then, we estimated the bootstrap 95% confidence interval (CI) for the loading of the phantom variable.⁶ The CI of this coefficient is thus the CI of the overall indirect effect (Cheung, 2007). The model also yields a bootstrapped 95% CI for the total effect. Table 3 shows the results of the bootstrap analyses. For both the total and the overall indirect effect, the CIs did not include 0, indicating that the effects differed significantly from zero.

We also tested whether the mediation effect of rumination held when the depression factor was restricted to affective-cognitive or somatic symptoms of depression.⁷ First, the results showed that low self-esteem prospectively predicted both affective-cognitive and somatic symptoms (see the estimates for the total effect in Table 2; all $ps < .05$). Second, rumination

prospectively mediated these effects, with an effect size about the same as the overall indirect effect for the full CES-D (see the estimates in Table 2; all $ps < .05$).

Discussion

In the present research, we examined whether rumination mediates the prospective effect of low self-esteem on depression, using longitudinal data from a large sample, which was assessed five times over an eight-month period. For the analyses, we used longitudinal mediation models which included exclusively prospective effects and which systematically controlled for autoregressive effects of the constructs. The results indicated that low self-esteem predicted subsequent rumination, which in turn predicted subsequent depression, and that rumination partially mediated the prospective effect of low self-esteem on depression. The pattern of results held for both men and women, for both affective-cognitive and somatic symptoms of depression, and after controlling for content overlap between the self-esteem and depression measures. We discuss these findings in more detail below.

Implications of the Findings

The results of this study support the vulnerability model, but not the scar model, of low self-esteem and depression (i.e., low self-esteem contributing to depression but not vice versa). Thus, the present study adds to a growing body of research that suggests that low self-esteem is a prospective risk factor for depression (e.g., Orth, Robins, & Meier, 2009; Orth, Robins, Trzesniewski et al., 2009; Roberts & Monroe, 1992; Sowislo & Orth, 2011). Extending previous research, the present study identified a mediating process—i.e., rumination—that partially accounted for the vulnerability effect of low self-esteem on depression. Interestingly, research from other fields suggests that rumination mediates the effects of several other risk factors for depression such as reduced autobiographical memory, negative cognitive styles, neediness, and history of past depression (Raes, 2010; Spasojevic & Alloy, 2001). Thus, the present study,

which focused on low self-esteem as a risk factor, supports the notion that rumination is a common mechanism that prospectively links a heterogeneous set of risk factors with depression (Spasojevic & Alloy, 2001).

The present results suggest that the mediation effect of rumination on the relation between low self-esteem and depression is robust and holds across gender and type of depressive symptoms. Of course, the fact that the structural relations between self-esteem, rumination, and depression replicate across genders does not mean that men and women do not differ in their average level of self-esteem, rumination, and depression; in fact, men did score higher in self-esteem and lower in rumination and depression (which is consistent with findings reported in the literature; e.g., Culbertson, 1997; Hyde, Mezulis, & Abramson, 2008; Kling, Hyde, Showers, & Buswell, 1999; Nolen-Hoeksema et al., 1999). However, it suggests that the structural relations between self-esteem and depression are unaffected by gender. Moreover, the mediation effect of rumination—a cognitive process which is known to increase negative affect—is not restricted to the affective-cognitive symptoms of depression, but is also evident in the relation between low self-esteem and somatic symptoms of depression such as poor appetite and restless sleep.

The results of the present study raise the important question of why low self-esteem predicts increases in rumination over time. As discussed in the Introduction, several plausible mechanisms might account for the link between low self-esteem and rumination: Low self-esteem might motivate suppression of aversive self-related thoughts, which has the ironic effect of increasing rumination (Wenzlaff & Wegner, 2000); low self-esteem might motivate nondisclosure of socially undesirable thoughts, feelings, and goals, which likewise increases rumination (Gold & Wegner, 1995); and low self-esteem implies the perception that a fundamental need—the need for belongingness—is threatened (Leary & Baumeister, 2000), which further increases rumination (Gold & Wegner, 1995). However, none of these hypotheses

on the effect of low self-esteem on rumination have been studied in empirical research. Future research should therefore test the mediating processes that intervene between low self-esteem and rumination and thereby examine the hypothesized causal chain from low self-esteem to depression in more detail.

Although the size of the overall indirect effect of rumination was small, we believe that this study provides a significant contribution to the field. First, a strength of the study is the longitudinal design. As mentioned above, the methodological literature advises that mediation should be tested using longitudinal data (Cole & Maxwell, 2003; Maxwell & Cole, 2007; Selig & Preacher, 2009), because only longitudinal, but not cross-sectional, analyses provide valid insights into the temporal sequence of predictor, mediator, and outcome. Nevertheless, most studies that test for mediation are cross-sectional or, if longitudinal, do not control for prior levels of the constructs. Second, another strength of the study is that the longitudinal design included five waves. By constraining the structural coefficients across multiple waves (which was justified, as indicated by model fit comparison), we were able to strongly increase the precision of the estimates. Third, the analyses were based on latent variables and controlled for several sources of bias such as measurement error and occasion-specific systematic variance, which further strengthens confidence in the findings.

Limitations and Future Directions

A limitation of this research is that self-esteem, rumination, and depression were assessed via self-report. Although the self-report measures chosen for this study are reliable and well-validated measures of the constructs, future tests of the mediating processes between low self-esteem and depression may benefit from the use of informant-based measures of the constructs to control for possible self-report biases (e.g., underreporting of symptoms). Frequently, intercorrelations among measures that are based on the same method are artificially inflated and

would need to be corrected for the effect of shared method variance. Note, however, that by examining cross-lagged effects between the constructs we have addressed this concern to some extent: shared method variance cannot account for cross-lagged effects, because shared method variance has already been statistically removed by controlling for concurrent relations and for previous levels of each construct.

The data were collected via the Internet, which might raise concerns about equivalence with studies in which data were collected via paper-and-pencil methods. However, the available evidence suggests that data collected via the Internet are generally as reliable and valid as data collected via paper-and-pencil methods (Chua, Drasgow, & Roberts, 2006; Denissen, Neumann, & van Zalk, 2010; Gosling, Vazire, Srivastava, & John, 2004). Gosling et al. (2004) reviewed the available evidence on the validity of data collected on the Internet and concluded that findings from Web-based studies generalize across presentation formats and are generally not adversely affected by nonserious or unmotivated responders. Other concerns raised by Web-based data collection are related to sample selectivity. Sometimes, Web-based studies have been critiqued because participants are necessarily limited to people who have Internet access. In the past, Internet users tended to be male, young, and having higher socioeconomic status (SES), but more recent studies suggest that Internet samples are relatively heterogeneous in terms of gender, age, and SES (cf. Gosling et al., 2004; Soto, John, Gosling, & Potter, 2008), which is also true of the present sample. Nevertheless, future research on mediation of the link between low self-esteem and depression would benefit from probability samples.

Another methodological limitation is that the study design does not allow for strong conclusions regarding the causality of the effects. As in all passive observational designs, the observed effects may be caused by third variables that were not assessed (Finkel, 1995). Therefore, future research should test for the effects of relevant variables that might account for

the mediating effect of rumination. Nevertheless, longitudinal mediation models are useful because they can indicate whether the data are consistent with a causal model of the relation between the variables, by establishing the direction of the effects and ruling out some (but not all) alternative causal hypotheses.

Also, the results do not allow for firm conclusions with regard to clinical categories of depression such as major depressive disorder. First, the depression measure used in the present research relies on self-report, but conclusions about the antecedents of major depressive disorder should be based on clinical interviews. Second, our analyses are based on a nonclinical sample, which does not allow for valid conclusions about depressive episodes in clinical populations. Nevertheless, about 10% of the participants scored above the clinical cutoff value of the depression measure. Moreover, the vulnerability model has been supported both in clinical and nonclinical samples (Sowislo & Orth, 2011). Therefore, there is reason to believe that rumination might account for the vulnerability effect of low self-esteem also in the context of clinically relevant depression. However, future research should directly test for the mediating effect of rumination in clinical samples.

The finding that rumination only partially mediated the effect of low self-esteem on depression suggests that further mediators are involved. Future research should therefore investigate additional mechanisms that might account for the vulnerability effect of low self-esteem, ideally simultaneously with rumination to examine the unique effect of each mediating process. For example, some individuals with low self-esteem might excessively seek reassurance about their personal worth from friends and relationship partners, which increases the risk of being rejected and thereby increases the risk of depression (Joiner, Alfano, & Metalsky, 1992). Also, low self-esteem might motivate submissive behavior, which increases depression (Pearson, Watkins, & Mullan, 2010). Another interpersonal pathway might be that low self-esteem

motivates social avoidance, thereby impeding social reinforcement and social support, which has been linked to depression (Ottenbreit & Dobson, 2004). Relatedly, low self-esteem individuals are more sensitive to rejection and tend to withdraw and reduce interpersonal closeness after conflicts, thereby undermining attachment, support, and satisfaction in close relationships (Murray, Holmes, & Griffin, 2000). Finally, low self-esteem might strengthen a negative attributional style, which is a risk factor for depression (Abramson, Metalsky, & Alloy, 1989; Metalsky et al., 1993).

Future research on the relation between self-esteem, rumination, and depression should examine alternative modeling approaches for testing longitudinal mediation. For example, Selig and Preacher (2009) discuss how latent growth models (e.g., Preacher, Wichman, MacCallum, & Briggs, 2008) and latent difference score models (e.g., McArdle & Hamagami, 2001) can be used for mediation analysis. Also, it is possible that models that distinguish between latent traits and states (e.g., Cole, Martin, & Steiger, 2005) can be extended to test for mediation. In this research, we used Cole and Maxwell's (2003) mediation modeling approach based on cross-lagged regression models, because cross-lagged regression models are at present the most frequently used and recommended models to test whether data are consistent with causal hypotheses on the relation between constructs, when only nonexperimental longitudinal data are available (Cole & Maxwell, 2003; Finkel, 1995; Little, Preacher, Selig, & Card, 2007). Moreover, Cole and Maxwell's (2003) approach has already undergone considerable methodological scrutiny (Maxwell & Cole, 2007; Maxwell, Cole, & Mitchell, 2011).

Conclusion

The present study extends previous research by identifying a mediator of the vulnerability effect of low self-esteem on depression and thereby provides information on the question of why low self-esteem contributes to depression. If future research confirms the causal links between

the constructs, the findings may have important implications for interventions aimed at preventing depression. Given that the hypothesized causal chain between low self-esteem and depression may be interrupted at the stage of the mediating process, interventions among individuals with low self-esteem could seek not only to improve the participants' self-esteem but also to reduce their tendency to ruminate. Interventions designed for reducing rumination (see Dimidjian et al., 2006; Jacobson, Martell, & Dimidjian, 2001) might be effective in preventing, or at least significantly reducing, the detrimental effect of low self-esteem on depression.

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Footnotes

¹ Throughout this article, we use the term depression to denote a continuous variable (i.e., individual differences in depressive affect) rather than a clinical category such as major depressive disorder (American Psychiatric Association, 2000). Taxometric analyses suggest that depression is best conceptualized as a continuous construct (Hankin, Fraley, Lahey, & Waldman, 2005; Lewinsohn, Solomon, Seeley, & Zeiss, 2000; Prisciandaro & Roberts, 2005; Ruscio & Ruscio, 2000).

² In this research we did not use the Ruminative Response Scale (RRS; Treynor, Gonzales, Nolen-Hoeksema, 2003), which is based on Nolen-Hoeksema's response styles theory (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008), but used the rumination scale of the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999). Nevertheless, in our review of research on the hypothesized causal chain we also included studies that used the RRS. The available evidence suggests that there is significant overlap between the rumination scale of the RRQ and the RRS. For example, Schoofs, Hermans, and Raes (2009) report that the RRQ rumination scale correlated at .56 with the RRS and at .59 with the brooding subscale of the RRS. Similarly, in the study by Siegle, Moore, and Thase (2004), the RRQ rumination scale correlated at .57 with the RRS and at .56 with the RRS brooding subscale.

³ Although the coefficients were constrained to be equal across time, the constraints were imposed on unstandardized coefficients (as is typically recommended), which led to slight variation in the resulting standardized coefficients.

⁴ Note that, technically speaking, the overall direct effect from self-esteem at Time 1 to depression at Time 5 consists of indirect effects only, such as for example the path "self-esteem at Time 1—depression at Time 2—depression at Time 3—depression at Time 4—depression at

Time 5.” However, the point is that the overall direct effect does not include any effects involving the mediator construct (Cole & Maxwell, 2003).

⁵ Although the point estimate of the overall indirect effect can be estimated when using the MODEL INDIRECT command in Mplus (specifically, the overall indirect effect equals the sum of several indirect effects), the statistical significance of this effect cannot be assessed without additionally using a phantom variable. The reason is that both the overall indirect effect and the overall direct effect consist, technically speaking, of indirect effects only (see Figure 2 and Footnote 4). Therefore, the statistics provided by the MODEL INDIRECT command do not provide information on the significance of the overall indirect effect as shown in Figure 2B. We therefore used a phantom variable for testing the significance of the overall indirect effect (Cheung, 2007).

⁶ In the bootstrap analyses, we followed the recommendations of Shrout and Bolger (2002), using 1,000 replications and the bias-corrected confidence interval.

⁷ The CES-D subscales were constructed following Radloff (1977) and Stansbury, Ried, and Velozo (2006). The subscale measuring somatic symptoms included the following items: “I was bothered by things that usually don’t bother me,” “I did not feel like eating; my appetite was poor,” “I had trouble keeping my mind on what I was doing,” “I felt that everything I did was an effort,” “My sleep was restless,” “I talked less than usual,” and “I could not get going.” The subscale measuring affective-cognitive symptoms included all other items, assessing depressive affect, lack of positive affect, and perceived interpersonal difficulties.

Table 1

Means, Standard Deviations, and Intercorrelations of Self-Esteem, Rumination, and Depression

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. SE1	3.99	0.47	--														
2. SE2	4.00	0.49	.77*	--													
3. SE3	4.01	0.51	.77*	.81*	--												
4. SE4	4.06	0.52	.73*	.79*	.84*	--											
5. SE5	4.02	0.53	.74*	.81*	.82*	.86*	--										
6. RU1	2.52	0.74	-.47*	-.47*	-.38*	-.36*	-.46*	--									
7. RU2	2.47	0.72	-.44*	-.56*	-.48*	-.44*	-.51*	.70*	--								
8. RU3	2.48	0.76	-.54*	-.55*	-.57*	-.53*	-.58*	.65*	.72*	--							
9. RU4	2.42	0.77	-.38*	-.44*	-.44*	-.47*	-.49*	.58*	.66*	.76*	--						
10. RU5	2.44	0.77	-.45*	-.49*	-.47*	-.46*	-.55*	.61*	.67*	.65*	.69*	--					
11. D1	0.58	0.42	-.54*	-.46*	-.40*	-.37*	-.45*	.60*	.52*	.50*	.43*	.47*	--				
12. D2	0.57	0.42	-.48*	-.63*	-.54*	-.54*	-.56*	.50*	.65*	.55*	.49*	.51*	.66*	--			
13. D3	0.55	0.42	-.53*	-.57*	-.66*	-.61*	-.61*	.40*	.50*	.63*	.52*	.46*	.58*	.70*	--		
14. D4	0.53	0.43	-.45*	-.50*	-.52*	-.62*	-.55*	.40*	.48*	.56*	.63*	.49*	.55*	.66*	.72*	--	
15. D5	0.56	0.43	-.45*	-.51*	-.51*	-.54*	-.66*	.44*	.58*	.58*	.53*	.67*	.53*	.58*	.61*	.66*	--

Note. SE1 to SE5 = self-esteem at Time 1 to Time 5; RU1 to RU5 = Rumination at Time 1 to Time 5; D1 to D5 = depression at Time 1 to Time 5.

Response scales ranged from 1 to 5 for self-esteem and rumination and from 0 to 3 for depression.

* $p < .05$.

Table 2

Fit of Models Tested

Model	χ^2	<i>df</i>	CFI	TLI	RMSEA (90% CI)
Bivariate analyses (self-esteem and depression)					
Measurement Models					
1. Free loadings	449.9*	300	.99	.99	.027 (.022-.033)
2. Longitudinal constraints on loadings	472.2*	316	.99	.99	.027 (.022-.032)
Structural Models					
3. Free structural coefficients	614.7*	340	.98	.98	.035 (.030-.039)
4. Longitudinal constraints on structural coefficients	636.1*	352	.98	.98	.035 (.031-.039)
Mediation analyses (self-esteem, rumination, and depression)					
Measurement Models					
5. Free loadings	1035.9*	750	.99	.98	.024 (.020-.027)
6. Longitudinal constraints on loadings	1062.7*	774	.99	.98	.024 (.020-.027)
Structural Models					
7. Free structural coefficients	1295.8*	828	.98	.97	.029 (.026-.032)
8. Longitudinal constraints on structural coefficients	1360.2*	855	.98	.97	.030 (.027-.033)

Note. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; CI = confidence interval.

* $p < .05$.

Table 3

Total Effect and Overall Indirect Effect of Self-Esteem at Time 1 on Depression at Time 5

	Total effect		Overall indirect effect	
	Standardized Estimate	Unstandardized Estimate (95% CI)	Standardized Estimate	Unstandardized Estimate (95% CI)
Depression measure				
Full CES-D	-.273*	-.187 (-.257, -.117)	-.032*	-.022 (-.041, -.009)
Affective-cognitive symptoms	-.294*	-.172 (-.237, -.113)	-.040*	-.022 (-.042, -.009)
Somatic symptoms	-.186*	-.151 (-.241, -.053)	-.028*	-.023 (-.047, -.009)

Note. The significance of the estimates was tested using the bootstrapped bias-corrected 95% CI. CI = confidence interval; CES-D = Center for Epidemiologic Studies Depression Scale.

* $p < .05$.

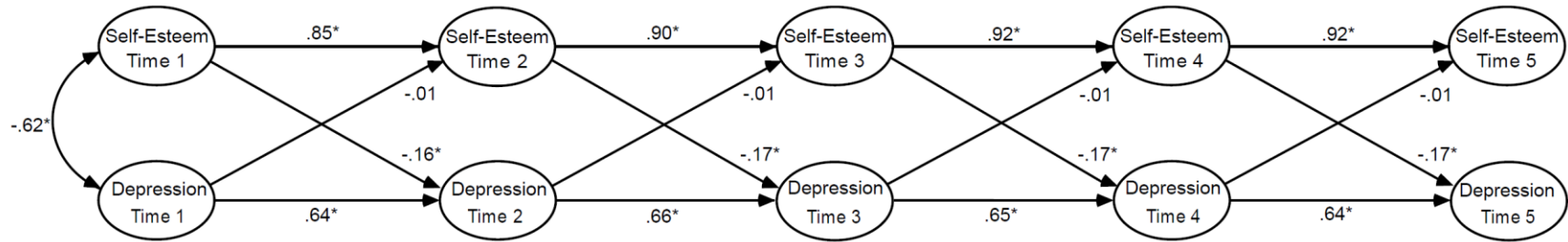


Figure 1. Standardized structural coefficients for the bivariate model of self-esteem and depression. The figure shows only latent constructs and omits observed variables and within-wave correlations of residual variances.

* $p < .05$.

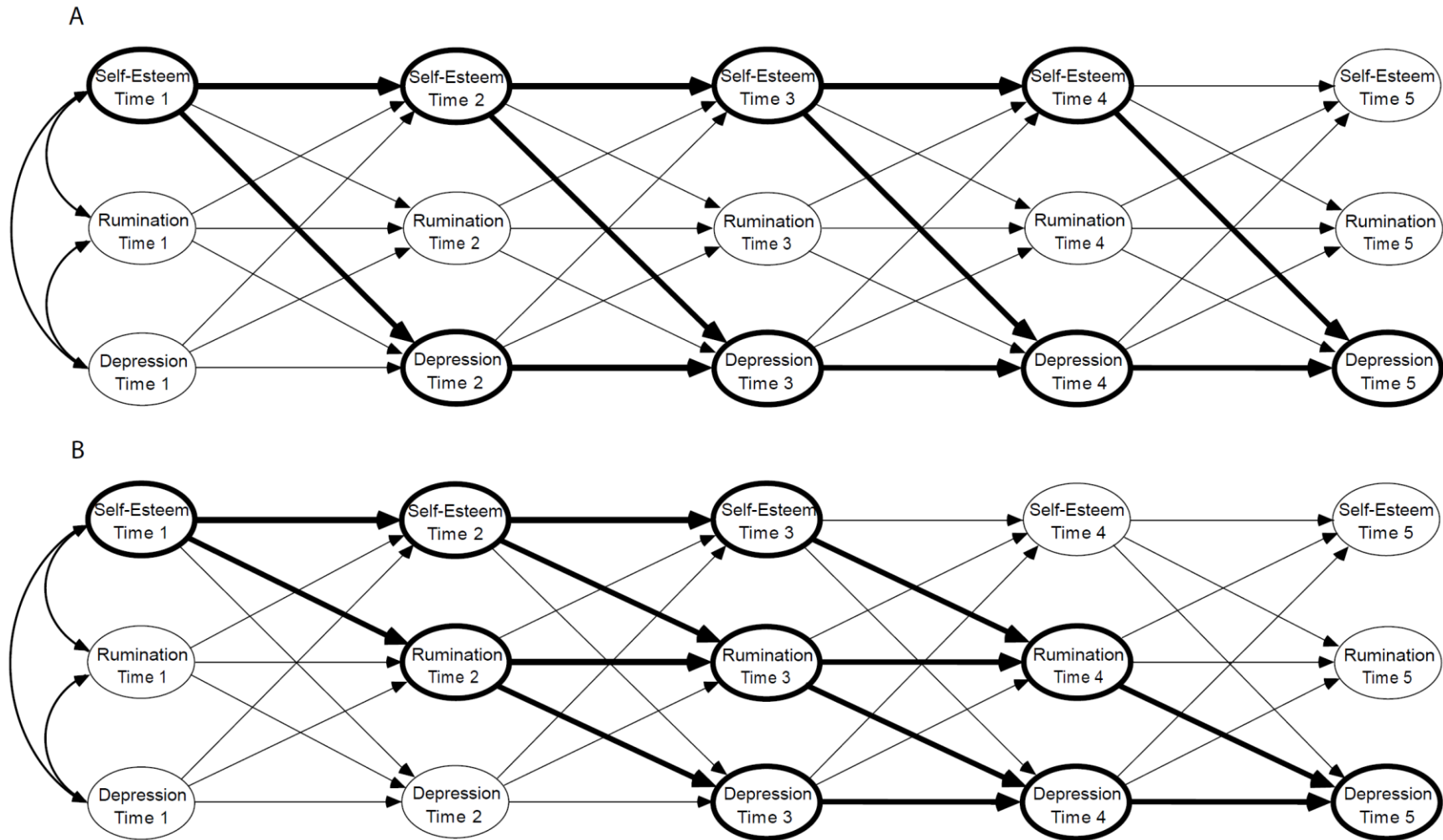


Figure 2. The figure illustrates the longitudinal mediation model of self-esteem, rumination, and depression. Figure 2A shows the paths involved in the overall direct effect (i.e., all paths from self-esteem at Time 1 to depression at Time 5 that do not pass through

rumination at any wave). Figure 2B shows the paths involved in the overall indirect effect (i.e., all paths from self-esteem at Time 1 to depression at Time 5 that pass through rumination at least once).

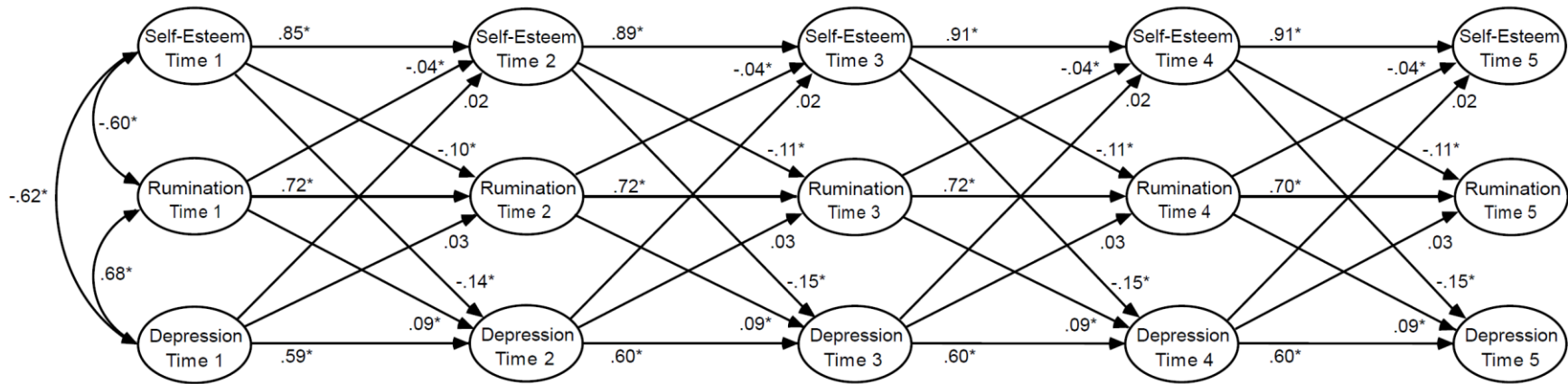


Figure 3. Standardized structural coefficients for the mediation model of self-esteem, rumination, and depression. The figure shows only latent constructs and omits observed variables and within-wave correlations of residual variances.

* $p < .05$.