



Scar, vulnerability, or both? A longitudinal study of the association between depressive tendencies and global negative self-esteem from early adolescence to young adulthood with gender as a moderating factor

Magnus Jørgensen^{a,*}, Sara Madeleine Kristensen^a, Kyrre Breivik^b

^a Department of Health Promotion and Development, University of Bergen, Årstadveien 17, 5009 Bergen, Norway

^b Regional Centre for Child and Youth Mental Health and Child Welfare, NORCE Norwegian Research Centre, Postbox 22, Nygårdstangen, 5838, Bergen, Norway

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ABSTRACT

Purpose: Many studies on adolescents have investigated whether self-esteem affects depression (the vulnerability model) or vice versa (the scar model), but only recently have studies begun distinguishing differences between individuals (state-like) from differences within individuals (trait-like). The resulting findings for the scar and vulnerability model have been mixed. In this study, we thus explore both models in a Norwegian sample spanning ages 13 to 23. We also test if gender moderation can account for the mixed findings.

Methods: Our sample consisted of 985 adolescents (54,8 % boys and 45,2 % girls) who were surveyed at six time points from age 13 to 23 on global negative self-esteem and depressive tendencies. We tested both an unconstrained and constrained RI-CLPM based on equal time lags. Finally, we tested with moderation by gender.

Results: Moderately strong vulnerability effects were found from ages 13 to 14 and ages 14 to 15 while small scar effects were found from ages 15 to 18 and ages 18 to 21. No moderation by gender was indicated. A high association was also found between trait-like and state-like global negative self-esteem and depressive tendencies. **Conclusion:** Our findings suggest that vulnerability and scar effects might differ depending on the stage of adolescence.

1. Introduction

Depressive symptoms in adolescents pose a major public health concern. Studies show that most mental health disorders (including major depression) have their onset during adolescent years - with sub-clinical depressive symptoms often preceding clinical depression (Hill et al., 2014; Kessler et al., 2007; Lépine & Briley, 2011; Patel et al., 2016). For adolescents, depressive symptoms are frequently associated with suicidal thoughts, comorbid psychiatric disorders, poor academic performance, and reduced social functioning (Noyes et al., 2022; Verboom et al., 2014). Left untreated, adolescent depressive symptoms can lead to mental and somatic health conditions in adulthood along with a heightened risk of unemployment (Bardone et al., 1998; Kim-Cohen et al., 2003). Therefore, it is important to identify the precursors of adolescent depressive symptoms to enable early intervention policies.

Self-esteem has been put forth as a precursor of depression and several mechanisms have been proposed to explain the association in adolescence. For one, low self-esteem has been linked to higher levels of

stress and poorer coping skills (e.g., more avoidance behavior) which can make adolescents more vulnerable in the face of common challenges during adolescence, such as transitioning to a new school or establishing and maintaining peer connections (Dumont & Provost, 1999; Eisenbarth, 2012). Secondly, adolescents with low self-esteem might also spend more time ruminating, confirming negative self-evaluations, and thus, experience more sensitivity towards peer rejections (Giesler et al., 1996; Murray et al., 2000; Neff & Vonk, 2009). The negative effects of self-esteem on depressive outcomes are often referred to as a vulnerability effect.

Some studies have also pointed to a potential opposite effect from depressive outcomes to self-esteem. The scar model, as the name implies, suggests that depression can leave 'scars' in cognitions related to people's self-concept and self-worth (Zeigler-Hill, 2011). For instance, depressed adolescents might experience a perceptual bias towards negative stimuli, which is detrimental to their self-esteem (Orth et al., 2008). Alternatively, depression might influence appearance and behavior in a way that facilitates negative feedback from peers, harming

* Corresponding author at: University of Bergen, Norway.

E-mail address: Magnus.Jorgensen@uib.no (M. Jørgensen).

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self-esteem indirectly (Orth et al., 2008). Indeed, Hammen (1991, 2005, 2006) established that depressed people tend to actively create contexts in their environment that they perceive as stressful. Importantly, the scar and vulnerability models do not necessarily exclude each other but might instead have a bidirectional relationship (Johnson et al., 2016; Rosenberg et al., 1989).

Until recently, the scar and vulnerability models have mainly been investigated using the cross-lagged panel model (CLPM) without accounting for trait-like differences between adolescents. But importantly, some adolescents have stably lower self-esteem and stably higher depressive symptoms than others. Thus, newer studies on the relationship between self-esteem and depression have employed the random intercept cross-lagged panel model (RI-CLPM) which better allows distinguishing differences between adolescents from differences within adolescents over time. Masselink, Roedel, et al. (2018) found support for the vulnerability model in a meta-analytic study of three samples of adolescents while another meta-analytic study by Orth et al. (2021) found small support for the scar model, but not the vulnerability model across ten samples based on different age groups (adolescence, early adulthood and adulthood). Yet another study by Tran et al. (2023) also found evidence for the scar model, but not the vulnerability model in a sample of adolescents. Lastly, Gao et al. (2022) found support for both the vulnerability and scar model in young adulthood. Thus, it could be that the scar and vulnerability model are salient depending on different stages of adolescence (e.g., early adolescence, mid-adolescence, early adulthood etc.).

Furthermore, it is possible that gender differences could help explain the conflicting findings as studies almost consistently show that adolescent girls experience lower self-esteem and higher depressive symptoms compared to boys (Moksnes & Reidunsdatter, 2019; Quatman & Watson, 2001). That is especially true during puberty where girls are known to experience more negative emotions as well as greater body dissatisfaction which is directly tied to lower self-esteem (Dahl & Gunnar, 2009; Ge et al., 2001; Hamlat et al., 2014; Paxton et al., 2006). Accordingly, it is possible that girls show greater vulnerability effects than boys in early-adolescence. In a similar vein, a recent study on college students by Gao et al. (2022) also looked at gender as a moderator in the relationship between self-esteem and depression across a 4-year period in college and found a relatively stable vulnerability effect for males and a progressively stronger vulnerability effect for females (Gao et al., 2022). However, an earlier meta-analysis by Sowislo and Orth (2013) did not find gender to moderate the scar and vulnerability model across different age periods, but importantly, this study was based on CLPM which does not distinguish between trait- and state-like differences, and thus, possibly biasing estimates of cross-lagged effects (Hamaker et al., 2015).

In the present study, we thus sought to investigate the longitudinal within- and between-person associations between depressive tendencies and global negative self-esteem from early adolescence to early adulthood with gender as a possible moderating factor. Because earlier findings for the scar and vulnerability model have been mixed, we opted for an explorative approach in the present study.

2. Methods

2.1. Sample and procedure

Our analytic sample consisted of 958 Norwegian individuals who were surveyed on variables pertaining to health and lifestyle at six time points (ages 13, 14, 15, 18, 21, and 23). The data collection used in this study took place in 1990, 1991, 1992, 1995, 1998, and 2000 from a selection of randomly sampled schools in Hordaland County, Norway. At baseline, the sample consisted of adolescents with a mean age of 13 (SD

= 0.19) and a gender distribution of 54,8 % boys (n = 527) and 45,2 % girls (n = 431). All participants gave informed written consent to participate, and the data collection was reviewed by the Data Inspectorate of Norway and received a recommendation from the Regional Committee of Medical Research ethics. For more detailed information on the Norwegian Longitudinal Health Behavior Study (NLHBS) which our analytic sample is from, please see Birkeland et al. (2009) and Holsen et al. (2000).

2.2. Instruments

2.2.1. Depressive tendencies

Depressive tendencies were measured using Alsaker's (1992) scale. Respondents indicated to what extent seven statements regarding depressive symptoms applied to themselves. Ratings were done on a 6-point Likert Scale wherein 1 = does not apply at all and 6 = applies exactly. An example item is: "Sometimes I think everything is so hopeless that I don't feel like doing anything". An earlier study by Holsen et al. (2000) established good concurrent validity for the scale in relation to the CES-D measure of depression ($r = 0.82$). Omega reliability (ω) was satisfactory for all time points (0.82–0.92) and is reported in Table 1. Support for a one-factor structure is reported in Table 5.

2.2.2. Global negative self-esteem

Global Negative Self-Esteem was measured using the Global Negative Self-Evaluations Scale (Alsaker & Olweus, 1986) which is a revised version of Rosenberg's Self-Esteem Scale. Six items were included in The Global Negative Self-Evaluations Scale, and respondents rated each statement on a 6-point Likert Scale ranging from 1 = does not apply at all to 6 = applies exactly. One example item is: "All in all, I am inclined to feel that I am a failure". Omega reliability was satisfactory for all time points ($\omega \geq 0.87$) and is reported in Table 1. Support for a one-factor structure is reported in Table 5.

2.2.3. Gender

Gender was self-reported as a binary variable in 1990 (age 13) with boys coded as 1 and girls coded as 2.

2.3. Analytical plan

SPSS version 25 was used for preliminary analyses. Mplus version 8.7 (Muthén & Muthén, 1998–2017) was used to investigate factor structures, measurement invariance, and the RI-CLPM. Robust maximum likelihood estimation was used to handle potential non-normal distribution of the variables. Missing data was handled by full information maximum likelihood (FIML). Model fit of the RI-CLPM was assessed using common cut-off criteria: 1) a comparative fit index (CFI) above 0.90 for acceptable fit; 2) a root mean square error of approximation (RMSEA) below 0.08 for adequate fit; and 3) a standardized root mean square residual (SRMR) lower than 0.08 for satisfactory fit (Chen, 2007). During measurement invariance testing, we used the effects-coding approach by Little et al. (2006). Acceptable model fit differences between comparison and nested models were based on recommendations by Chen (2007). The RI-CLPM requires at least metric invariance for both constructs (Mulder & Hamaker, 2021).

2.3.1. RI-CLPM analyses

We specified the model following recommendations by Hamaker (2018) and Mulder and Hamaker (2021). The correlation between the two random intercepts (i.e., one for depressive tendencies and one for global negative self-esteem) implies how strongly associated the trait-like components of the two constructs are. The within-person variables were used to estimate within-person carry-over effects, cross-

lagged effects, and state-like correlations between negative self-esteem and depressive tendencies. After conducting the primary RI-CLPM analysis and testing equality constraints on time lags, gender was included as a moderator in a multiple-group analysis. We compared model estimates across genders using the constraint function in Mplus.

3. Results

3.1. Descriptive statistics and correlations

The descriptive statistics of global negative self-esteem and

depressive tendencies at all measurement occasions are presented in Table 1, and the bivariate correlations are presented in Table 2. Means, standard deviations and correlations are reported for boys and girls in Tables 3 and 4.

3.2. Measurement invariance

Fit indices from measurement invariance testing are reported in Table 5. For the depressive tendencies scale, residual correlations between items 3 (“I often feel depressed without knowing why”) and 5 (“I am often sad without seeing any reason for it”) and items 4 (“Sometimes

Table 1
Descriptive statistics of the study variables.

Variable	n	ω	M	SD	Skewness	Kurtosis
Global negative self-esteem age 13 (1990)	865	0.87	2.72	1.09	0.84	0.32
Global negative self-esteem age 14 (1991)	950	0.88	2.58	1.17	0.91	0.28
Global negative self-esteem age 15 (1992)	954	0.90	2.71	1.20	0.81	0.03
Global negative self-esteem age 18 (1995)	777	0.90	2.53	1.11	1.07	0.73
Global negative self-esteem age 21 (1998)	590	0.89	2.11	0.93	1.30	1.71
Global negative self-esteem age 23 (2000)	629	0.92	2.00	0.95	1.72	3.46
Depressive tendencies age 13 (1990)	801	0.82	2.24	0.91	0.94	0.71
Depressive tendencies age 14 (1991)	949	0.86	2.19	1.02	1.22	1.30
Depressive tendencies age 15 (1992)	919	0.87	2.41	1.09	0.98	0.58
Depressive tendencies age 18 (1995)	777	0.90	2.38	1.08	1.03	0.63
Depressive tendencies age 21 (1998)	590	0.92	1.99	0.97	1.38	1.73
Depressive tendencies age 23 (2000)	629	0.92	1.89	0.96	1.72	3.04

Note. Minimum = 1 and maximum = 6 in all variables.

Table 2
Correlations between global negative self-esteem and depressive tendencies at all time points.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Global negative self-esteem age 13 (1990)	–											
2. Global negative self-esteem age 14 (1991)	0.58***	–										
3. Global negative self-esteem age 15 (1992)	0.51***	0.67***	–									
4. Global negative self-esteem age 18 (1995)	0.37***	0.47***	0.53***	–								
5. Global negative self-esteem age 21 (1998)	0.31***	0.38***	0.41***	0.67***	–							
6. Global negative self-esteem age 23 (2000)	0.31***	0.39***	0.39***	0.53***	0.65***	–						
7. Depressive tendencies age 13 (1990)	0.65***	0.47***	0.38***	0.29***	0.27***	0.23***	–					
8. Depressive tendencies age 14 (1991)	0.50***	0.79***	0.57***	0.41***	0.33***	0.37***	0.52***	–				
9. Depressive tendencies age 15 (1992)	0.43***	0.54***	0.67***	0.45***	0.37***	0.36***	0.44***	0.59***	–			
10. Depressive tendencies age 18 (1995)	0.35***	0.38***	0.41***	0.74***	0.60***	0.44***	0.35***	0.41***	0.46***	–		
11. Depressive tendencies age 21 (1998)	0.25***	0.30***	0.30***	0.48***	0.77***	0.51***	0.23***	0.30***	0.34***	0.55***	–	
12. Depressive tendencies age 23 (2000)	0.26***	0.34***	0.32***	0.40***	0.55***	0.78***	0.24***	0.39***	0.34***	0.45***	0.60***	–

Note. *** $p < .001$, ** $p < .01$, * $p < .05$.

Table 3
Depressive tendencies (DT) and global negative self-esteem (GNSE) stratified by gender.

	n	Boys		n	Girls	
		M	SD		M	SD
GNSE Age 13 (1990)	475	2.60	1.06	390	2.87	1.11
GNSE Age 14 (1991)	528	2.34	1.10	422	2.88	1.18
GNSE Age 15 (1992)	528	2.36	1.05	426	3.14	1.22
GNSE Age 18 (1995)	380	2.29	1.00	397	2.77	1.16
GNSE Age 21 (1998)	271	1.94	0.85	319	2.26	0.97
GNSE Age 23 (2000)	308	1.87	0.85	321	2.14	1.03
DT Age 13 (1990)	437	2.17	0.91	364	2.33	0.90
DT Age 14 (1991)	528	2.05	0.98	421	2.37	1.03
DT Age 15 (1992)	507	2.26	1.07	412	2.60	1.07
DT Age 18 (1995)	380	2.20	1.07	397	2.54	1.08
DT Age 21 (1998)	270	1.86	0.95	320	2.10	0.98
DT Age 23 (2000)	308	1.73	0.84	321	2.05	1.04

Note. DT = depressive tendencies. GNSE = global negative self-esteem.

Table 4
Correlation matrix for depressive tendencies (DT) and global negative self-esteem (GNSE) stratified by gender.

	1	2	3	4	5	6	7	8	9	10	11	12
1. DT Age 13 (1990)	–	0.49***	0.38***	0.30***	0.23***	0.21**	0.62**	0.44***	0.34***	0.22***	0.24***	0.22***
2. DT Age 14 (1991)	0.55***	–	0.56***	0.45***	0.35***	0.39***	0.44***	0.76***	0.52***	0.42***	0.34***	0.40***
3. DT Age 15 (1992)	0.48***	0.60***	–	0.51***	0.38***	0.35***	0.39***	0.51***	0.72***	0.48***	0.38***	0.41***
4. DT Age 18 (1995)	0.40***	0.33***	0.39***	–	0.57***	0.40***	0.36***	0.44***	0.43***	0.75***	0.59***	0.47***
5. DT Age 21 (1998)	0.22**	0.19**	0.24**	0.50***	–	0.62***	0.28***	0.36***	0.33***	0.50***	0.76***	0.56***
6. DT Age 23 (2000)	0.25***	0.33***	0.26***	0.48***	0.55***	–	0.24***	0.36***	0.30***	0.34***	0.52***	0.75***
7. GNSE Age 13 (1990)	0.68***	0.54***	0.44***	0.31***	0.16*	0.23***	–	0.56***	0.47***	0.37***	0.34***	0.34***
8. GNSE Age 14 (1991)	0.49***	0.81***	0.53***	0.28***	0.18**	0.25***	0.60***	–	0.65***	0.47***	0.41***	0.44***
9. GNSE Age 15 (1992)	0.41***	0.59***	0.63***	0.32***	0.20**	0.24***	0.53***	0.64***	–	0.52***	0.37***	0.41***
10. GNSE Age 18 (1995)	0.35***	0.35***	0.38***	0.73***	0.41***	0.45***	0.33***	0.40***	0.48***	–	0.67***	0.54***
11. GNSE Age 21 (1998)	0.28***	0.27**	0.32***	0.58***	0.78***	0.57***	0.22***	0.27**	0.39***	0.63***	–	0.67***
12. GNSE Age 23 (2000)	0.21**	0.28***	0.24***	0.37***	0.41***	0.81***	0.21***	0.27**	0.30***	0.49***	0.59***	–

Note. *** $p < .001$, ** $p < .01$, * $p < .05$. Estimates reported with scalar constraints. DT = depressive tendencies. GNSE = global negative self-esteem. The lower diagonal shows estimates for boys and the upper diagonal shows estimates for girls.

Table 5
Measurement invariance for global negative self-esteem and depressive tendencies across time and gender.

	χ^2	df	RMSEA [90%CI]	CFI	SRMR	$\Delta\chi^2$	p-value	Δ RMSEA	Δ CFI	Δ SRMR
<i>Global negative self-esteem</i>										
<i>Across time</i>										
Configural	735.250	477	0.022 [0.019,0.025]	0.981	0.042					
Metric	858.011	508	0.025 [0.022,0.028]	0.975	0.048	122.761	0.000	0.003	0.006	0.006
<i>Across gender</i>										
Configural	1390.041	966	0.028 [0.025,0.031]	0.969	0.053					
Metric	1419.139	996	0.028 [0.024,0.031]	0.969	0.053	29.098	0.062	0.000	0.000	0.000
<i>Depressive tendencies</i>										
<i>Across time</i>										
Configural	1397.507	681	0.031 [0.029,0.033]	0.948	0.045					
Metric	1511.410	717	0.032 [0.030,0.034]	0.942	0.048	113.903	0.000	0.001	0.006	0.003
<i>Across gender</i>										
Configural	2272.086	1374	0.035 [0.032,0.037]	0.938	0.055					
Metric	2318.199	1410	0.034 [0.032,0.037]	0.937	0.064	46.113	0.062	0.001	0.001	0.009

Note. χ^2 = chi-square; df = degrees of freedom; RMSEA = the root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; SRMR = standardized root mean square residual.

I think everything is so hopeless that I don't feel like doing anything") and 6 ("Sometimes I am just so depressed that I feel like staying in bed for the whole day") were allowed due to high item overlap. For Global Negative Self-Esteem, one residual correlation was added between items 2 ("I would like to change many things about myself") and 5 ("I have often wanted to be someone else") due to item overlap. Metric invariance was achieved across time and gender for both scales.

3.3. The longitudinal association between global negative self-esteem and depressive tendencies

We first tested an unconstrained RI-CLPM which yielded acceptable fit: $\chi^2 = 8713.695$, $df = 5487$, $p < .001$, $RMSEA = 0.033$, 90 % CI [0.031, 0.034], $CFI = 0.908$, $SRMR = 0.065$. To increase model parsimony, we constrained cross-lagged and autoregressive paths to be equal in two intervals from age 13–14/14–15 (1990–1991/1991–1992) and age 15–18/18–21 (1992–1995/1995–1998). The constraints did not significantly change model fit, according to the Satorra-Bentler scaled chi-square difference test ($\Delta\chi^2 = 8.99$, $\Delta df = 8$, p -value = .343). Therefore, we accepted the constrained version as the final model ($\chi^2 4623.551$, $df = 2746$, $p < .001$, $RMSEA = 0.025$, 90 % CI [0.024, 0.026],

$CFI = 0.942$, $SRMR = 0.052$). The final model is depicted in Fig. 1 (see Appendix A for unstandardized and standardized estimates with standard errors).

A strong and positive correlation between the random intercepts was found. On the within-person level, there were also positive and strong, but typically somewhat weaker, concurrent correlations at each measurement wave. Positive carry-over stability effects were found in glo- there were also positive and strong, but typically somewhat weakerbal negative self-esteem across all time points. Positive carry-over stability effects in depressive tendencies were observed from ages 15 to 18 (1992–1995) and ages 18 to 21 (1995–1998). The cross-lagged effects from global negative self-esteem to depressive tendencies were positive and significant from ages 13 to 14 (1990–1991) and 14 to 15 (1991–1992). The cross-lagged effects from depressive tendencies to subsequent self-esteem were also positive from ages 15 to 18 (1992–1995) and from ages 18 to 21 (1995–1998).

3.4. Multiple-group analysis by gender

The RI-CLPM with gender as a moderator produced satisfactory model fit: $\chi^2 = 8713.695$, $df = 5487$, $p < .001$, $RMSEA = 0.033$, 90 % CI

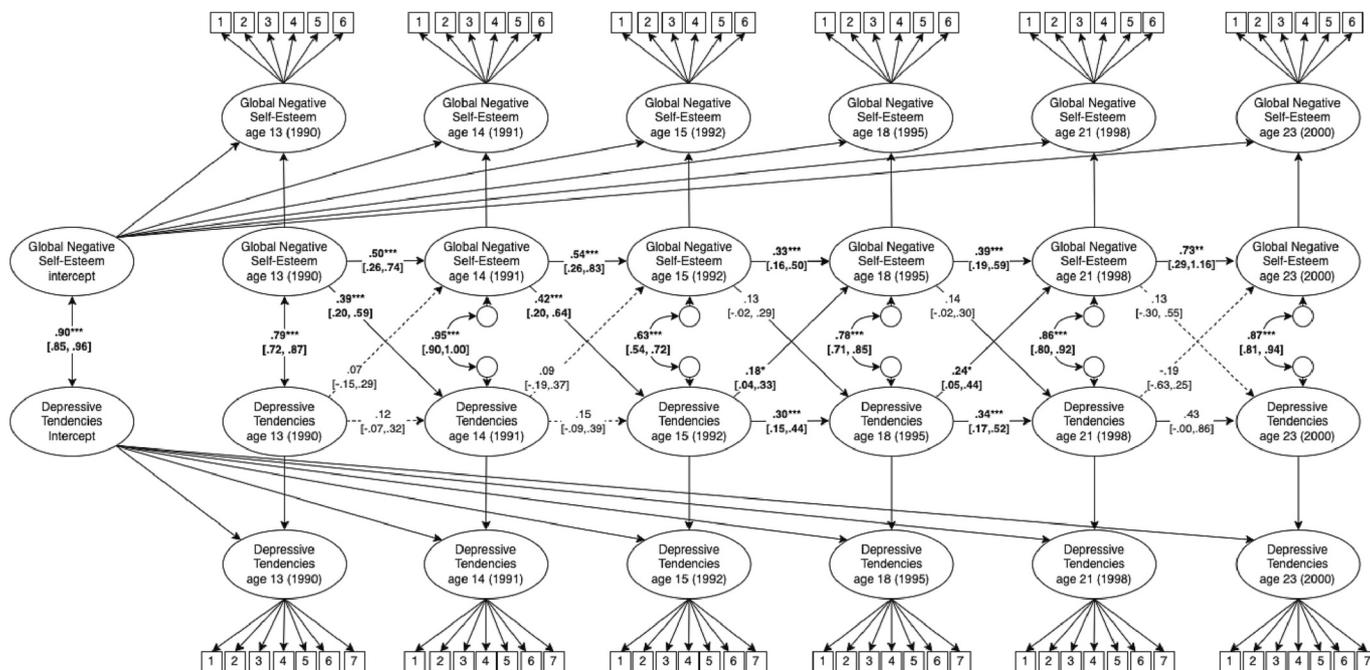


Fig. 1. Random intercept cross-lagged panel model with global negative self-esteem and depressive tendencies from age 13 (1990) to 23 (2000). Note. Standardized estimates are presented with 95 % confidence intervals in brackets. *** $p < .001$, ** $p < .01$, * $p < .05$.

[0.031, 0.034], CFI = 0.908, SRMR = 0.065. Adding the same constraints as in the original RI-CLPM did not lead to a significant deterioration in model fit according to the Satorra-Bentler scaled chi-square difference test ($\Delta\chi^2 = 11.80$, $\Delta df = 16$, p -value = .758). We also tested

for gender equality between the cross-lagged and autoregressive paths using the model constraint function in Mplus. No significant gender differences were found. Estimates for the final RI-CLPM models for boys and girls are reported in Figs. 2 and 3.

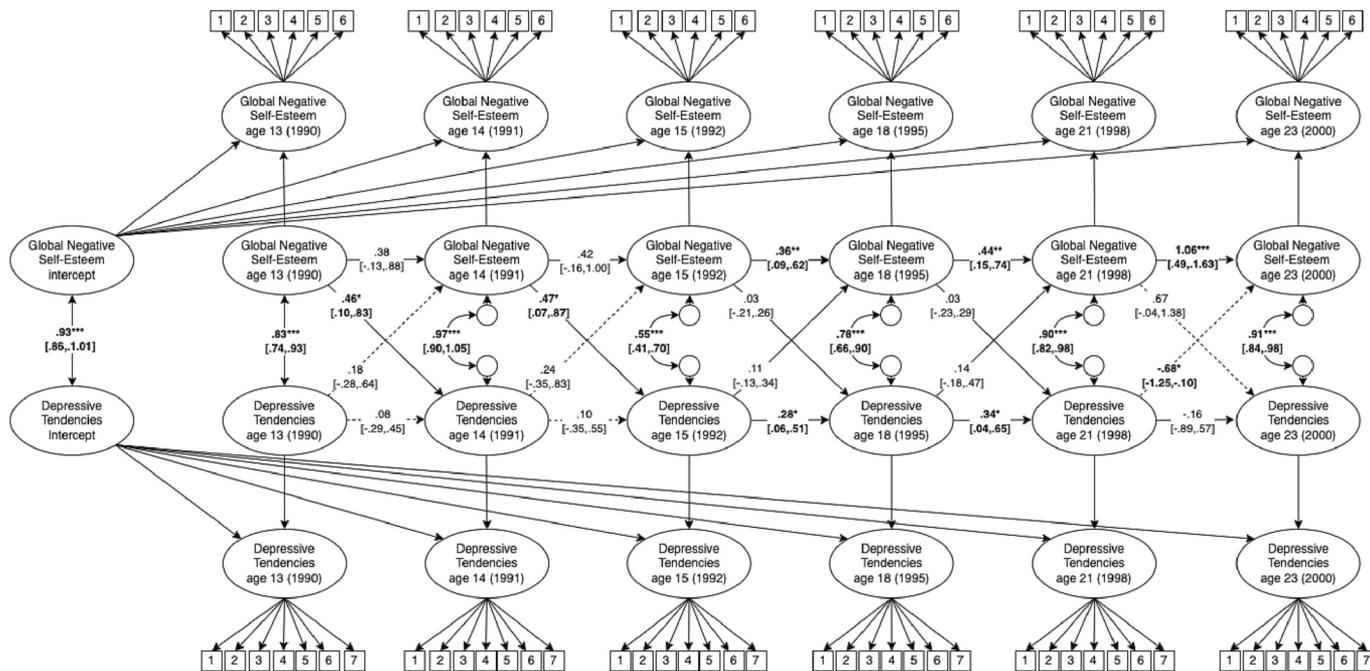


Fig. 2. Random intercept cross-lagged panel model for boys with global negative self-esteem and depressive tendencies from age 13 (1990) to 23 (2000). Note. Standardized estimates are presented with 95 % confidence intervals in brackets. *** $p < .001$, ** $p < .01$, * $p < .05$.

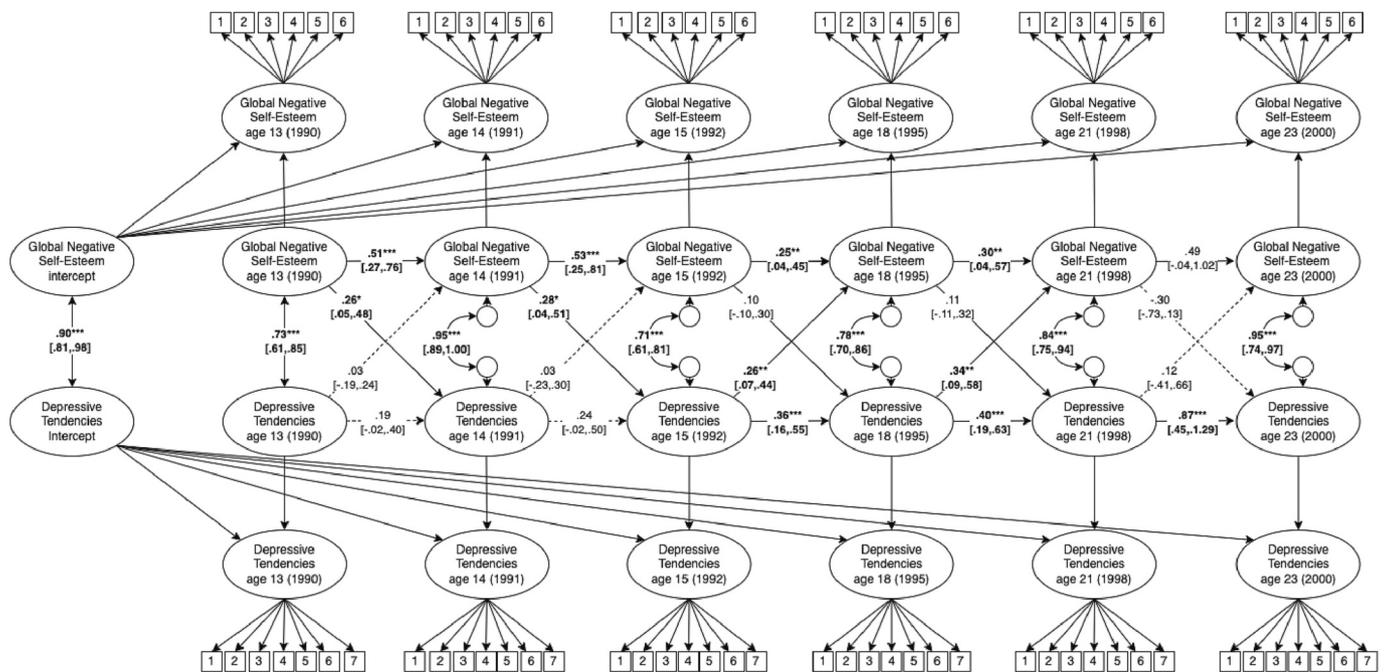


Fig. 3. Random intercept cross-lagged panel model for girls with global negative self-esteem and depressive tendencies from age 13 (1990) to 23 (2000). Note. Standardized estimates are presented with 95 % confidence intervals in brackets. *** $p < .001$, ** $p < .01$, * $p < .05$.

4. Discussion

This study examined the intraindividual relationship between global negative self-esteem and depressive tendencies from early adolescence to early adulthood with gender as a possible moderator in the association. Vulnerability effects were found from ages 13 to 14 and 14 to 15 while scar effects were found from ages 15 to 18 and 18 to 21. There were no apparent gender differences in the within- and between-person associations of global negative self-esteem and depressive tendencies. We found a strong and positive association between global negative self-esteem and depressive tendencies on a trait- and state-like level. There were also positive carry-over stability effects in global negative self-esteem throughout adolescence and carry-over stability effects in depressive tendencies from age 15 to 21.

The vulnerability effects found from early- to mid-adolescence aligns with the findings of Masselink, Van Roekel, and Oldehinkel (2018) who also found vulnerability effects for early- to mid-adolescence in two of their samples. This could be because adolescents with low self-esteem are more motivated to avoid negative and harmful experiences, but with the unintentional side-effect of also missing out on positive experiences (Masselink, Van Roekel, & Oldehinkel, 2018). It is also possible that some of the early transitions in adolescence (e.g., puberty etc.) might influence self-esteem with ramifications for depressive tendencies (Huang et al., 2022).

We also observed scar effects from middle adolescence to early adulthood. Similar results were found in a study by Tran et al. (2023) on mid-adolescents. It has been suggested that the first onset of a depressive episode is more likely to be preceded by an external trigger, whereas subsequent episodes might occur in a more autonomous matter (Post, 1992). Thus, it could be that external triggers in early adolescence (e.g., puberty, stressful life events etc.) have led to depressive tendencies in mid-adolescence which then act independently to affect self-esteem in late adolescence and early adulthood - irrespective of co-occurring stressors and triggers (Monroe et al., 1999).

Neither scar nor vulnerability effects showed significant moderation by gender. This is somewhat surprising given how girls generally tend to place more value on interpersonal connections and be more worried about the judgement of others compared to boys (Rose & Rudolph,

2006). Because of this difference in social sensitivity, girls might have shown stronger vulnerability effects than boys as their self-esteem is more susceptible to peer influences (Blakemore & Mills, 2014; Rose & Rudolph, 2006). However, the absence of gender differences in the present study does not necessarily imply that differences do not exist in the intraindividual relationship between self-esteem and depressive outcomes, but that more research is warranted.

The positive carry-over stability effects in global negative self-esteem observed in the present study has been reported in earlier studies and might be related to adolescents' different social functioning, likeability, and popularity among peers (Nelis & Bukowski, 2019; Trzesniewski et al., 2003). In a similar vein, it has been argued that adolescents differ in how sensitive they are towards environmental stressors and how adept they are at affect regulation which could underlie the regularity of fluctuations in self-esteem over time (Aldao et al., 2010; Nelis & Bukowski, 2019).

For depressive tendencies, only limited positive carry-over stability effects were found from ages 15 to 18 and 18 to 21. Similar, but smaller carry-over stability, has been indicated in earlier research (Masselink, Roekel, et al., 2018; Orth et al., 2021; Tran et al., 2023). At present, it is not clear why such differences exist, but it could be due to different instruments used as well as different stages of adolescence being studied.

The strong trait- and state-like correlations observed between global negative self-esteem and depressive tendencies might, in part, be explained by the fact that both scales are negatively worded. According to Lindwall et al. (2012), people experiencing depression tend to favor negatively worded items. However, it is likely also a reflection of the fact that depression and self-esteem are intimately connected as components of the self as according to Rosenberg and Owens (2001).

4.1. Limitations

Some limitations of the present study should be noted. Firstly, our measures of depressive tendencies and global negative self-esteem have not been applied widely in the literature. However, both measures were developed specifically for adolescents due to less viable alternatives at the time of the first data collection. In addition, given the high concurrent validity between our measure of depressive tendencies and the

CES-D scale for depression as well as the fact that our measure of global negative self-esteem scale was developed as a revised version of Rosenberg’s scale, we believe it is reasonable to assume that our instruments have satisfactory validity. Secondly, given the very high association between trait-like depressive tendencies and trait-like global negative self-esteem in the present study, it is important to replicate these findings using alternative measurement instruments which might better discriminate between the two constructs.

4.2. Implications

Some clinical implications can be inferred from the present study. More specifically, interventions might benefit from targeting global negative self-esteem in early adolescence (to address depressive tendencies) while interventions from mid-adolescence might benefit more from targeting depressive tendencies (to address global negative self-esteem). Further research, especially using randomized controlled trials, could help shed further light on the efficacy of such interventions. In addition, similar to the present study, researchers should seek to encompass a wide developmental period with enough time lags to detect differences in the scar and vulnerability model based on the stage of adolescence (e.g., early adolescence, mid-adolescence etc.).

5. Conclusion

The main contribution of the present study is the inclusion of gender as a possible moderator of the scar and vulnerability model from early adolescence to early adulthood. In conjunction with earlier research, our findings indicate that the scar and vulnerability model might differ in effect based on the stage of adolescence considered - with the

vulnerability model being more common from early to mid-adolescence and the scar model being more common from mid-adolescence and onwards. Further research could help illuminate why this might be the case and what mechanisms underpin these differences. More research should also seek to explore gender differences in this regard.

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CRedit authorship contribution statement

Magnus Jørgensen: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Sara Madeleine Kristensen:** Formal analysis, Writing – original draft, Writing – review & editing. **Kyrre Breivik:** Supervision, Project administration, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability statement

The authors agree to make data, materials and scripts supporting the results or analyses presented in the paper available upon reasonable request.

Appendix A. Unstandardized and standardized estimates with standard errors for global negative self-esteem and depressive tendencies in the general RI-CPLM (Fig. 1)

	Unstandardized	SE	Standardized	SE
<i>Autoregressive coefficients</i>				
Global negative self-esteem age 13 (1990) → Global negative self-esteem age 14 (1991)	0.56***	0.14	0.50***	0.12
Global negative self-esteem age 14 (1991) → Global negative self-esteem age 15 (1992)	0.56***	0.14	0.54***	0.15
Global negative self-esteem age 15 (1992) → Global negative self-esteem age 18 (1995)	0.31***	0.08	0.33***	0.09
Global negative self-esteem age 18 (1995) → Global negative self-esteem age 21 (1998)	0.31***	0.08	0.39***	0.10
Global negative self-esteem age 21 (1998) → Global negative self-esteem age 23 (2000)	0.72**	0.24	0.73**	0.22
Depressive Tendencies age 13 (1990) → Depressive Tendencies age 14 (1991)	0.16	0.13	0.12	0.10
Depressive Tendencies age 14 (1991) → Depressive Tendencies age 15 (1992)	0.16	0.13	0.15	0.12
Depressive Tendencies age 15 (1992) → Depressive Tendencies age 18 (1995)	0.31***	0.08	0.30***	0.07
Depressive Tendencies age 18 (1995) → Depressive Tendencies age 21 (1998)	0.31***	0.08	0.34***	0.09
Depressive Tendencies age 21 (1998) → Depressive Tendencies age 23 (2000)	0.41	0.21	0.43	0.22
<i>Cross-lagged coefficients</i>				
Global negative self-esteem age 13 (1990) → Depressive Tendencies age 14 (1991)	0.37***	0.09	0.39***	0.10
Global negative self-esteem age 14 (1991) → Depressive Tendencies age 15 (1992)	0.37***	0.09	0.42***	0.11
Global negative self-esteem age 15 (1992) → Depressive Tendencies age 18 (1995)	0.12	0.07	0.13	0.08
Global negative self-esteem age 18 (1995) → Depressive Tendencies age 21 (1998)	0.12	0.07	0.14	0.08
Global negative self-esteem age 21 (1998) → Depressive Tendencies age 23 (2000)	0.13	0.23	0.13	0.22
Depressive Tendencies age 13 (1990) → Global negative self-esteem age 14 (1991)	0.11	0.17	0.07	0.11
Depressive Tendencies age 14 (1991) → Global negative self-esteem age 15 (1992)	0.11	0.17	0.09	0.14
Depressive Tendencies age 15 (1992) → Global negative self-esteem age 18 (1995)	0.20*	0.08	0.18*	0.07
Depressive Tendencies age 18 (1995) → Global negative self-esteem age 21 (1998)	0.20*	0.08	0.24*	0.10
Depressive Tendencies age 21 (1998) → Global negative self-esteem age 23 (2000)	-0.17	0.21	-0.19	0.23
<i>Correlations coefficients</i>				
Global negative self-esteem age 13 (1990) ↔ Depressive Tendencies age 13 (1990)	0.43***	0.05	0.79***	0.04
Global negative self-esteem age 14 (1991) ↔ Depressive Tendencies age 14 (1991)	0.54***	0.05	0.95***	0.03
Global negative self-esteem age 15 (1992) ↔ Depressive Tendencies age 15 (1992)	0.34***	0.04	0.63***	0.05
Global negative self-esteem age 18 (1995) ↔ Depressive Tendencies age 18 (1995)	0.52***	0.05	0.78***	0.04
Global negative self-esteem age 21 (1998) ↔ Depressive Tendencies age 21 (1998)	0.37***	0.05	0.86***	0.03
Global negative self-esteem age 23 (2000) ↔ Depressive Tendencies age 23 (2000)	0.35***	0.05	0.87***	0.03
Global negative self-esteem RI ↔ Depressive Tendencies RI	0.22***	0.04	0.90***	0.03

Note. RI = random intercept, SE = standard errors. *** $p < .001$, ** $p < .01$, * $p < .05$.

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