Associations between perceived somatic symptoms and mental health after Roux-en-Y gastric bypass: A 3-year prospective cohort study

Ingela Lundin Kvalem, PhD[1]

Silje Bårdstu, PhD[2]

Irmelin Bergh, PhD[3]

Thomas Nordvik, MPhil[4]

Stephanie Sogg, PhD[5, 6]

Tom Mala, PhD[7]

[1] University of Oslo, Oslo, Norway

[2] Norwegian Institute of Public Health, Oslo, Norway

[3] Netlife Design, Oslo, Norway

[4] The Office of Children, Youth, and Family Affairs, Oslo, Norway

[5] Massachusetts General Hospital Weight Center, Boston, Massachusetts

[6] Harvard Medical School, Boston, Massachusetts

[7] Department of Gastrointestinal and Pediatric Surgery, and Department of Endocrinology, Morbid Obesity and Preventive Medisin, Oslo University Hospital, Oslo, Norway

Corresponding author: Ingela Lundin Kvalem, Dept. of Psychology, University of Oslo, PB 1094, Blindern, N-0317 Oslo, Norway

Phone: +47262596, Fax: +4722845001, e-mail: i.l.kvalem@psykologi.uio.no

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Abstract

Background

Preoperative anxiety, and to some extent depression, predict the perceived impact of somatic symptoms (such as dumping, pain, and fatigue) one year after Roux-en-Y gastric bypass (RYGB). Negative attention to and interpretation of somatic symptoms may thus be associated with post-operative changes in affect.

Objectives

The aim of this study was to explore whether preoperative anxiety and depressive symptoms predicted the perceived impact of somatic symptoms three years after RYGB. Secondly, we aimed to examine the three-year trajectory of depressive and anxiety symptoms, and their interaction with perceived somatic symptoms postoperatively.

Setting

University hospital.

Methods

Pre-surgery, 1-, and 3-years post-surgery data were collected from 169 participants (62.4% follow-up). A cross-lagged, autoregressive regression analysis was employed to examine the mutual interaction of trajectories over the follow-up period.

Results

Fatigue (30.8%) and dumping (23.7%) were common high-impact symptoms three years postoperatively. Pre-surgery anxiety was associated with higher impact of fatigue ($p<.001$), pain ($p<.001$), and diarrhea ($p<.001$), while pre-surgery depressive mood was related to reporting higher impact of diarrhea ($p<.01$) at 3-year follow-up. Higher anxiety/depression symptoms were related to higher perceived total symptom impact at one and three years postoperatively, controlling for percent total weight loss. Higher impact of somatic symptoms

at one-year post-surgery predicted a significant increase in depressive symptoms 3-years post-surgery.

Conclusion

Higher perceived total symptom burden (pain, fatigue, dumping, diarrhea, and vomiting) at one-year post-surgery predicted increase in depression over the next two years. The results underscore the importance of managing somatic symptoms after surgery to prevent patients' distress.

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Keywords: symptom perception, gastric bypass, prospective study, mental health

Highlights:

- The most common somatic symptoms at 3 years after RYGB were fatigue and dumping
- Pre-surgery mental health predicted impact of somatic symptoms 3 years after RYGB
- High symptom burden at 1 year predicted increased depression the next 2 years

Somatic symptoms and side effects, like fatigue, dumping, and abdominal pain, are common and often catalyzers for patients to seek help or hospitalization after bariatric surgery [1, 2, 3, 4].

We previously found that preoperative anxiety (and depressive mood) were associated with dumping, fatigue, and pain one year after Roux-en-Y gastric bypass (RYGB)[5]. This is supported by studies showing that pre-surgical negative affect was related to pain perception shortly after surgery[6] and influenced pain one to three years postoperatively[7].

Negative affect might increase detection of and selective attention to bodily sensations, symptom sensitivity, and influence how symptoms are interpreted and reported[8, 9]. Thus, changes in negative affect may influence the perception of somatic symptoms after RYGB. To our knowledge, no study has prospectively investigated possible bidirectional associations between affect and somatic symptoms after RYGB.

Anxiety and mood disorders are higher in bariatric than in other surgical populations[10]. Prospective studies have generally reported substantial reduction in self-reported depressive symptoms that tend to level out after the 2-year weight loss peak[11-13]. However, long-term studies have indicated a rebound in depressive symptoms approaching pre-surgery levels after 6-9 years[11, 12], possibly a result of weight regain[11, 14]. Although some studies report a slight decrease in anxiety symptoms early after RYGB[12], the general impression is that anxiety symptoms remain stable after surgery[13, 14].

Moreover, research showed that patients reporting higher levels of anxiety or depression at baseline also experienced higher impact of symptoms, such as dumping, one year after surgery[5]. Dumping usually levels off following the first year, while symptoms like abdominal pain and fatigue tend to last longer[1, 4, 15]. Gastrointestinal symptoms, pain, and fatigue are often ambiguous, and thus more susceptible to psychological influences and

previous illness experiences[9, 16]. Knowing whether somatic symptom impact is related to changes in patients' distress levels can help clinicians to focus their efforts and resources in post-surgical consultations.

The aim of this study was to explore whether preoperative anxiety and depressive symptoms predicted perceived impact of somatic symptoms three years after RYGB. Secondly, we aimed to examine the three-year trajectory of depressive and anxiety symptoms, and their interaction with perceived somatic symptoms postoperatively.

Material and methods

Participants and procedure

Participants in this study were recruited at the Center for Morbid Obesity and Bariatric Surgery at Oslo University Hospital between February 2011 and September 2013[17]. Out of 506 eligible participants, 302 signed an informed written consent and completed a questionnaire, 271 of these underwent RYGB. The final study sample consisted of 169 participants (62.4% follow-up) who responded to all questionnaires: baseline (T1), one year (T2), and three years (T3) postoperatively.

The Regional Ethics Committee for Medical Research approved the study protocol.

Measures

"*Symptom perception*" refers both to the reported number and perceived impact of symptoms, measured at T2 and T3. The question: "Have you experienced any side effects/changes after the operation that affect your eating behavior or physical activity?" was followed by 11 side effects (symptoms) and expected changes that may impact behavior postoperatively. Only symptoms commonly considered aversive were retained in this study: fatigue, pain, dumping, diarrhea, constipation, heartburn, and vomiting. Four typical post-RYGB changes that patients experience as positive or desirable were excluded: feeling full

quickly, not desiring food, increased hunger, and change of taste. For each symptom, participants rated the impact: (1) No, (2) A bit, (3) Some, (4) Quite a lot, (5) Much, (6) Extremely much. The mean value for *total impact of symptoms* was computed. The response for each symptom was also grouped into three categories: No symptoms (1), Some impact of symptoms (2-3), and High impact of symptoms (4-6).

Number of symptoms. This was the sum of all responses after being re-categorized as absence (0) or presence (1) of each symptom (presence = reported impact rating ≥ 2).

Anxiety and depressive symptoms. The Hospital Anxiety and Depression Scale (HADS)[18], was used to measure negative affect. Two 7-item separate subscales for anxiety and depression (response scale 0–3) were added separately (total score ranged from 0–21). A higher total score reflected more symptoms. Cronbach's alpha for T1, T2, and T3 was .84, .84, and .84 for anxiety, and .76, .76, and .77 for depressive symptoms.

Sociodemographic variables included gender, marital status (married/partner vs. single), education level (high/low), and employment status (employed/on sick leave/on disability).

Weight/Body Mass Index (BMI) was measured at the hospital at all time points. Weight loss was calculated as percent total weight loss (%TWL) and percent excessive BMI loss (%EBMIL)[19].

Statistical Analyses

Mean group differences were tested by analysis of variance (ANOVA). Analyses in the framework of structural equation modeling (SEM) were conducted using Mplus Version 7.3 [20]. Full information maximum likelihood estimation was used to handle missing data [21]. Confirmatory factor analyses (CFA) were performed to construct latent depression, anxiety, and symptom perception factors based on their observed indicators (i.e. items) at each time point. Tests were performed to determine whether the same observed indicators would relate

to their corresponding latent depression, anxiety, and symptom perception factors in the same fashion across all waves (i.e., measurement invariance over time)[22]. The fitness of these measurement models was evaluated by the Chi squared test (χ^2), root mean square error of approximation (RMSEA), comparative fit index (CFI), and the Tucker-Lewis index (TLI) statistics [23]. Development of depression and anxiety over time was tested by constructing second-order latent growth curve models for each construct based on their latent factors at each time point[24]. Two parameters for each construct were estimated; the *intercept*, representing the estimated baseline levels of depression and anxiety at T1, and the *slope*, representing estimated rate of change over time.

Finally, to test the nature of associations between the latent variables, that is depression and anxiety, and the latent symptom perception across time points, an autoregressive cross-lagged panel model approach was used. In this model, stability estimates within the variables (e.g. time1 to time2, time2 to time3, etc), within-time correlations between the variables at each time point, and cross-lagged effects between variables across time points were estimated.

Results

The study sample (n=169) included 77.5% women. Mean age was 45.2 years (SD=9.3). Mean preoperative weight and BMI were 124.3 kg, (SD=20.5) and 44.5 kg/m^2 (SD=5.6) respectively. At T3, mean weight was 89.8 kg (SD=17.0) and BMI was 31.1 kg/m^2 (SD=5.4). Mean %TWL at T3 was 27.8% (SD=8.9) and mean %EBMIL was 71.3% (SD=22.3).

The mean number of somatic symptoms reported at T3 was 3.9 (SD=1.7), and the two most common high-impact symptoms were fatigue (30.8%) and dumping (23.7%) (Table 1). Participants on sick leave reported higher numbers of symptoms, and higher impact of fatigue, pain, dumping (all $p<.01$), and vomiting ($p<.05$), compared to working participants, and

higher impact of constipation ($p<.01$) than both working participants and those on disability. There were no differences in total number of perceived symptoms postoperatively with regard to gender, education, or marital status. %TWL was not associated with any of the three symptom variables at T3.

Higher preoperative anxiety was associated with reporting more symptoms at T3 ($p<.01$), and higher impact of fatigue ($p<.001$), pain ($p<.001$), and diarrhea ($p<.001$). Higher preoperative depressive symptoms were related to reporting higher numbers of somatic symptoms at T3 ($p<.05$) and higher impact of diarrhea ($p<.01$) (Table 1).

Results of the CFA identified both latent depression and anxiety factors based on all their indicators for each time point, while the latent symptom perception factor only accounted for five (pain, fatigue, dumping, diarrhea, and vomiting) out of the seven symptom indicators, which then excluded constipation and heartburn from the remaining analyses. Results also showed good model fit regarding measurement invariance over time for the three latent factors.

For the growth trajectory of anxiety, there was significant individual variability in participants' average intercept levels at T1 ($i=.58$, $p<.01$), indicating that individuals differed in their anxiety scores at baseline. However, the slope factor was not significant, indicating that across individuals, the average level of anxiety remained stable over time. For depression, there was no significant individual variability in participants' average depression intercept levels, indicating that participants started with a similar level of depression at baseline. However, the slope factor indicated that average depression levels decreased with .12 standard deviations per year ($p<.01$). Higher levels of depression at baseline were also significantly associated with a smaller decrease in average depression levels over time ($r=.15^{*}$, $p<05$).

The cross-lagged, autoregressive regression analysis between anxiety/depression symptoms and impact of somatic symptoms illustrates how the latent variables mutually interacted over the 3-year period, controlling for %TWL (Figure 1 and 2). Results mainly showed the presence of concurrent associations between symptom perception and both anxiety and depression symptoms, with higher anxiety/depression being related to higher perceived impact of somatic symptoms at both T2 and T3. In contrast, results only yielded a few prospective paths. Notably, besides the observed stability in post-surgery anxiety/depression and symptom perception, results also showed that reporting higher impact of somatic symptoms at T2 predicted a significant increase in depressive symptoms the next two years (Figure 2).

Discussion

This was the first prospective study to examine how anxiety and depression symptoms related to people's perceived impact of somatic symptoms over three years after RYGB. Our results showed that dumping and fatigue were the most commonly reported symptoms at one[5] and three years postoperatively, and are also frequent in other studies[1, 25]. Preoperative anxiety was associated with several somatic symptoms three years after surgery, while the bivariate associations with depressive symptoms were less apparent. Participants on sick leave, compared to those working, reported a higher number, and higher perceived impact of most somatic symptoms. Sick leave prevalence tended to decrease after surgery, but persisting symptoms/comorbidity has been related to more clinical consultations[1], thereby increasing the probability of sick leave.

The CFA revealed covariance among five somatic symptoms: pain (not specified), fatigue, dumping, diarrhea, and vomiting, which indicated how impact from these symptoms on health behavior is similarly perceived. Studies have found that such symptom clusters (observed or inferred) may share a common etiology and mechanism, and are present in

various medical conditions[26]. The symptom cluster in the present study was highly stable postoperatively, perhaps caused by a lack of improvement in these symptoms, or because the symptoms were ambiguous and thus more vulnerable to interpretation.

Anxiety/depression were bidirectionally associated with higher somatic symptom burden at both T2 and T3 (controlling for previous levels) in the cross-lagged model. The Symptom Perception Hypothesis suggests that negative affect influences if and how symptoms are perceived[8]. The Disability Hypothesis, however, proposes that illness and health problems predict negative affect, especially when symptoms are recurring, painful, and interfere with functioning[8]. This last hypothesis might explain why higher perceived symptom impact one-year post-surgery predicted an increase in depressive symptoms two years later, even while controlling for previous levels of depressive mood and %TWL.

A higher symptom burden, either perceived or real, may increase depressive symptoms via different pathways. In various types of surgical procedures, unmet outcome expectations have been associated with more depression[27]. Alongside the expected weight loss, RYGB patients might expect symptom relief in general, and better physical function. If symptoms remain - or new ones emerge - several years postoperatively, this may lead to disappointment and a feeling of hopelessness. Rumination, a type of emotion-focused coping with a repetitive focus on possible causes and consequences of ambiguous symptoms, has been found to predict the severity of depressive symptoms[28].

The trajectory of self-reported anxiety symptoms remained stable over the 3-year course of this study, while there was a significant decrease in depressive symptoms, corroborated in several prospective studies[11, 13, 14]. Possible explanations are reduced distress due to massive weight loss, reversal of insulin resistance, deactivation of inflammatory pathways, and normalization of HPA axis functioning[13]. Karlsson et al.[14] found that depression changed in parallel with weight loss and regain, and Mitchell et al.[11] observed a

correlation between BMI and depression trajectories among patients with depression. Our finding of increased depression when symptom impact is perceived as high, suggests that somatic symptoms may also play a role in the rebound of depressive symptoms found in long-term studies (e.g.[11]), and in the continued or increased post-surgical use of antidepressants reported in register-based studies[29, 30].

Addressing health anxiety, e.g. by training patients to re-interpret bodily signals, could be helpful in both pre- and postoperative counselling. Our results also underscore the importance for clinicians to more aggressively target somatic symptoms, including teaching coping methods, in follow-up consultations to prevent increased depression.

Study limitations include lack of baseline information regarding somatic symptoms and the association with negative affect. Due to the wording of the symptom question, it was not apparent when exactly a given symptom was experienced. However, the fact that being on sick leave coincided with higher reporting of impact on several symptoms, indicated that the symptoms were present when responding. Answering a long list of symptoms might in itself lead to an over-exaggeration of symptoms. Study strengths include the prospective design and in-depth analyses of symptoms. The positive aspect with the single center design was the comparable surgical procedure and management, but the external validity may be reduced. High attrition rates are a problem in long-term evaluations, but our follow-up rate of 62.4% seems acceptable in this context.

Conclusions

This prospective cohort study found an association between mental health problems and perceived somatic symptoms three years after RYGB. The main finding was that higher perceived symptom impact one-year post-surgery predicted an increase in depressive mood two years later. The findings underscore the importance of assessing and managing somatic symptoms after RYGB surgery to prevent further distress.

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Table 1. Descriptive statistics of perceived impact of somatic symptoms three years after Roux-en-Y gastric bypass (RYGB). Correlations (Pearson´s r) between mental health before and somatic symptoms three years after RYGB

3 years after RYGB						Mental health before RYGB	
		Impact of symptoms					
		No symptom	Some impact of symptom[1]	High impact of symptom[2]	Mean impact of symptom	Anxiety symptoms	Depressive symptoms
Impact of specific symptom	n	%	%	%	Mean (SD)	*r*	*r*
1.Fatigue	169	22.5	46.7	30.8	2.86 (1.54)	.290***	.109
2.Pain	167	40.8	44.4	14.8	2.14 (1.34)	.287***	.125
3.Dumping	168	4.1	72.2	23.7	2.80 (1.14)	.124	.027
4.Diarrhea	168	38.5	45.6	16.0	2.21 (1.34)	.360***	.209**
5.Constipation	169	50.3	37.9	11.9	1.98 (1.36)	.029	-.080
6.Vomiting	169	72.8	22.5	4.7	1.48 (1.04)	.112	.071
7.Heartburn	168	78.7	19.5	1.8	1.34 (0.73)	.103	.084

Note: [1]Some impact of symptom = “A bit/ Some”;

[2]High impact of symptom = “Quite a lot/ Much/ Extremely much”;

* = p < .05, ** = p < .01, *** = p < .001; SD = Standard deviation; r = correlation coefficient (Pearson`s r)

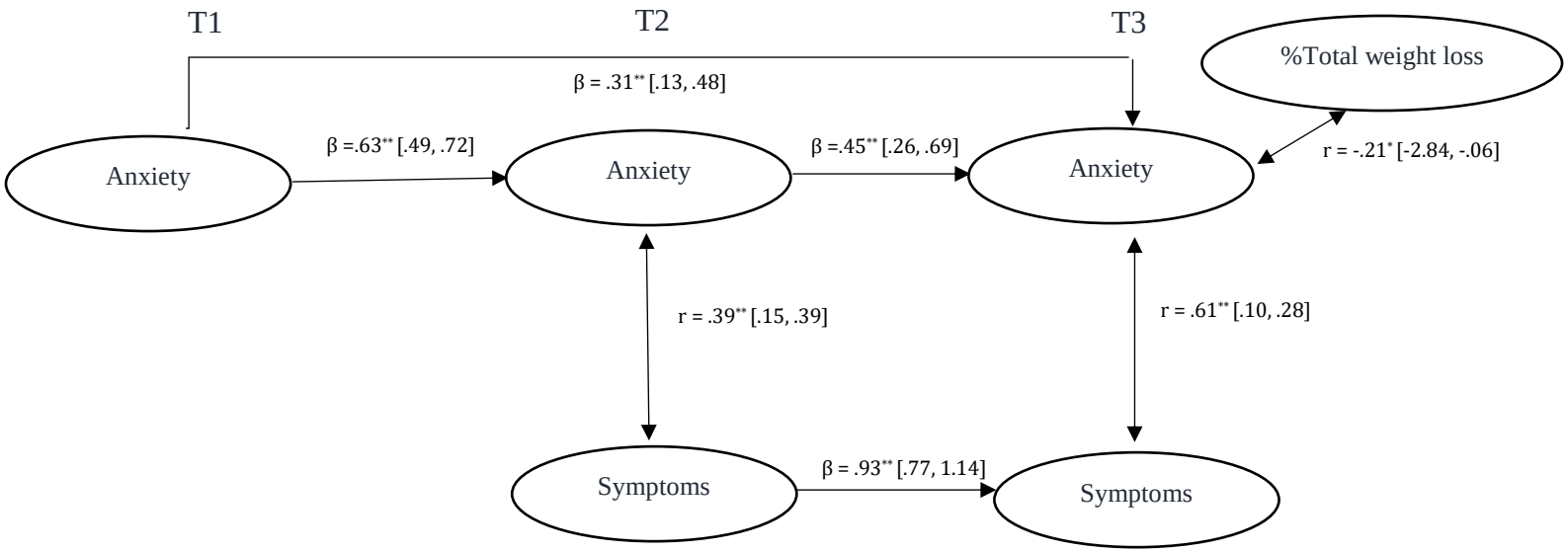

Figure 1

Cross-lagged, autoregressive (i.e., bidirectional) associations between *depression* and *symptom perception* across baseline (T1), one year (T2), and three years (T3) postoperatively, controlled for %TWL at T3. For simplicity, only the latent factors and the significant pathways are shown in the model.

Note: %TWL = percent total weight loss; r = the correlation coefficient measures the strength of the association between the two variables at T2 and T3, respectively; β = Standardized beta coefficient indicates the strength of a relationship between a given predictor and the outcome in a standardized form (making it possible to compare the independent variables: the higher the absolute value of the beta coefficient, the stronger the effect).

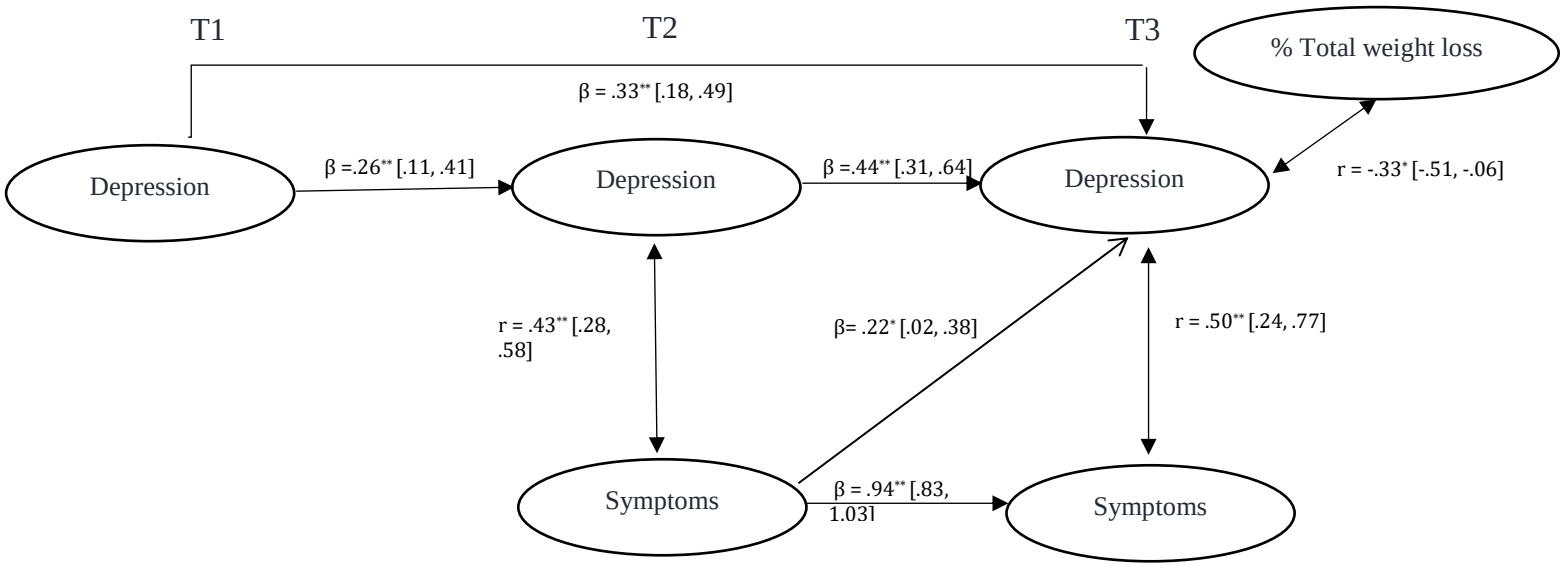

Figure 2

Cross-lagged, autoregressive (i.e., bidirectional) associations between anxiety and somatic symptom perception across baseline (T1), one year (T2), and three years (T3) postoperatively, controlled for %TWL at T3. For simplicity, only the latent factors and the significant pathways are shown in the model.

Note: %TWL = percent total weight loss; r = the correlation coefficient measures the strength of the association between the two variables at T2 and T3, respectively; β = Standardized beta coefficient indicates the strength of a relationship between a given predictor and the outcome in a standardized form (making it possible to compare the independent variables: the higher the absolute value of the beta coefficient, the stronger the effect).

Table S1:

Difference in total mean perceived impact of somatic symptoms 3 years post-surgery between gender, education, and relationship status groups (t-test).

	Total impact of somatic symptoms				
	M	SD	n	t	p
Women	2.12	0.77	144		
Men	2.05	0.72	39	-0.54	.59
Low education	2.12	0.82	131		
High education	2.04	0.59	50	-0.60	.55
Married	2.02	0.78	81		
Single	2.17	0.78	99	1.35	.18

Note: M = Mean; SD = Standard deviation; t = Student´s t-test; p = p-value

Table S2:

Developmental trajectories for anxiety and depression across T1-T3

Model	Mean (i)	Variance (i)	Mean (s)	Variance (s)	r (i s)	χ^2	*df*	RMSEA	CFI	TLI
1. Anxiety	.00	.58**	-.004	-.01	.03	277.73	190	.039	.97	.96
2. Depression	.00	.16	-.12**	-.07	.15*	363.3	187	.056	.88	.87

Note. i = intercept; s = slope; * p <.05, ** p <.01. Means of the intercept were specified to 0. r (i s) = correlation between intercept and slope; χ^2 = Chi squared test; df = degrees of freedom; RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index