Journal of Psychiatry & Mental Disorders

Open Access

Austin Publishing Group

Research Article

Adolescent Patients with Eating Disorders at an Outpatient Clinic: Structural Relationship between Attachment Style (ASQ), Perceived Self-Image (SASB), BMI, and CGAS before and after Treatment

Björn A Wahlund[1]*, Christina ME Gezelius[2] and Britt M Wiberg[3]

[1]Department of Clinical Neuroscience, Karolinska Institute, Stockholm, Sweden

[2]Department of Children and Youth Psychiatry, Falun Hospital, Falun, Sweden

[3]Department of Psychology, Umeå University, SE-901 87 Umeå, Sweden

***Corresponding author:** Björn Wahlund, Department of Clinical Neuroscience, Karolinska Institute, Stockholm, Höga vägen 85, SE-272 92 Simrishamn, Sweden

Tel: +46706872070;

Email: wahlund.bjorn@gmail.com

Received: May 01, 2025

Accepted: May 15, 2025

Published: May 19, 2025

Abstract

The aim of this clinical longitudinal study on adolescents with Eating Disorders (ED) was to further explore the data using a multivariate statistical method, known as path analysis, and to apply theoretical hypotheses to our results. Two psychological self-report instruments, ASQ and SASB, measuring attachment style and perceived self-image, respectively, and two clinical outcome measures BMI and CGAS, have been used before and after treatment at an intensive outpatient program. In our two earlier publications, we found significant changes in the insecure attachment style towards secure, especially in *Need for Approval* (ASQ4), and improvements in several of the SASB scales, especially in *Self-love* (SASB3). The changes, indicated by Δ (delta), these variables were also found to be related to the outcome variables: ΔASQ4 is related to an increase in weight gain (BMI) but not to well-being (CGAS). As a result of this third study, we found several alternative solutions with path analysis. One of the best models included ΔBMI as the dependent and ΔASQ4 as the independent variable, and *Self-affirmation* (ΔSASB2), *Self-love* (ΔSASB3), *Self-blame* (ΔSASB6), and *Self-neglect* (ΔSASB8) as mediators. All criteria for an acceptable model were fulfilled. It is interpreted as the negative self-image becomes more positive by a more secure attachment and promotes weight gain. In another model rise in *Self-love* (ΔSASB3) seems to be the most important variable predicting an increase in CGAS. The path analysis showed that *Self-neglect* (ΔSASB8) was a mediator and significantly influenced the whole model. The conclusion is that path analysis can be used as a complement to validate earlier results from different self-report instruments and demonstrates how they may be combined with both this multivariate statistical technique and theoretical assumptions. The result underlines the importance of a relational perspective in the treatment of ED adolescent patients, who need to have a safe base and the treatment to be ongoing for a relatively long time to enable new ways of relating, developing a positive self-image and leaving the ED as an emotion regulator and attachment figure.

Keywords: Eating Disorders; Clinical study; Path analysis; ASQ; SASB

Abbreviations

ASQ: Attachment Style Questionnaire; BMI: Body Mass Index; CGAS: Children´s Global Assessment Scale; ED: Eating Disorders; SASB: Structural Analysis of Social Behavior.

Introduction

Eating Disorders (EDs) are a great suffering for the patient and the family. From many studies and clinical experience, we know that genetic, temperamental, and social aspects play a role in causing EDs [1]. Communication and relationships are central to human beings and contribute to shaping life and personality. Attachment theory offers theoretical and empirical models that explain relationships and adult functioning [2,3]. According to this theory, children develop certain expectations about themselves and others based on their experience of communication with their caregivers. This lays the foundation for the development of IWM (*Internal Working Models*) [2], which influence psychological functioning and can be categorized in different attachment styles. The capability for both proximity and separation expand, and both positions gradually get fully accepted in a stable and balanced way. Secure attachment promotes the ability to identify and describe emotions and to regulate them, so-called *mentalization*. Even though it is an innate human capacity, it takes considerable environmental input to be fully developed. If the individual´s capacity to mentalize is exceeded, and the ability to understand the intentions behind actions from self and others breaks down, the sensitive individual - often insecurely attached - is vulnerable in communicating through action instead of words, even towards oneself, so-called *somatization* [4]. ED patients are found to have mainly an insecure attachment [5,6] with difficulties in

Citation: Björn A Wahlund, Christina ME Gezelius, Britt M Wiberg. Adolescent Patients with Eating Disorders at an Outpatient Clinic: Structural Relationship between Attachment Style (ASQ), Perceived Self-Image (SASB), BMI, and CGAS before and after Treatment. J Psychiatry Mental Disord. 2025; 10(1): 1081.

emotion regulation and mentalization and a perceived negative self-image, formed in the relational context [7-11]. Lacking good ways of handling distress and negative feelings, they attack and control themselves and their bodies to endure momentarily, but a negative self-image develops. It seems to be a driving force for EDs, when found that improving self-image is essential to reduce ED-psychopathology [10,11].

Our longitudinal clinical study is based on a theoretical model for the treatment of adolescents with ED and their parents with a focus on attachment style, measured with the Attachment Style Questionnaire (ASQ) and perceived self-image, measured with the self-report questionnaire Structural Analysis of Social Behavior (SASB). Self-image is defined as one´s mental model of oneself. We have earlier published two papers on this study [6,10], before and after treatment together with the outcome measures; weight gain (BMI) and well-being (CGAS). In the first study [10] we found significant changes in several of the SASB-clusters. The perceived self-image turned from negative to positive with higher *Self-love* (SASB3) and lower *Self-blame* (SASB6).

A positive correlation between change in SASB3 and in the significant increase of CGAS after treatment was found, but not to BMI. Increased *Self-love* was an important factor, explaining a variance of 26%. In the second study [6], we found adolescent patients scoring high on the Insecure/Anxious-related attachment scale, especially *Need for Approval* (ASQ4) before treatment, and they had a significant decrease in ASQ4 after treatment. The change was related to one of the outcome variables: a significant increase in weight gain (BMI) but not to the rise of well-being (CGAS). In summary, we found that this treatment model had a positive impact on attachment security and perceived self-image, respectively related to significant increases in BMI and CGAS.

In this third current study, we want to demonstrate and deeply evaluate how attachment style and perceived self-image interplay and how these aspects may statistically affect the outcome variables BMI and CGAS. Since our studies have a small sample, we also would like to see if the instruments with many factors change coherently, and in line with theory, to further validate our findings. For these purposes, we apply path analysis. This statistical method makes it possible to study the direction of the correlations and many intercorrelated variables as in multiple regression. Moreover, by resampling using a bootstrapping method, we increase the sample size to n=5000 and can calculate maximum likelihood estimates.

Aims

The main aim of the current study is to further study changes in various measures before and after the treatment of adolescent ED patients by applying path analysis. Path analysis and bootstrapping allow us to study potential relationships between many variables at a time and to find the direction of relations between the studied variables in order to strengthen the validation of the treatment effect despite the small sample size. Another aim is to get a deeper understanding of the consequences of the treatment according to attachment style (ASQ), perceived self-image (SASB), weight gain (BMI), and well-being (CGAS), and to apply theoretical perspectives from especially attachment theory and interpersonal theory.

Objectives

Our intention is to find possible path analysis models, considering the interchange and direction between attachment style (ASQ) and perceived self-image (SASB) related to the clinical symptoms of weight gain (BMI) and well-being (CGAS), and to apply theoretical concepts to these results to get a deeper understanding of the given treatment.

Materials and Methods

The Context of the Treatment and the Setting of the Study

A specialized outpatient clinic, from which this study originates, was established within the Children and Youth Psychiatric Clinic in a medium-sized Swedish town as a day-care unit. The background was that the acute inpatient wards at the central hospital (psychiatric and pediatric) and the five psychiatric outpatient clinics in the region experienced problems in meeting adolescents with ED psychopathology desirably and successfully. The patients were often stuck in one of the units, and families and staff felt powerless and irresolute.

As a center for the treatment of adolescent ED patients and their families and for the evaluation and development of the care this specialized unit was established. It was prepared to hold on during the whole treatment process, even if other interventions were needed temporarily, like hospitalization. The unit should also assist during gradual moving back to the outpatient clinic, if there was comorbidity and need for a long-term follow-up. A clear, well-documented plan was set up, step-by-step throughout the treatment. Regular checkups, somatic and psychological, could change the pace of the plan according to the needs of the individual patient and her/his family, who had their own mini team; one therapist, and two staff members.

Initially, the treatment was concentrated on connecting with the patient and her/his parents to establish good regular eating habits at the day-care unit and to handle anxiety after meals to attain full nutrition. Parents were instructed to apply the same routines at home. In the beginning, the patient spent every weekday at the clinic and thereafter with diminishing frequency merely as outpatients. The days were structured with four meals, resting by lying down twice, and calm activities. The two staff members of the patient's mini team were close and communicating during the day and served as support and role models. When the acute somatic phase was over, a new therapeutic contract was signed. Based on psychodynamic and attachment theories, family therapy - and individual therapy when needed - was given together with cognitive elements. No manuals were used. The initial self-reports of the family were of good help. Joint tutorials were given a whole day every month to all personal categories, and evaluation and special training were held every 11th week. This intensive outpatient program had a duration of 16 ± 2 months (mean ± standard error of the mean [SEM]).

Study Design

The current study has an observational cohort design. "Research-quality naturalistic data" [12] were used, based on a clinical sample of ED adolescent patients and their parents without a control group. The naturalistic design shows how complex the context was. The patients received treatment according to the above account in the intensive

outpatient program and were included in the research study between May 2004 and May 2010, just a few patients in the beginning when the unit was set up.

Participants

The final research sample included 33 patients (3 boys and 30 girls) between 12 and 17 years, mean age of 15.6 ± 0.7 years (mean ± standard error of mean [SEM]) at admission. The distribution of diagnoses by using DSM-IV-TR (APA, 2000) [13] was as follows; Anorexia Nervosa (AN) (n=19; 58%), Eating Disorders Not Otherwise Specified of anorectic type (EDNOS-AN) (n=14; 42%).

Measures

The Attachment Style Questionnaire (ASQ) [14] is a psychometric self-report instrument for measuring attachment styles among adolescents and adults based on attachment theory [2,3]. The ASQ was developed to capture common themes in attachment theory, such as dependence, trust, and self-reliance, and to assess attachment styles in relationships in general. ASQ is suitable for people with limited experience in romantic relationships and comprises five scales: *Discomfort with Closeness* (ASQ1) and *Relationships as Secondary* (ASQ2), measuring Insecure/Avoidant-related attachment [15], *Confidence* (ASQ3) measuring Secure-related attachment [15], *Need for Approval* (ASQ4), and *Preoccupation with Relationships* (ASQ5) measuring Insecure/Anxious-related attachment [15]. The five ASQ-scales corresponded to Hazan and Shaver´s [16] original three attachment styles: Security, Avoidance, and Anxiety/Ambivalence. The ASQ questionnaire contains 40 items with answers on a 6-point scale, ranging from 1 (totally disagree) to 6 (totally agree). ASQ has high validity and reliability, and a Swedish version of ASQ [17] was used.

Structural Analysis of Social Behavior (SASB) [8,18] was used to assess interpersonal dimensions – perceived self-image (introject) - based on interpersonal theory, circumplex models, and to some extent, attachment theory [19]. The long version of the questionnaire comprises 36 self-referential statements, framed either positively or negatively. The items are constructed to a circumplex model with two orthogonal main axes or vectors, *"Affiliation"* (X-axis) and *"Autonomy"* (Y-axis), containing eight expressions of the two dimensions of the model [20]. These two vectors are composed of eight distinct clusters, which are assigned positive or negative weights according to their position in relation to the intersection of the axes. The SASB-clusters are the following: *Self-emancipation* (SASB1); *Self-affirmation* (SASB2); *Self-love* (SASB3); *Self-protection* (SASB4); *Self-control* (SASB5); *Self-blame* (SASB6); *Self-hate* (SASB7); and *Self-neglect* (SASB8). The items are rated on a scale of 0 (not at all characteristic) to 100 (perfectly characteristic) in 10-point increments, indicating the degree to which each behavior applies. SASB is a widely used research instrument to measure self- and social perception in order to examine both interpersonal behaviors and introjected self-image. SASB is also clinically used to give meaning to symptoms as anxiety, depression, and symptoms in ED-psychopathology.

Children's Global Assessment Scale (CGAS) [21,22] is a tool used in both research and clinical assessment and can be a useful measure of well-being and the overall global functioning and severity of disturbance of patients aged 4-20 years. The scale is continuous, ranging from 1 (the most impaired level) to 100 (superior level of functioning), considering all available information about the child (home, school, friends). The scale is separated into 10-point sections that are headed with a description of the level of functioning and followed by examples matching the interval. The raters identify the lowest level of general functioning and well-being during a specific period. CGAS is a complement to syndrome-specific scales in accordance the distribution of diagnoses by using DSM-IV-TR (APA, 2000) [13]. CGAS was found to be reliable between raters and across time and demonstrated both discriminant and concurrent validity.

Body Mass Index (BMI) is currently used as a measure for defining anthropometric measure in a person's weight in kilograms, divided by the square of the person's height in meters. We used the cut-off points of the World Health Organization [23], where the normal BMI-values increase with the age of healthy children.

Procedure

On the first day of treatment, the SASB- and ASQ questionnaires were administered to both the adolescent patients and their parents. The physical examination of the patients, including weight and height was performed after the questionnaires were completed and then the BMI was calculated. At the second last meeting before the end of the treatment, the same procedure took place. CGAS was performed within two weeks of getting to know the patients and again at the end of the treatment. Child and Youth psychiatrist diagnosed the patients by using DSM-IV-TR [13] at the start and at the end of the treatment. The results of the questionnaires were presented in a dialogue with the family at the last consultation.

Statistical Analyses

In this study, we use what is generally described as path analysis. Path analysis focuses on the estimation and interpretation of the conditional nature (the moderation component) of the indirect and/or direct effects (the mediation component) of X on Y in a causal system. Path analysis is a kind of extension of regression analysis. There is an observed independent variable (X) and a dependent (Y). In the path analysis, we used the difference between the first measurement and the last to quantify the changes. This change is denoted by the Greek letter delta, Δ.

The problem with many research studies is the correlation between the X-variables. Path analysis is a way to solve these problems by decomposing the correlation matrix and constructing new variables, named mediators. From this procedure, we may find new regression coefficients, often called effects. There are direct effects and indirect effects. The direct effect is the regression coefficient between the X and Y variables. Indirect effects are a series of effects between other variables. We selected the X and Y variables as well as mediators based on the results of our two earlier studies [6,10]. All variables were standardized. We used both Macro C by Andrew Hayes (24) implemented in SPSS [25] and the AMOS program [26] to perform the path analyses. The two programs complement each other. AMOS has a graphic interface for constructing path analysis. The AMOS fit model was tested with the Comparative Fit Index (CFI<1; p-values>95) and Root Mean Square Residuals (RSMA, values<0.06). We used Maximum Likelihood Estimates (MLE) to evaluate regression model estimates. We used bootstrapping of the original sample to get large

enough samples to use the MLE method. The number of individuals resulting from bootstrapping was 5000. We set the significance level to p<0.05 and used 95% confidence intervals.

Results

In our two earlier studies [6,10], we have significant changes in the measured variables: Structural Analysis of Social Behavior (SASB) and Attachment Style Questionnaire (ASQ) on adolescents with ED psychopathology before and after treatment at an intensive outpatient program. As reported in the first paper [10], according to SASB, we found significant changes before and after treatment among adolescents with an ED psychopathology. Significant increases in SASB1 (*Self-emancipation*) (p<0.01), SASB2 (*Self-affirmation*), (p<0.001), SASB3 (*Self-love*) (p<0.001), SASB4 (*Self-protection*) (p<0.05), and significant decreases in SASB6 (*Self-blame*) (p<0.001) and SASB7 (*Self-hate*) (p<0.001) were found. There was a positive correlation between change in SASB3 and CGAS-score, which rose significantly. Increased *Self-love* (SASB3) was an important factor, explaining a variance of 26%. In the second paper [6], according to ASQ, only ASQ4 (*Need for Approval*) of the five attachment scales decreased significantly in adolescents (p<0.01) after treatment, which correlated inversely to the increase in BMI but not to CGAS.

Correlations between ASQ, CGAS, and BMI with SASB-clusters

In Table 1, we present a reduced correlation matrix of changes in variables before and after treatment. As we can see, ΔASQ4 (*Need for Approval*) correlated significantly with the SASB-clusters; ΔSASB2 *(self-affirmation)*, ΔSASB6 *(self-blame*) positively, and ΔSASB7 (*self-hate*) and ΔSASB8 *(self-neglect*) negatively. ΔCGAS correlated with four of the ΔSASB clusters: ΔSASB2 (*self-affirmation*), ΔSASB3 *(self-love*), ΔSASB6 *(self-blame)* and ΔSASB8 (*self-neglect*) as well as the ΔBMI.

In Figure 1, the correlations between all the ΔSASB clusters (1-8) are presented. ΔSASB3 *(self-love*) and ΔSASB8 (*self-neglect)* had the largest number of significant correlations (connections) with other clusters. The result indicates that ΔSASB3 and ΔSASB8 may regulate other ΔSASBs.

Mediation-path Analysis of Hypothetical Path Models

We studied several path models using ΔBMI and ΔCGAS as dependent variables (Y) in each model. Below, we present all path models fulfilling the criteria of a specific path or regression model, which is why we show several models of each outcome variable.

Table 1: Reduced correlation matrix of changes of variables before and after treatment.

	ΔASQ4	ΔBMI	ΔCGAS
ΔASQ4	1		
ΔBMI	0,321*	1	
ΔCGAS	-0,261	0,370*	1
ΔSASB1	-0,311	-0,149	-0,024
ΔSASB2	-0,714***	-0,026	0,438**
ΔSASB3	-0,559***	0,097	0,582***
ΔSASB4	-0,078	0,111	0,202
ΔSASB5	-0,068	-0,071	0,119
ΔSASB6	0,538***	-0,189	-0,312*
ΔSASB7	0,554**	-0,184	-0,252
ΔSASB8	0,543***	-0,141	-0,491**

*Correlation is significant at the level of 0.05 (2-tailed).
**Correlation is significant at the level of 0.01 (2-tailed).
***Correlation is significant at the level of 0.001 (2-tailed).

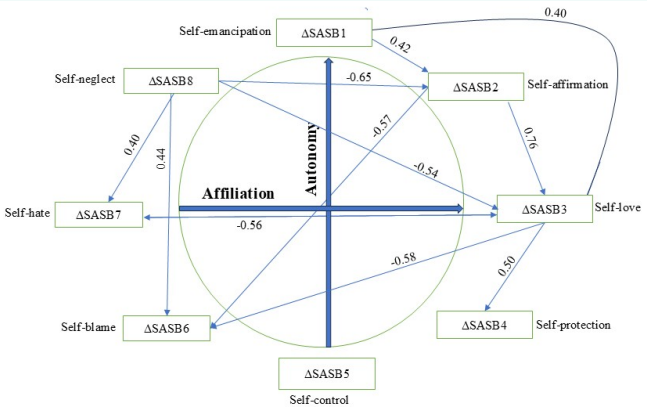

Figure 1: Relationships in the form of correlations between self-image based on the change in clusters of the Structural Analysis of Social Behavior (SASB) model between before and after treatment, Surface 3. The fat arrows indicate the orthogonal relation between the two main dimensions, Affiliation and Autonomy. The thin double arrows indicate a significant correlation between two clusters at a time. The numbers on the lines are the correlation values.

Model 1

ΔASQ4 in relation to ΔBMI: One of the best models is path model 1, according to R-squared (0.475), which is shown in Table 2 and Figure 2. R-squared increased from 0.170 to 0.475 in the full model, including ΔSASB6 (*self-blame*), and ΔCGAS as mediators. ΔASQ4 (*Need for Approval*) had the largest total direct effect (-0.728) on ΔBMI. The ΔCGAS had little direct effect on ΔBMI but contributed to the total direct effect on ΔBMI and on the whole model. The criteria, i.e., CFI and RSMA, had a high degree of model fitting.

Table 2: Path models of relationships between change in ΔBMI (dependent variable Y) related to a change in Need for approval (ASQ4), (independent variable X) and mediated by self-blame (M1=ΔSASB6) and (M2=ΔCGAS). All beta-values are standardized, (Figure 2).

Variables		Model 1							
				X=ΔASQ4	Y=ΔBMI	M1	M2		
				Model Parameters				Model fit	
		R	R2	F	p	df1	df2	CFI	RSMA
		0.689	0.475	7.841	0.001	3	26	1.0	0.0
Standardized Total Effects									
Path				b	SE		p	LLCI and ULCI 95%	
a	ΔASQ4	----->	ΔSASB6	-0.525	0.09		0.001	-1.577	
b	ΔSASB6	----->	ΔBMI	0,567	0.1		0.01	0.024--2.341	
c	ΔSASB6	----->	ΔCGAS	-0,325	0.15		0.01	-0.706	
d	ΔCGAS	----->	ΔBMI	0.28	0,14		0.05	0.509	
e'	ΔASQ4	----->	ΔBMI	-0.427	0,17		0.01	-2.103	
Standardized Direct Effect of X on Y									
				-0.728	0.164		0	-1.087	
Standardized Indirect Effect of X on Y									
Sum of products of									
a*b+a*c*d				0.298				0.039--0.479	

*: Correlation is significant at the level 0.05 level (2-tailed).
**: Correlation is significant at the level 0.01 level (2-tailed).
***: Correlation is significant at the level 0.001 level (2-tailed).
Abbreviations: CFI (Comparative Fit Index), RSMA (Root Mean Squared Error of Approximation). LLCI and ULCI: Lower and Upper Confidence Intervals respectively (95%).
Number of bootstrap samples for percentile confidence intervals: 5000.

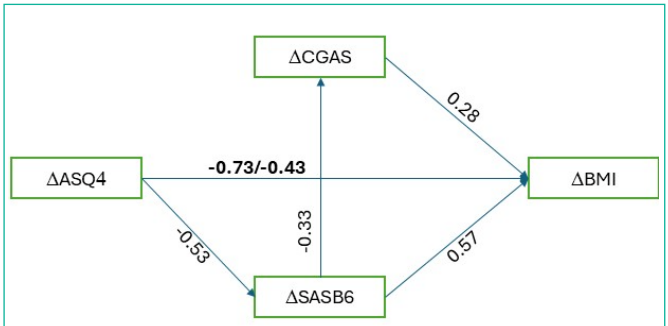

Figure 2: Path model of ΔASQ4 as independent variable (X) and ΔBMI as dependent variable (Y) with ΔSASB 6 and ΔCGAS as mediators. The figure on the lines depicts standardized beta coefficients (direct effects) (see Table 2). To simplify the figure, we used two decimals instead of three, as in Table 2.

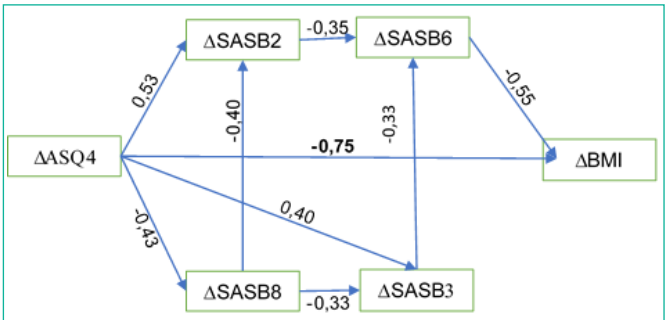

Figure 3: Path model of ΔASQ4 as independent variable (X) and ΔBMI as dependent variable (Y) with ΔSASB2, 3, 6, and 8 as mediators. The figure on the lines depicts standardized beta coefficients (direct effects) (see Table 3). To simplify the figure, we used two decimals instead of three, as in Table 3.

Table 2 shows that all beta coefficients were significant in this model and within the 95% confidence limits. However, the total effect decreased to -0.465, while the significant indirect effect had a reversed sign as compared to the direct effect. This may be caused by the high correlation between ΔASQ4 and ΔSASB6, as shown in Table 2.

Model 2

ΔASQ4 and ΔSASB Clusters as Mediators: In model 2, we initially included all eight ΔSASB clusters as mediators. Path model 2 had a little lower R-squared (-0.459) than path model 1. Only 4 had significant regression coefficients: ΔSASB2 (*self-affirmation*), ΔSASB3 (*self-love*), ΔSASB6 (*self-blame*) and ΔSASB8 (*self-neglect*) as mediators. Model 2 had significant regression coefficients (effects) in the model as well as within the 95% confidence limits. The total direct effect was high, -0.745 (Figure 3). The criteria, i.e., CFI and RSMA, had a high degree of model fitting (Table 3). One interesting finding in this model (see also Figure 1) is how ΔASQ4 and the four changes in ΔSASB-clusters were connected in specific directions and combinations, which will be reflected under "Discussions".

Model 3

ΔSASB3 in relation to ΔCGAS: The overall best model is Model 3, which is shown in Table 4 and Figure 4. This model is based on the strong univariate linear regression models between ΔCGAS and ΔSASB3, as previous findings in the literature SASB1 [18]. Thus, ΔSASB3 *(self-love)* was defined as the X-variable and ΔCGAS as the Y-variable. ΔSASB1 (*self-emancipation*) and ΔSASB 8 *(self-neglect)*, were the only mediators with significant coefficients (effects) in this path model.

The R-square was about half of the explained variance (0.519) in the regression model. The standardized coefficients of the total

Table 3: Path model of relationships between change in BMI (dependent variable) Y) related to change in ΔASQ4 (independent variable X). Significant mediators (M) in the model are self-image-based on ΔSASB2 (Self-affirm, M1), ΔSASB3 (Self-love, M2), ΔSASB6 (Self-blame, M3), and ΔSASB8 (Self-neglect, M4), see also Figure 3. All beta-values are standardized.

Variables, Mediators		Model 2							
		X=ΔASQ4	M1	M2	M3	M4	Y=ΔBMI	Model fit	
					Model Parameters			CFI	RSMA
		R	R2	F	df1	df2	p	1.0	0.0
		0.677	0.459	4.064	5	24	0.01		
Standardized Total Effects									
Path					b	SE	p	LLCI and ULCI 95%	
a	ΔASQ4	----->	ΔSASB2		-0.718	0.154	0	1.585--0.134	
b	ΔSASB2	----->	ΔSASB6		-0,35	0.19	0.05	-0.478	
c	ΔSASB6	----->	ΔBMI		-0.55	0.112	0	-0.661	
d	ΔSASB8	----->	ΔSASB2		-0.397	0.135	0.001	-1.06	
e	ΔASQ4	----->	ΔSASB8		-0.476	0.16	0.01	-1.532	
f	ΔASQ4	----->	ΔSASB3		0.564	0.144	0.01	0.082--1.532	
g	ΔSASB8	----->	ΔSASB3		-334	0.155	0.05	-0.483	
h	ΔSASB3	----->	ΔSASB6		-0.331	0.183	0.05	-0.214	
k'	ΔASQ4	----->	ΔBMI		-0.465	0.134	0	-1.792--0,210	
Standardized Direct Effect			Δ		-0.745				
Sum of products of indirect effects			Δ	Δ	0.28				
axbxc=0.53x(-0.35)x(-0.56)=0.07									
exgxhxc=(0.48)x(-0.33)x(-0.33)x(-0.55)=0.03									
fxhxc=x(-33)x(-0,55)=0.18									

*: Correlation is significant at the 0.05 level (2-tailed).
**: Correlation is significant at the level 0.010 level (2-tailed).
***: Correlation is significant at the 0.0001 level (2-tailed).
Abbreviations: CFI: Comparative Fit Index; RSMA: Root Mean Squared Error of LLCI and ULCI: Confidence Intervals Lower and Upper Percentile Confidence Approximation; LLCI and ULCI, respectively (95%). Number of bootstrap samples for the percentile confidence intervals: 5000.

Table 4: Path models of relationships between change in CGAS (dependent variable y) related to change in self-image (based on cluster 3 of SASB), self-love (ΔSASB3), (independent variable x), and mediated by self-neglect (ΔSASB8) and self-mancipation (ΔSASB1), (see Figure 1). This model has the highest R2 and a very good model fit.

Variables, Mediators		Model 1							
			X=ΔSASB3	M1=ΔSASB1	M2=ΔSASB8	Y=ΔCGAS			
		Model parameters						Model fit	
		R	R2	F	p	df		CFI	RSMA
		0.717	0.514	6.87	0.001	4		1.0	0.0
Standardized Total Effects				Effects					
Path				b	SE		p	LLCI and ULCI 95%	
a1	ΔSASB3	----->	ΔSASB1	0.393	0.092		0.01	0.023 -- 0.411	
b1	ΔSASB3	----->	ΔSASB8	-0.523	0.11		0.01	-0.706	
a2	ΔSASB1	----->	ΔCGAS	-0.307	0,145		0.05	-0.706	
b2	ΔSASB8	----->	ΔCGAS	-0.258	0,171		0.05	-1.103	
c	ΔSASB3	----->	ΔCGAS	0.551	0.092		0.001	0.164 -- 0.631	
Standardized Direct Effect				539					
Standardized Indirect Effect				0.012					
a1xb1				-0.121	0.039			-0,149 -- 0,003	
a2xb2				0.133	0.071			-0,041 -- 0,257	

*: Correlation is significant at the level 0.05 level (2-tailed).
**: Correlation is significant at the level 0.01 level (2-tailed).
***: Correlation is significant at the level 0.001 level (2-tailed).
Abbreviations: CFI (Comparative Fit Index), RSMA (Root Mean Squared Error of Approximation). LLCI and ULCI: Lower and Upper Confidence Intervals respectively (95%).
Number of bootstrap samples for percentile confidence intervals: 5000.

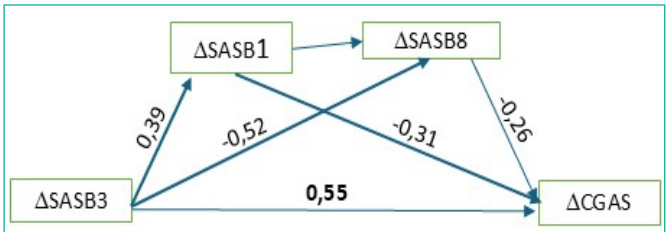

Figure 4: Path model of ΔSASB3 as independent (X) and ΔCGAS as dependent variable (Y) with ΔSASB1 and 8 as mediators. The figure on the lines depicts standardized beta coefficients (direct effects) (see Table 4). To simplify the figure, we used two decimals instead of three, as in Table 4.

effects of beta-coefficients were all significant. Moreover, this model had a very good fit (CFI=1, RSMA=0). The standardized total effect between ΔSASB3 (*Self-love*) and ΔCGAS was 0.539.

The overall best models for the outcome measures were Model 1, Model 2 for the BMI, and Model 3 for CGAS.

Discussion

This paper is the third of a series of papers investigating how perceived self-image (SASB) and attachment styles (ASQ) are related to weight gain (BMI) and well-being (CGAS). The current study is based on the idea that attachment style and perceived self-image are the two main targets for treating adolescent patients with ED-psychopathology to improve weight gain and global functioning of well-being [6,10] before and after treatment at an outpatient clinic. The main aim was to further study changes in various measurements before and after treatment of adolescent ED patients through exploring potential relationships between attachment style (ASQ), perceived self-image (SASB), and the outcome variables weight gain (BMI) and well-being (CGAS). By applying path analysis, it is possible to study potential relationships between many variables at a time and to find the direction of relations between the studied variables. Another aim of our study was to strengthen the validation of the treatment effect by using theoretical perspectives with concepts, especially attachment theory and interpersonal theory.

The two models of *Need for Approval* (ASQ4) (X) and BMI (Y) change both R-squares at approximately the same level. Anyhow, Model 1 (Figure 2) had a very simple structure with ΔSASB6 (*Self-blame*) and ΔCGAS as mediators. The addition of the mediator ΔCGAS is small but has a substantial impact on the R-square of the model. Our findings indicate that a change in Insecure/Anxious-related attachment, especially the the scale *need for Approval* (ASQ4) is related to the change in BMI via changes in *Self-blame* (SASB6) and in CGAS, although the contribution of ΔCGAS was small but significant [18]. Insecure/ Anxious-related attachment has been found in patients with ED psychopathology [5-7]. The SASB-cluster *Self-blame* has also been found to be an important factor in the self-image of ED patients [7,21,28] and could be expected to influence the liability to gain weight (BMI). When the patients become more secure attached their mentalization grows, and self-blame and restrictive eating diminish. Our findings are in line with the previous study by Forsén Mantilla and colleagues [7], who found that Insecure/Anxious-related attachment ASQ4 (X-variable) was related to EDQ (Y-variable) with SASB1 *(Self-emancipation)* and SASB6 (*Self-blame*) as mediators. A major difference is that they used EDQ as a Y-variable and found even SASB1 *(Self-emancipation)* to be a mediator in addition to SASB6 (*Self-blame*). These researchers see how the patients relate to their ED as an *attachment figure*.

According to Bowlby [2], Secure attachment is the key for a child to develop a safe and good relationship with their parents as well as psychological proximity further on–in life. Moreover, according to the interpersonal theory, an interpersonal copy process through the experience of a new attachment-related style can be introjected and change the perceived self-image [19]. Our findings follow both attachment theory [29,30] and interpersonal theory [19,31].

In Model 2, we initially included all eight ΔSASB-clusters as mediators. Only ΔSASB2 (*Self-affirmation*), ΔSASB3 (*Self-love*), ΔSASB6 (*Self-blame*), and ΔSASB8 (*Self-neglect*) had significant regression coefficients (effects) in this model as well as within the 95% confidence limits. The sign was different between the total direct effect (-0.728) and the total indirect effect (+0.298) (Figure 3). This finding

may be explained by the strong correlations between ASQ4 (*Need for Approval*) and ΔSASB2, ΔSASB3, ΔSASB6, and ΔSASB8. Despite the reduced total effect, the total effect was fairly good (0.465). One of the most interesting aspects of this model is how the SASB-clusters form an internal pattern with a certain direction following the ΔASQ4 projection on ΔBMI. Interestingly, ΔSASB8 (*Self-neglect*) is directly connected to ΔSASB2 (*Self-affirmation*), Figure 3. These two SASB clusters represent the *Autonomy axis* and may supervise SASB6 and SASB3, respectively. These directions of relations are calculated in the path analysis and stem from the correlations in Table 1.

Interestingly, ΔSASB6 (*Self-blame*) again has the strongest relation to the outcome variable, weight gain (BMI). Self-blame has been reported to be involved in ED-psychopathology in several studies [7,27,28]. In one of the studies, self-blame was shown to be the only predictor of ED symptoms in a 9-year follow-up study [27]. One major difference between our study and the referenced study is that the outcome variables are different. However, it seems reasonable that diminished Insecure attachment and self-blame are involved in eating and weight gain during the treatment process. Our results support a rather complex model involving eating, weight gain, and improvement in anorectic symptoms. The two outcome variables, BMI and CGAS, may also be related to the theoretical model of the treatment work. Initially, the patient and staff work with basic eating problems, i.e., Insecure attachment and distorted self-image. The measures before and after treatment may catch the dynamics of the treatment process not be found otherwise.

ΔSASB3 (*Self-love*), directed by ΔSASB2 (*Self-affirmation*), affects BMI but also has a major effect on the ΔCGAS, as in Model 3. Thus, self-love is important for improvement during treatment. In one published study, self-love was reported to display substantial power in predicting the outcome of self-image after a 12-month outcome in females with eating disorders [28].

To our knowledge, there is no clinical treatment study of adolescents that reports self-love and its positive effect on the CGAS. It's conceivable that CGAS may be related to ED symptoms. The findings of ΔBMI relating to Insecure attachment and ΔCGAS relating to self-image, measured by ΔSASB, confirm the validity of the study and the effect of the treatment model. The beginning of the treatment was concentrated on connecting with the patient and her/his parents to establish good regular eating habits at the day-care unit and to handle anxiety after meals to attain full nutrition. Based on a new systematic review [32], the researchers found that mealtime assistance provided the patients shows an overall positive effect on eating behavior and dysfunctional attitudes. In our clinical study, based on psychodynamic and attachment theories, family therapy was given together with cognitive elements, and no manuals were used. The two staff members of the patient's mini team were close and communicated during the day and served as supporters and role models. We believe that the initial treatment with a regular schedule of meals and activities is a good help for patients with ED [4-7,10,27,28]. Thus, creating a stable and safe atmosphere around the patient while eating with a competent person, who is listening and talking with the patient, who feels seen and valued. Possibly, the patient becomes attached to the person he/she is working with.

The result underlines the importance of a relational perspective in the treatment of adolescent ED patients, who need to have a safe base and the treatment to be ongoing for a relatively long time. In this study, the treatment was going on for more than one year for adolescents, which is a long time in a teenager´s life. Many daily events with good communication enable new ways of relating, mentalization, emotion regulation and the development of a positive self-image. The people in the team at the outpatient clinic became new attachment figures because of their holding of emotions, containing bad thoughts, and the whole clinic became a "holding environment" where everything could be said and listened to. The professional people had their eyes and ears on their patients, who felt her/his value and meaning in the family and at the clinic. The patient's bad somatic state, failure of mentalization, and difficulties in affect regulation were replaced by emotions and thoughts, as Fonagy and colleagues reflect [33]. Thus, the ED psychopathology is no longer needed as an emotion regulator, attachment figure, or an unsafe haven [7]. This is in line with Monell and colleagues [11], although their patients ranged in age from 16 to 58 years.

Conclusions

The conclusion from this study is that path analysis can be useful as a complement to validate earlier results from different self-report instruments and demonstrates how they may be combined with both this multivariate statistical technique and theoretical assumptions. The results of the path analysis combined with bootstrapping strengthen the validation of the clinical treatment model. Higher total effects are obtained by a considerable increase in the beta coefficients compared to the values in the ordinary least squares equations, reported in our earlier published studies. The original sample increased a lot by bootstrapping. Patterns of change and mutual influence are shown by putting together all obtained values of the measures and using the path analysis. Nytt stycke summarize the theoretical findings of this study, one may express that both improvements in the *Affiliation-Axis* and *Autonomy-Axis* according to the circumplex model of SASB [8] are crucial for the clinical effect on ED-psychopathology. The findings of the self-image confirm how weight gain (BMI) and well-being (CGAS) correlate to the attachment style *Need for Approval* (ASQ4), which also confirms the validity of the study and the effect of the treatment model. The ED-adolescents changed their attachment style to a more secure attachment, and their subsequent positive self-image reflected changes in BMI and CGAS, respectively. Measures before and after treatment have been communicated to the family members and have strengthened the insight of the participants in this treatment model. Developing relations is fundamental and inner change takes time.

Strengths

- Measures of the patients and the parents before and after treatment.
- Significant changes occur towards better health.
- The effect of the treatment model shows that attachment theory and interpersonal theory are good and meaningful approaches in the treatment of adolescents with ED-psychopathology and their families.

- The approach of the staff and the family and individual treatment during sufficient time gives a more secure attachment, a more positive self-image, increased weight, more well-being, and better functioning.
- The statistical findings are in line with theory and validate earlier obtained results.
- The relatively long time for the treatment (16 months) is a long period for teenagers, and adolescents can change to more secure-related attachment and a more positive self-image with support from an engaged staff.

Limitations

- The main limitation concerns the rather small sample size, which was also the reason why the patients were not stratified into different groups according to gender or diagnosis.
- The difference in weight cut-off between anorexia and atypical anorexia is questioned by Monteleone and colleagues [34] when they found that adolescents with atypical AN diagnosis do not differ from those with full AN diagnosis. They may even show greater psychopathology. The patients in our study received the same treatment irrespective of their diagnoses. The fall-off was examined and found with small differences, both in the distribution of diagnoses and patterns of attachment. The long-time-standing result is not at hand, and a follow-up study is eligible. Further studies are necessary to explore more deeply the connection between attachment and self-image.
- Bootstrapping helped in upgrading the sample size. In the lack of ED-specific instruments, BMI, CGAS and DSM were helpful.

Clinical Implications

Attachment theory and interpersonal theory are good and meaningful approaches in the treatment of adolescents with ED-psychopathology and their families, and give a deeper understanding of the participants' communication, its lacks, and its possibilities, when taken into consideration in both individual and family treatment.

Ethical Considerations

Ethical Approval

This study was done in compliance with ethical standards by the Declaration of Helsinki. The ethical approval for this research was granted by the Central Research Ethical Board, Stockholm, Sweden (Dnr Ö 16-2010).

Informed Consent

Informed consent to participate in this research study was obtained from all individual adolescent patients with an ED and from their parents included in the study. The parents signed on behalf of underaged children. We gave assurance that refusal to participate in the study would not compromise the patient's treatment in any way. No incentives were given.

Acknowledgements

We want to thank all parents and children for participating in this study. The current study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The support from the Department of Children and Youth Psychiatry, Falun Hospital, Falun, and the Department of Psychology, Umeå University, Umeå has been important and valuable.

References

1. Thornton LM, Mazzeo SE, Bulik CM. The Heritability of Eating Disorders: Methods and Current Findings. In: Adan, R. A., & Kaye, W. H. (Eds.). Behavioral Neurobiology of Eating Disorders. 2011; 6: 141–156. Springer Science & Business Media.
2. Bowlby JA. A Secure Base: Parent-Child Attachment and Healthy Human Development. New York: Basic Books, Inc. ISBN 0-465-07597-5. 1988.
3. Ainsworth MDS. The Bowlby-Ainsworth Attachment Theory. Behavioral and Brain Sciences. 1978; 1: 436-438.
4. Haynos AF, Fruzzetti AE. Anorexia nervosa as a disorder of emotion dysregulation: Evidence and treatment implications. Clinical Psychology: Science and Practice. 2011; 18: 183-202.
5. Tasca GA. Attachment and eating disorders: a research update. Current opinion in psychology. 2019; 25: 59-64.
6. Gezelius CME, Wahlund BA, Wiberg BM. Relation between increasing attachment security and weight gain: a clinical study of adolescents and their parents at an outpatient ward. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity. 2023; 28: 82.
7. Forsén Mantilla E, Clinton D, Birgegård A. The unsafe haven: Eating disorders as attachment relationships. Psychology and Psychotherapy: Theory, Research and Practice. 2019; 92: 379-393.
8. Benjamin LS. Structural Analysis of Social Behavior. Psychological Review. 1974; 81: 392-425.
9. Björck C, Clinton D, Sohlberg S, Hällström T, Norring C. Interpersonal profiles in eating disorders: Ratings of SASB self-image. Psychology and Psychotherapy: Theory, Research and Practice. 2003; 76: 337-349.
10. Gezelius CME, Wahlund BA, Carlsson L, Wiberg BM. Adolescent patients with eating disorders and their parents: a study of self-image and outcome at an intensive outpatient program. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity. 2016; 21: 607-616.
11. Monell E, Clinton D, Birgegård A. Emotion dysregulation and eating disorder outcome: Prediction, change and contribution of sel-image. Psychology and Psychotherapy: Theory, Research and Practice. 2022; 95: 639-655.
12. Birgegård A, Björck C, Clinton D. Quality assurance of specialized treatment of eating disorders using large-scale Internet-based collection systems: Methods, results and lessons learned from designing the Stepwise database. European Eating Disorders Review. 2010; 18: 251-259.
13. American Psychiatric Association (APA). Diagnostic and Statistical Manual of Mental Disorders (4th ed, text revision) (DSM– IV–TR®) Washington, DC: American Psychiatric Association. ISBN. 2000; 13: 978-0890420256.
14. Feeney JA, Noller P, Hanrahan M. Assessing adult attachment. In: Sperling MB, Berman WH (Eds.), Attachment in Adults: Clinical and developmental perspectives, 128-15). New York, NY: Guilford Press. ISBN 0-89862-547-5. 1994.
15. Fossati A, Feeney JA, Donati D, Donini M, Novella L, Bagnato M & et al. On the dimensionality of the Attachment Style Questionnaire in Italian clinical and nonclinical participants. Journal of Social and Personal Relationships. 2003; 20.1: 55-79.
16. Hazan C, Shaver PR. Romantic love conceptualized as an attachment process. Journal of Personality and Social Psychology. 1987; 52: 511-524.
17. Håkanson A, Tengström A. Attachment Style Questionnaire. [Translation into Swedish and introductory tests. In Swedish.] Report from Department of Applied Psychology, Umeå University, Umeå, Sweden. 1996.
18. Benjamin LS. Introduction to the special section on structural analysis of social behavior. Journal of Consulting and Clinical Psychology. 1996; 64: 1203-1212.
19. Benjamin LS. Interpersonal diagnosis and treatment of personality disorders. New York, NY: Guilford Press, 2nd edition. ISBN 9781572308602. 2002.

20. Pincus AL, Newes SL, Dickinson KA, Ruiz MA. A comparison of three indexes to assess the dimensions of structural analysis of social behavior. Journal of Personality Assessment. 1998; 70: 145-170.

21. Lundh A, Kowalski J, Sundberg CJ, Gumpert C, Landén M. Children's Global Assessment Scale (CGAS) in a naturalistic clinical setting: Inter-rater reliability and comparison with expert ratings. Psychiatry Research. 2010; 177: 206-210.

22. Shaffer D, Gould MS, Brasic J, Ambrosini P, Fisher P, Bird H, Aluwahlia S. A children's global assessment scale (CGAS). Archives of General Psychiatry. 1983; 40: 1228-1231.

23. The WHO Child Growth Standards. The challenge of obesity in the WHO European Region and the strategies for response. World Health Organization. Regional Office for Europe. 2007. ISBN 978 92 890 1408 3.

24. Hayes AF. An Index and Test of Linear Moderated Mediation. Multivariate Behavioral Research. 2015; 50: 1-22.

25. IBM SPSS Statistics for Windows (Version 29.0.2.0). 2022.

26. Arbuckle JL. Amos 26.0 - User's Guide. Chicago: IBM SPSS. 2022.

27. Petersson S, Birgegård A, Brudin L, Forsén Mantilla E, Monell E, Clinton D, Björk C. Initial self-blame predicts eating disorder remission after 9 years. J Eat Disord. 2021; 9: 81.

28. Forsén Mantilla E, Norring C, Birgegård. Self-image and 12-month outcome in females with eating disorders: extending previous findings. J Eat Disord. 2019; 7: 15.

29. Mikulincer, M, Shaver PR. Attachment in adulthood: Structure, dynamic and change (2nd ed.). New York, NY: The Guilford Press. 2007.

30. Shaver PR, Mikulincer M, Sahdra B, & Gross J. Attachment security as a foundation for kindness toward self and others. The Oxford Handbook of Hypo-egoic Phenomena, Chapter. 2016; 15: 223-242.

31. Henry WP. Interpersonal case formulation: Describing and explaining interpersonal patterns using the structural analysis of social behavior, In: T D Eells (Ed.), Handbook of psychotherapy case formulation (pp. 223–259). New York: Guilford Press. 1997.

32. Klein EM, Benecke C, Kasinger C, Brähler E, Ehrenthal J, Strauss B, et al. Eating disorder psychopathology: The role of attachment anxiety, attachment avoidance, and personality functioning. Journal of Psychosomatic Research. 2022; 160: 1-8.

33. Fonagy P, Steele, M, Steele, H, Moran & AC. The capacity for understanding states: The reflective self in parent and child and its significance for security of attachment. Infant Mental Health Journal. 1991; 12: 201-218.

34. Monteleone AM, Mereu A, Cascino G, Ruzzi V, Castiglioni MC, Patriciello G, et al. The validity of the fifth and the 10th Body Mass Index percentile as weight cut-offs for anorexia nervosa in adolescence: No evidence from quantitative and network investigation of psychopathology. European Eating Disorders Review. 2021; 29: 232-244.