

EMPIRICAL ARTICLE

Networks of guilt, shame, pride, and disordered eating in youths show stability over time

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Abstract

Recent literature suggests that self-conscious emotions (i.e., shame, guilt, and pride) play an important role in increasing the risk for disordered eating behaviors and cognitions. Despite the increasing frequency and intensity of self-conscious emotions and of disordered eating behaviors and cognitions during childhood and adolescence, little is known about how self-conscious emotions are related to disordered eating during this age, or how stable these relations are over time. The present study utilized a network analysis approach to address these gaps. One hundred sixteen youths (ages 9–17) completed daily diaries every evening for 28 days (Nassessments = 3004) reporting their emotions and disordered eating behaviors and cognitions during a population-level stressor. We fitted a network for each of the 4 weeks to investigate the stability of the associations among shame, guilt, pride, and disordered eating across time. Specific self-conscious emotions clustered with different groups of disordered eating: pride was associated with restrictive eating, shame was uniquely associated with weight concerns, and guilt was more associated with binge-eating-related disordered eating. The 4 weekly networks were similar, indicating stability across time. Our findings emphasize the importance of investigating differential interactions among self-conscious emotions with disordered eating behaviors and cognitions to understand eating disorder risk in youth.

KEY WORDS

adolescents, daily diaries, eating disorders, guilt, network analysis, pride, self-conscious emotions, shame

Eating disorders (EDs) are life-threatening psychiatric conditions. Their emergence during childhood and adolescence (Ágh et al., 2016) has been linked to the affective reactivity and social sensitivity that hallmark this period (Rapee et al., 2019). Importantly, subclinical levels of disordered eating behaviors (e.g., restrictive eating) and cognitions (e.g., weight concerns), which are highly prevalent in this age period, have been shown to precede the onset of EDs (Peschel et al., 2024; van Eeden et al., 2021). Recent research has highlighted the importance of studying disordered eating in community samples of youth to inform early intervention and prevention methods for eating pathology (e.g., Hansson et al., 2016; Meshkova et al., 2023; Peschel et al., 2024; Viborg et al., 2018). Theoretical models suggest that difficulties in coping with certain emotions increase the risk for the development of disordered eating patterns (Rapee et al., 2019).

Particularly, self-conscious emotions (shame, guilt, pride) may contribute to the risk for the development of disordered eating behaviors and cognitions in youth (Nechita & David, 2023).

Self-conscious emotions are complex emotions that develop during late childhood; they require self-evaluative processes and imagining oneself through the eyes of other people (Izard, 2007; Leary, 2004; Tangney et al., 1992; Tangney & Dearing, 2002). Guilt is a negative self-conscious emotion that involves remorse about a specific behavior taken by the self (Tangney & Dearing, 2002). Shame is a negative self-conscious emotion that involves negative feelings about the stable and global self (Tangney & Dearing, 2002; Tracy & Robins, 2004). Pride is often defined as a positive self-conscious emotion and is a favorable emotional reaction to an event relevant to an individual's identity goals (Tangney et al., 1992; Tracy &

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Robins, 2004). Pride is viewed as a beneficial emotion since it motivates the individual to align with their goals (Hart & Matsuba, 2007). However, it has been empirically shown to consist of two distinct facets: authentic or achievement-oriented pride and hubristic pride (Tangney et al., 1992; Tracy et al., 2020; Tracy & Robins, 2004, 2007a, 2007b). Authentic pride emerges from attributing goal achievements to specific and controllable causes such as one's effort and is positively associated with adaptive personality traits such as conscientiousness (Tangney et al., 1992; Tracy & Robins, 2004, 2007a, 2007b). On the other hand, hubristic pride emerges from attributing goal achievement to global and uncontrollable causes such as one's natural ability and is positively associated with maladaptive personality traits such as narcissism (Tangney et al., 1992; Tracy & Robins, 2004, 2007a, 2007b).

The transition to adolescence involves self-concept development and heightened concern about others' perceptions (Senín-Calderón et al., 2017). In response, youth experience elevated levels of self-conscious emotions (Muris & Meesters, 2014). Research suggests that self-conscious emotions can form vicious cycles with disordered eating behaviors and cognitions (Duarte et al., 2017). For example, various theories view shame as both a possible consequence and an antecedent of disordered eating (Goss & Gilbert, 2002; Treasure et al., 2008). The role of self-conscious emotions in disordered eating is reflected in the fact that feeling guilty or ashamed after binge eating is one of the symptoms of binge-eating disorder (DSM-5; American Psychiatric Association, 2013). Indeed, studies show that both guilt and shame display bidirectional associations with binge-eating, creating self-perpetuating cycles (Schaefer et al., 2020). Moreover, despite being studied interchangeably, guilt and shame may play distinct roles in disordered eating (Panero et al., 2022). Therefore, it is essential to study shame, guilt, and pride as crucial risk factors for disordered eating and the risk of later development of eating disorders (Peschel et al., 2024).

According to the "Process Model of Self-conscious Emotions" (Tracy & Robins, 2004), self-conscious emotions emerge when identity-relevant events are attributed to causes within the individual. According to this model, shame emerges from a global evaluation of the self as flawed, whereas guilt emerges from a negative evaluation of behaviors (Tracy & Robins, 2004). Similarly, authentic pride stems from attributions of the positive event to controllable and specific causes, such as effort, whereas hubristic pride emerges from attributions to uncontrollable and global causes, such as innate ability (Tracy & Robins, 2004). These appraisals lead to distinct behavioral outcomes; for example, empirical research has shown that shame drives avoidance, whereas guilt motivates reparative behavior (Tangney, 1993; Tangney et al., 2007; Tangney & Dearing, 2002; Tracy & Robins, 2004). Research suggests that positive and negative self-conscious emotions are largely independent from each other and contribute to risk for different aspects of disordered eating (Sznycer, 2019). For example, negatively-valenced self-conscious emotions (guilt and shame) are associated with binge-eating. Conversely,

positively-valenced self-conscious emotions, like pride, are associated with restrictive eating (e.g., Engel et al., 2013). Further, shame and guilt may be differentially related to disordered eating (e.g., Levinson et al., 2016). Some studies found a stronger association of shame (vs. guilt) with disordered eating behaviors (e.g., binge eating, Levinson et al., 2016). By contrast, pride can motivate behaviors to gain control of eating for the achievement of the "thin ideal" (Rodríguez-Testal et al., 2023). Qualitative accounts from patients with anorexia nervosa (AN) show that successful restrictive eating is a source of pride (e.g., Mortimer, 2019). Theoretical models increasingly recognize pride's role in influencing disordered eating (e.g., Faija et al., 2017). Empirical evidence shows that pride exhibits bidirectional associations with restrictive eating behaviors (e.g., Fitzsimmons-Craft et al., 2015). Taken together, positive and negative self-conscious emotions may play distinct roles in increasing risk for disordered eating.

Given the unique roles of positive and negative self-conscious emotions, research emphasizes a transdiagnostic approach in studying the relation of these emotions to disordered eating (Solomon-Krakus et al., 2022). One such transdiagnostic approach is network analysis. Network analysis can examine multiple factors together (Borsboom, 2017). For example, interactions among disordered eating behaviors and cognitions that are related to both restrictive and binge-eating behaviors (Wang et al., 2019). In networks, nodes represent variables (e.g., emotions and disordered eating behaviors and cognitions) interconnected by edges (regularized partial correlations; Borsboom, 2017). Such networks can elucidate reciprocal influences among emotions and disordered eating, enhancing our understanding of how vulnerability for EDs increases during youth (Marchetti et al., 2021).

To our knowledge, only a handful of studies have used network analysis to understand the relationship between self-conscious emotions and disordered eating transdiagnostically. Levinson et al. (2022) identified guilt as central in a within-individual network of disordered eating in a clinical sample of adults. Similarly, Wong et al. (2021) revealed that guilt about eating was the most central emotion in a between-person network of guilt, shame, and pride and disordered eating in a clinical sample of adults. Finally, Sahlan and Sala (2022) found general shame as a central bridge node across negative affect and disordered eating in a between-person network in a sample of Iranian college students. Despite these important advances, some questions regarding self-conscious emotions and disordered eating remain open.

Gaps in the literature

One gap in the literature on self-conscious emotions and disordered eating is lack of research on children and adolescents. Limited research has considered the association between disordered eating and self-conscious emotions in youth, and it is restricted to unidirectional associations between one type of self-conscious emotion within one specific diagnosis (e.g.,

guilt and AN; Pila et al., 2019), or associations of body-related self-conscious emotions with eating behaviors (e.g., body-related shame, Mustapic et al., 2017). Studies found that dietary restraint predicted guilt and that body-related shame was significantly associated with disordered eating behaviors in adolescents diagnosed with AN (e.g., Pila et al., 2019). However, these studies on adolescents did not investigate how different self-conscious emotions are related to one another and in turn with disordered eating behaviors. Considering that eating disorder symptoms typically emerge during childhood and adolescence, understanding how subclinical levels of disordered eating and self-conscious emotions are inter-related during this age may help us identify novel targets for prevention and intervention before the symptoms have become ingrained.

A second gap in the literature is studying how general (i.e., not eating-specific; Nechita & David, 2023) self-conscious emotions relate to disordered eating in youth. Much of the literature has focused on the role of body-related self-conscious emotions arising from evaluations of one's body and appearance (Figueiredo et al., 2019), with studies showing that these emotions are associated with increased engagement in disordered eating related to weight control (Thibault et al., 2023). Other studies investigated the associations among eating-related (but not general) guilt, shame, or pride and disordered eating in adolescence (e.g., Mason et al., 2021). Little is known about how general shame, guilt, and pride work together in relation to disordered eating.

A third gap in the literature is that most studies examining networks of multiple self-conscious emotions and disordered eating are cross-sectional (e.g., Sahlan & Sala, 2022). Only one study, to our knowledge, showed how guilt about eating can predict eating disorders' severity in adults using networks based on an intensive longitudinal design (Levinson et al., 2022); however, no such study examined disordered eating in adolescents. Considering criticisms about network replicability and instability (Forbes et al., 2017), it is important to examine whether networks remain stable over time.

The present study

To address these gaps, we applied network analysis to study the interplay between general shame, guilt, pride, and disordered eating behaviors and cognitions in childhood and adolescence, using daily-diary data collected during the beginning of the COVID-19 pandemic. Given that severity of eating disorder symptoms increased in youth during the pandemic (e.g., Agostino et al., 2021), it is crucial to investigate how the interactions between self-conscious emotions and disordered eating may have contributed to the risk of eating disorders during this period. The present study extends previous research by employing network analysis on a longitudinal daily diary dataset collected in youth to understand how shame, guilt, pride, and disordered eating interact with each other. Estimating networks from repeated measures data, like daily diaries, reduces reliance on single

self-reported items (Shiffman et al., 2008). Intensive longitudinal studies are important for creating stable and replicable networks of disordered eating and emotions (Costantini et al., 2019). The present study estimates four between-person networks of guilt, shame, and pride, along with nine disordered eating behaviors and cognitions: 1: "Felt like I couldn't stop eating," 2: "Exercised with the goal of losing weight," 3: "Had a strong desire to lose weight or were afraid of gaining weight," 4: "Felt ashamed of how much I ate," 5: "Tried to limit the amount of food I ate on purpose (e.g., skipped a meal, followed rules—whether or not you succeeded)," 6: "Weighed myself," 7: "Ate in secret because I was ashamed," 8: "Ate what other people would consider as an unusually large amount of food," 9: "Felt Fat" across 4 weeks. Our analyses had four main hypotheses: (a) guilt and shame would form an independent cluster from pride; (b) pride, guilt, and shame would be in the center of the network, particularly guilt, given that guilt about eating was the most central node in adults (e.g., Wong et al., 2021); (c) guilt and shame would cluster with binge-related disordered eating behaviors and cognitions, while pride would cluster with restrictive eating; and (d) the networks would be largely consistent and stable across all weeks.

METHOD

Procedure

All procedures were approved by Yale University Institutional Review Board. The present analyses are part of a larger study on emotions, social experiences, and eating behaviors in youth (Deng et al., 2021; Dworschak et al., 2023; Gadassi-Polack, Chertkof, et al., 2021; Gadassi-Polack, Everaert, et al., 2021; Gadassi-Polack et al., 2023; Gadassi-Polack, Sened, et al., 2021). The study follows a multi-time-scale longitudinal design, in which three data waves of an intensive longitudinal design were collected once a year over three years. The first wave was a 21-day diary study collected between January 31, 2019, and September 31, 2019. During Wave 1, 149 youths aged 9–15 were recruited via flyers in the Yale University area, Craigslist, and social media. To participate, youths were required to have daily access to an internet-enabled device and consent from a legal guardian. We allowed 8-year-olds who turned 9 during the diary period to participate at Wave 1. Every evening for 21 days, approximately 1 h before bedtime, participants received a link via email to complete a survey about emotions and social interactions. Because bedtime varies, we asked participants to choose one of three possible times (7 pm, 8 pm, or 9 pm) that was closest to 1 h before their bedtime.

The present investigation is based on Wave 2 of a multi-wave daily-diary study. Wave 2 was a 28-day diary study that was collected during the beginning of the COVID-19 pandemic between March 30, 2020, and June 8, 2020. Youths who participated in Wave 1 and were interested in participating in additional studies were invited to

participate in Wave 2. Interested participants were invited to an online consent Zoom session with the parent and the child, during which they received explanations about the diary. Then, youths filled out a demographic questionnaire as well as additional questionnaires not included in the current investigation. Every evening for the subsequent 28 days, participants received a link via email to the daily diary survey. Participants were instructed to complete the survey before going to bed. Table S1 presents characteristics and demographics for both waves. Wave 3 was collected during the writing of the current manuscript (Gadassi-Polack et al., 2024).

Participants

We contacted 139 participants from Wave 1; 23 declined to participate. The final sample at Wave 2 included 116 youths (age range = 9–17 years, $M = 12.70$, $SD = 2.12$, 53% female, 71% White/Caucasian). Table 1 presents demographic characteristics of the sample in Wave 2 (Table S1 presents demographic and characteristics of both samples in Wave 1 and Wave 2 and study characteristics of both waves). Participants completed a mean of 25.90/28 diary entries ($SD = 3.28$) during Wave 2.

Measures

Self-conscious emotions

Participants indicated how “ashamed,” “proud,” and “guilty” they felt at the time of filling out every day during the diary, along with the experience of other negative and positive emotions using the Positive and Negative Affect Schedule for Children questionnaire (PANAS-C; Ebesutani et al., 2012). Items were adapted to assess emotional experiences at the time of filling out the diary instead of during the past few weeks. Participants recorded their answers with a 5-point

Likert-type scale that ranged from (1) “very slightly or not at all” to (5) “extremely.”

Disordered eating behaviors and cognitions

To assess disordered eating behaviors and cognitions, we adapted items from the Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008). The original EDE-Q has four subscales: weight concern, restrictive eating, eating concern, and shape concern (Fairburn & Beglin, 2008). We asked participants to report on whether they had endorsed each of nine behaviors/cognitions since the previous night. Following our prior work (i.e., Dworschak et al., 2023), we grouped disordered eating behaviors and cognitions into five categories to test for hypotheses of differential relationships between types of disordered eating and emotions: weight concerns (“Have a strong desire to lose weight or were afraid of gaining weight” and “Weighed myself”), restrictive eating (“Exercised with the goal of losing weight” and “Tried to limit the amount of food I ate on purpose”), binge eating (“Felt like I couldn’t stop eating” and “Ate what other people would consider an unusually large amount of food”), eating concerns (“Felt ashamed of how much I ate” and “Ate in secret because I was ashamed”) and shape concern (“Felt fat”).

Statistical analysis

Network estimation

We aimed to estimate networks representing the interplay among self-conscious emotions and disordered eating behaviors and cognitions over time. However, the relatively limited within-person variance in reported disordered eating cognitions and behaviors limited the utility of estimating temporal and contemporaneous networks. Therefore, following Marchetti et al. (2021), who used a similar method, we binned the data into 4 weeks and estimated four cross-sectional networks to directly examine whether networks were stable across time. We opted to bin the data into 4 weeks to allow for the examination of as many multiple time points as possible within the 28-day period while also retaining significant within-person variance. Across each week, we investigated the consistency of the networks and their characteristics such as centrality, which indicates which variables have the strongest relations to others in the network (Bringmann et al., 2019). Wave 2 was chosen for the present investigation because it was the best dataset available (at the time of writing the manuscript) to examine how between-person networks of emotions and disordered eating change over time in youths. We were unable to use Wave 1 because it used dichotomous variables to assess disordered eating behaviors and cognitions, and consequently, there was too little within-person variance to estimate networks. Wave 3 data collection was completed

TABLE 1 Demographic characteristics of sample.

Sample ($N = 116$)	
N (% girls)	116 (53%)
Age	12.70, $SD = 2.12$
Diary days	25.90, $SD = 3.28$
American Indian, Native American, or Alaska native	0
Asian or Asian American	11 (9.48%)
Black, African American, or African	11 (9.48%)
Latino or Hispanic	6 (5.17%)
Middle Eastern or Arab	4 (3.45%)
Native Hawaiian or other Pacific Islander	0
White or Caucasian	82 (70.69%)
Other	2 (1.72%)

after the writing of the current manuscript (Gadassi-Polack et al., 2024).

We estimated networks using the estimateNetwork function in the bootnet package in R (Epskamp & Fried, 2018). Particularly, we used Gaussian Markov random field estimation using graphical LASSO and extended Bayesian information criteria (EBIC) for all networks using the EBICglasso function in the qgraph package (Epskamp & Fried, 2018). The EBICglasso function computes regularized partial-correlation relationships between nodes. We used Spearman correlations to produce more stable networks (Epskamp & Fried, 2018). We set the EBIC hyperparameter to 0.5. Networks included day-level scores for all 12 items described previously.

Network centrality and influence

To characterize the relationship of each self-conscious emotion to each other and to the disordered eating behaviors and cognitions, we calculated centrality measures of strength and expected influence for each node in each weekly network. Strength is the sum of the absolute value of all the edge weights directly connected to a node. Expected influence identifies the strength of a node given other nodes but also accounts for the direction of associations (Bringmann et al., 2019). Nodes with the highest strength or expected influence are deemed the most core node in each network (Borsboom & Cramer, 2013).

Network stability over time

To examine how reliable and accurate the networks were across time, we bootstrapped the network estimation procedure for each week 1000 times using the R package bootnet (Epskamp et al., 2018). We estimated bootstrapped confidence intervals of edge weights and centrality indices in order to determine whether the order of edge weights or centrality indices remains the same after re-estimating the network with fewer data points (Epskamp et al., 2018). We quantified the stability of centrality indices using the centrality stability coefficient, which represents the maximum proportion of data points that can be dropped so that there is a 95% probability that the correlation between original centrality indices and centrality of networks based on subsets is 0.7 or higher (Epskamp et al., 2018).

Network comparison tests

To examine changes in network structure over time, we conducted Spearman correlation tests on network centrality indices across all four networks (edge weights as well as node strengths). Additionally, we used the NCT function of the NetworkComparisonTest R package (Borkulo et al., 2022) to compare whether the between-person estimated networks for each week differed in structure and global connectivity.

Missing data

In our dataset, 0.4% of the data were missing. Little's test was used to determine whether the data was missing completely at random (MCAR) using the *mcar_test* function in the *nanian* package in R (Little, 1988; Tierney & Cook, 2023). Results of the test indicate that the data is not missing completely at random ($\chi^2[97] = 150.74, p < .001$). Therefore, we assume data is missing at random since missingness is likely related to other observed variables in the dataset (e.g., negative mood the previous day). As a result, a multiple imputation approach was chosen to handle missing data since it has been shown to produce the least biased results for data not missing completely at random (Baraldi & Enders, 2010).

To estimate missing data, we carried out multiple imputation using the Multivariate Imputation by Chained Equations (MICE) package in R, which uses predictive mean matching to predict missing values (van Buuren & Groothuis-Oudshoorn, 2011). We imputed the data five times, and only retained edges in the final network that were included in the estimated networks, based on at least four out of five imputed datasets, similar to the procedure implemented in Liu et al. (2021).

RESULTS

Descriptive statistics

Table 2 presents means, SDs, ranges, and Intraclass Correlations (ICCs) for all study measures. Table 3 shows zero-order correlations between self-conscious emotions and disordered eating behaviors and cognitions estimated in the networks.

TABLE 2 Means, standard deviations, ICCs and ranges of each variable.

Variable	M_{within}	SD_{within}	SD_{between}	ICC	Range
Guilty	1.41	0.45	0.59	0.49	1–5
Ashamed	1.32	0.439	0.39	0.42	1–5
Proud	2.28	0.75	0.35	0.60	1–5
E1	0.58	0.64	0.51	0.47	0–4
E2	0.69	0.44	0.44	0.70	0–4
E3	0.90	0.43	0.44	0.76	0–4
E4	0.50	0.43	0.47	0.59	0–4
E5	0.46	0.33	0.47	0.56	0–4
E6	0.42	0.42	0.40	0.56	0–4
E7	0.27	0.32	0.45	0.44	0–4
E8	0.40	0.40	0.43	0.52	0–4
E9	0.90	0.42	0.44	0.79	0–4

Note: E1 “Felt like I couldn't stop eating,” E2: “Exercised with the goal of losing weight,” E3: “Had a strong desire to lose weight or were afraid of gaining weight,” E4: “Felt ashamed of how much I ate,” E5: “Tried to limit the amount of food I ate on purpose (e.g. skipped a meal, followed rules—whether or not you succeeded),” E6: “Weighed myself,” E7: “Ate in secret because I was ashamed,” E8: “Ate what other people would consider an unusually large amount of food,” E9: “Felt fat.”

TABLE 3 Zero-order correlations of network variables for each week.

Variable	Week 1			Week 2			Week 3			Week 4		
	Shame	Guilt	Pride	Shame	Guilt	Pride	Shame	Guilt	Pride	Shame	Guilt	Pride
E1	0.18	0.18	-0.07	0.27	0.26	-0.09	0.35	0.29	-0.07	0.32	0.35	0.02
E2	0.22	0.16	0.17	0.31	0.29	0.13	0.31	0.35	0.13	0.20	0.26	0.28
E3	0.23	0.21	0.06	0.30	0.29	0.07	0.33	0.33	0.12	0.15	0.23	0.22
E4	0.32	0.30	-0.03	0.41	0.37	-0.01	0.42	0.40	-0.03	0.34	0.40	0.08
E5	0.26	0.20	0.02	0.38	0.32	0.09	0.31	0.34	0.06	0.25	0.33	0.10
E6	0.26	0.26	0.07	0.44	0.38	0.04	0.43	0.38	0.03	0.33	0.40	0.10
E7	0.38	0.35	0.00	0.47	0.42	0.06	0.41	0.44	0.10	0.37	0.42	0.10
E8	0.17	0.20	0.02	0.35	0.31	0.05	0.37	0.33	0.00	0.32	0.40	0.03
E9	0.28	0.26	-0.06	0.30	0.26	-0.03	0.35	0.37	0.00	0.18	0.25	0.15

Note: E1 "Felt like I couldn't stop eating," E2: "Exercised with the goal of losing weight," E3: "Had a strong desire to lose weight or were afraid of gaining weight," E4: "Felt ashamed of how much I ate," E5: "Tried to limit the amount of food I ate on purpose (e.g. skipped a meal, followed rules—whether or not you succeeded)," E6: "Weighed myself," E7: "Ate in secret because I was ashamed," E8: "Ate what other people would consider an unusually large amount of food," E9: "Felt fat."

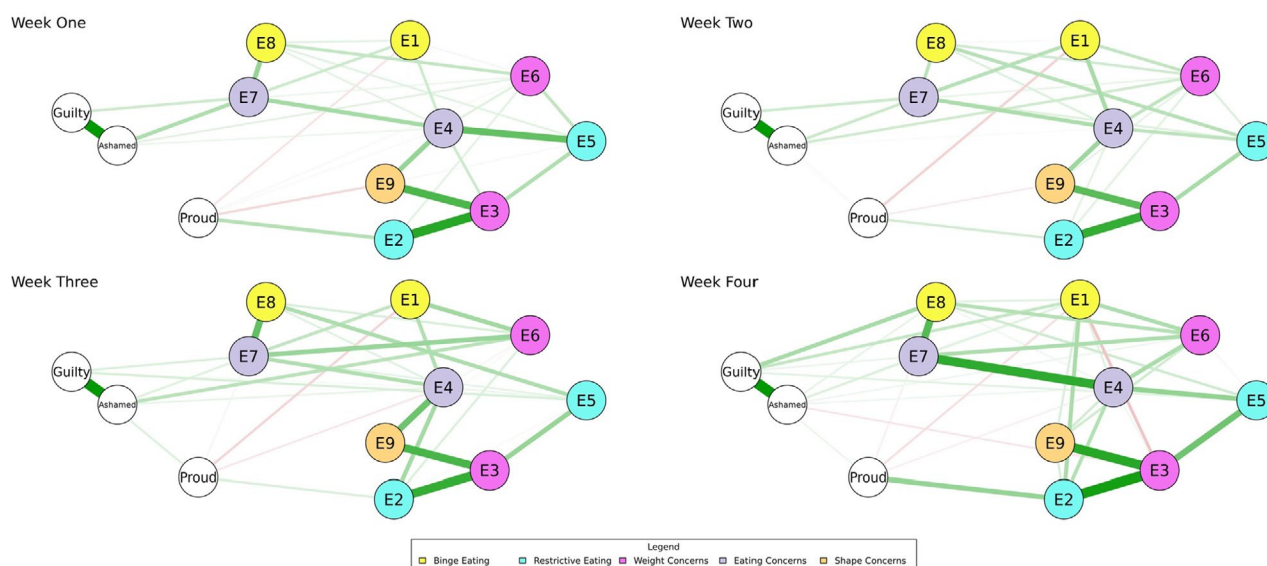


FIGURE 1 Between-person networks for each week. E1 "Felt like I couldn't stop eating," E2: "Exercised with the goal of losing weight," E3: "Had a strong desire to lose weight or were afraid of gaining weight," E4: "Felt ashamed of how much I ate," E5: "Tried to limit the amount of food I ate on purpose (e.g. skipped a meal, followed rules—whether or not you succeeded)," E6: "Weighed myself," E7: "Ate in secret because I was ashamed," E8: "Ate what other people would consider an unusually large amount of food," E9: "Felt fat."

Network estimation

Figure 1 visualizes the weekly networks. Nodes are color-coded based on their disordered eating groups: yellow for binge eating, pink for weight concerns, blue for restrictive eating, purple for eating concerns, and orange for shape concerns. To reduce the concern that the network structure was influenced by the unbalanced number of nodes of eating behaviors and emotions, we repeated all analyses with an equal number of eating behaviors and emotions (3 and 3, instead of 9 and 3). Figure S1 presents the results for this analysis.

Firstly, we predicted that pride would be independent from shame and guilt given the orthogonal nature of

negative and positive affect. The analysis supported this hypothesis; while shame and guilt formed a tightly connected cluster, pride remained largely independent across the 4 weeks. Although shame and guilt were strongly related, they had separate contributions (i.e., edges) to the network.

Pride had the lowest strength centrality index across all weeks (Figure 2), and the centrality difference test shows that its strength was significantly lower than more than half of the other nodes in the network (Figure 3). Specifically, pride was negatively associated with shape concern ("Felt fat") in weeks one and two, and with binge eating-related behavior ("Felt like I couldn't stop eating") across all weeks, positively with restrictive eating ("Exercised with the goal of

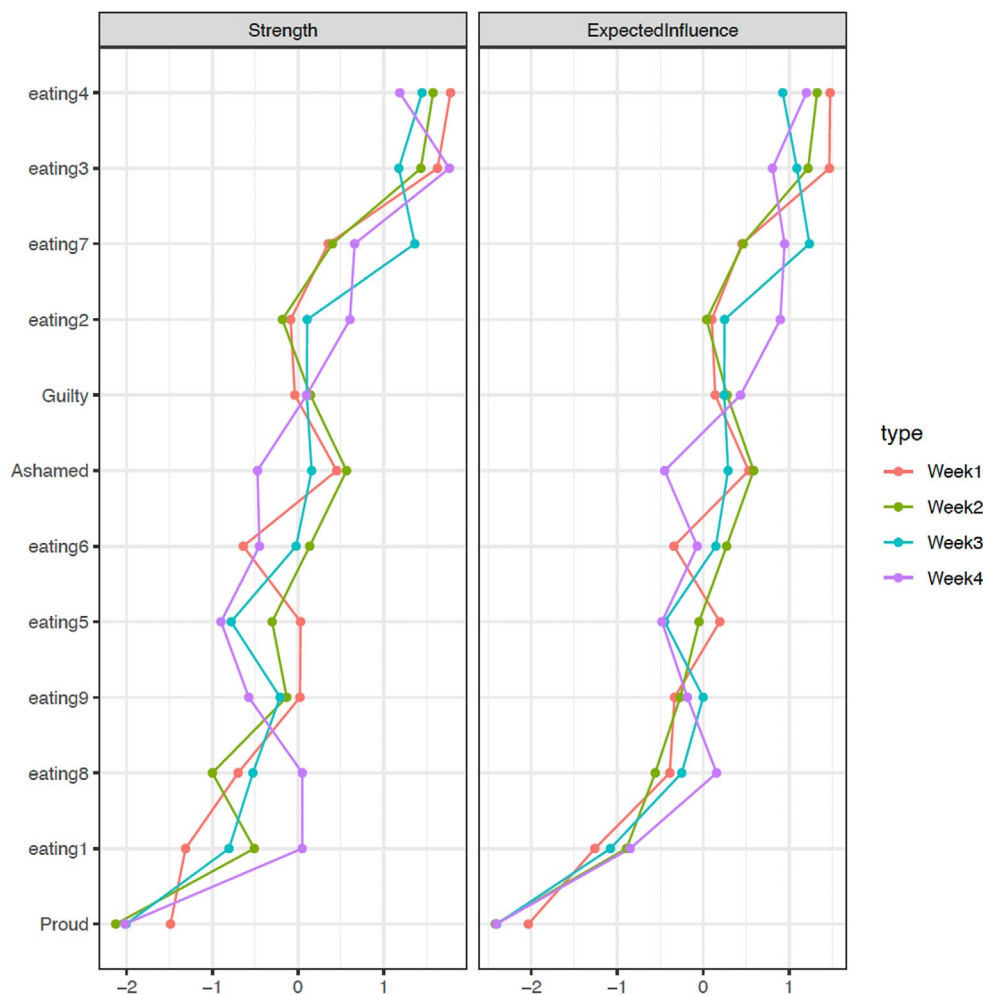


FIGURE 2 Strength and expected influence scores, shown as standardized z-scores, across the 4 weeks. E1 “Felt like I couldn’t stop eating,” E2: “Exercised with the goal of losing weight,” E3: “Had a strong desire to lose weight or were afraid of gaining weight,” E4: “Felt ashamed of how much I ate,” E5: “Tried to limit the amount of food I ate on purpose (e.g. skipped a meal, followed rules—whether or not you succeeded),” E6: “Weighed myself,” E7: “Ate in secret because I was ashamed,” E8: “Ate what other people would consider an unusually large amount of food,” E9: “Felt fat.”

losing weight”) across all weeks, and negatively with eating concerns (“Felt ashamed of how much I ate”) in Weeks 3 and 4.

Shame was positively associated with eating concerns (“Ate in secret because I was ashamed”) and weight concerns (“Weighed myself”) across all weeks. Guilt was positively associated with eating concerns (“Ate in secret because I was ashamed”) across all weeks, and with binge eating (“Ate what other people would consider an unusually large amount of food”) in Week 4.

Further, our prediction that guilt and shame would be distinctly connected to binge eating while pride would be connected to restrictive eating was partially supported. Across all weeks, as predicted, guilt and shame remained highly and positively associated with eating concerns (e.g., “Ate in secret because I was ashamed”). Also as expected, pride remained primarily and positively associated with restrictive eating behaviors across all weeks (“Exercised with the goal of losing weight”). Interestingly, pride was negatively associated

with shape concerns in weeks one and two (“Felt Fat”) and negatively associated with eating concerns (“Felt ashamed of how much I ate” and “Felt like I couldn’t stop eating”) across all weeks.

Shame and guilt, although primarily connected to binge-eating-related behaviors (mainly “Ate in secret because I was ashamed” across all weeks), also became distinctly connected to other disordered eating behaviors and cognitions over time. Shame was positively connected to weight concerns (“Weighed myself”) across all weeks, eating concerns (“Felt ashamed of how much I ate”) in 3 weeks out of four, and binge eating (“Ate what other people would consider an unusually large amount of food”) in 1 week out of four. Similarly, guilt was connected to restrictive eating (“Tried to limit the amount of food I ate on purpose”) in 2 weeks out of four, binge eating (“Ate what other people would consider an unusually large amount of food” and “Felt like I couldn’t stop eating”) in 1 week out of four.

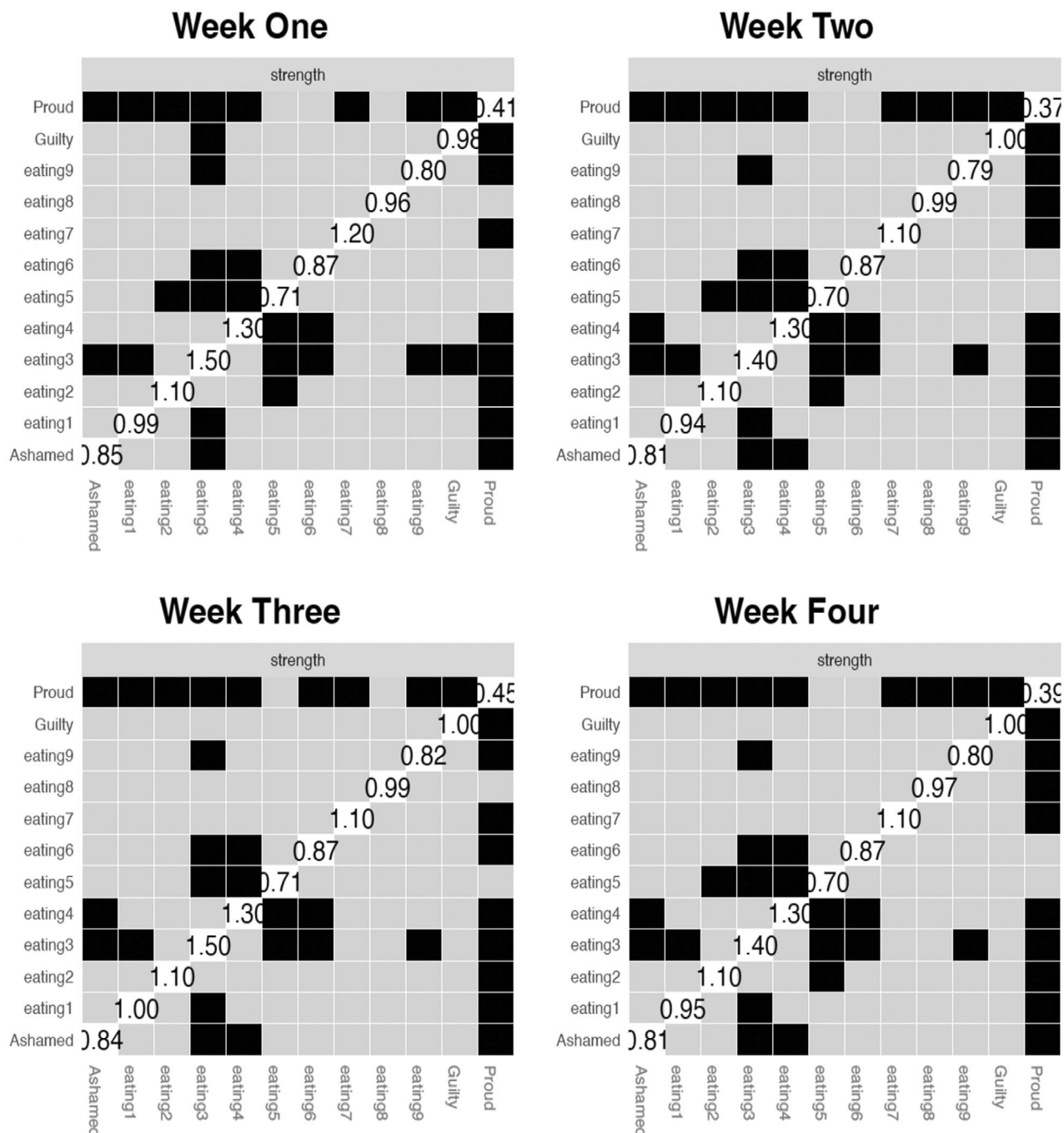


FIGURE 3 Strength centrality difference test for each week. Black squares indicate statistically significant differences between nodes at $p < .05$. Gray squares denote statistically insignificant differences in centrality between nodes. eating1: “Felt like I couldn’t stop eating,” eating2: “Exercised with the goal of losing weight,” eating3: “Had a strong desire to lose weight or were afraid of gaining weight,” eating4: “Felt ashamed of how much I ate,” eating5: “Tried to limit the amount of food I ate on purpose (e.g. skipped a meal, followed rules—whether or not you succeeded),” eating6: “Weighed myself,” eating7: “Ate in secret because I was ashamed,” eating8: “Ate what other people would consider an unusually large amount of food,” eating9: “Felt fat.”

Network centrality

Figure 2 shows the strength and expected influence centrality of self-conscious emotions and disordered eating behaviors and cognitions. Contrary to our predictions, self-conscious emotions were not the most central in terms of strength and expected influence but rather remained on the periphery of the networks across all 4 weeks; “Felt ashamed of how much I ate,”

an affect-based disordered eating cognition, and “Had a strong desire to lose weight” were the most central nodes across all weeks. Results from the centrality difference test demonstrated that guilt, pride, and shame were not significantly more central in terms of strength from most nodes across the weeks, compared to other disordered eating behaviors and cognitions (Figure 3). “Had a strong desire to lose weight or were afraid of gaining weight” and “Felt ashamed of how much I ate” are

shown to be significantly more central than most of the other nodes across the 4 weeks in Figure 3. Additionally, Figure S2 shows that the disordered eating behaviors and cognitions are less clustered into their groups when the emotions are not in the network.

We predicted guilt would be the most central self-conscious emotion in terms of strength and expected influence. However, results show that shame was the most central self-conscious emotion across most weeks, except for the fourth week. According to centrality difference tests in Figure 3, shame was significantly stronger than more nodes compared to guilt and pride across all networks. Pride had significantly lower strength centrality than more than half of the nodes across all networks.

Network comparison

The network structure remained largely similar across the 4 weeks. Network comparison tests in Table 4 showed no changes in global connectivity or network structure across all weeks (all p s > .80).

Network stability

Figure S3 shows results of the bootstrapping procedure for the centrality indices, demonstrating that strength and expected influence centrality indices were very reliable across all weeks. Correlation stability (CS) coefficients for strength and expected Influence ranged from 0.596 to 0.673 across all weeks. Additionally, Figure S4 shows that edges estimated in each weekly network were relatively sizeable, indicating many edges in each network may not be significantly different from one another.

DISCUSSION

The present study is the first to examine the interplay of self-conscious emotions—namely shame, guilt, and pride—and disordered eating behaviors and cognition in youth using network analysis in an intensive longitudinal design. Supporting our hypotheses, our results show that positive and negative self-conscious emotions play distinct roles in

disordered eating, and that these networks of self-conscious emotions and disordered eating behaviors and cognitions are stable across time.

Our hypothesis that self-conscious emotions would be the most central in each network was not supported. However, “Felt ashamed of how much I ate,” a disordered eating cognition containing the self-conscious emotion shame, was one of the most central disordered eating items across all networks. This finding aligns with adult studies that show that a disordered eating cognition containing a self-conscious emotion is a central node (“guilt about eating”; Wong et al., 2021). This suggests that self-conscious emotions—especially shame—may play a more significant role than pride and guilt in increasing the risk for disordered eating in youth. Conversely, general (vs. eating/body specific) self-conscious emotions remained at the periphery of all networks. However, general self-conscious emotions may not always remain peripheral in networks of disordered eating and self-conscious emotions in other samples. Future research should aim to replicate these findings to further clarify the role of general self-conscious emotions in networks of disordered eating behaviors and cognitions among youth. These findings align with earlier adult research (Wong et al., 2021) but also advance it by showing that, in youth, disordered eating behaviors and cognitions containing self-conscious emotions are central to the networks linking disordered eating behaviors and cognitions and self-conscious emotions. Shame and guilt were positively associated with eating concerns (“Ate in secret because I was ashamed”) across all weeks, and not with binge-related behaviors and cognitions as predicted. However, as predicted, guilt and shame were also connected to binge eating related behaviors (“Ate what other people would consider an unusually large amount of food”) in week four. This finding aligns with empirical literature indicating significant associations of these emotions with binge eating (e.g., O’Loughlen et al., 2022). Our results extend prior literature by showing that guilt and shame are associated with eating concerns more generally (e.g., Blythin et al., 2020). Moreover, these findings align with self-psychology theories, which suggest that disordered eating behaviors may reflect struggles with self-concept development during childhood and adolescence, when needs for self-esteem are learned to be met by others’ evaluations (Bachar, 2020). Consequently, youth may learn to regulate self-concept related internal needs through disordered eating to regulate guilt and shame

TABLE 4 Network comparison tests across each week.

Comparison	Edge weights similarity	Strength similarity	Global connectivity difference	Network structure difference
Weeks 1–2	$r_s = .83$	$r_s = .89$	$p = .88$	$p = 1$
Weeks 1–3	$r_s = .65$	$r_s = .83$	$p = .84$	$p = 1$
Weeks 1–4	$r_s = .68$	$r_s = .50$	$p = .91$	$p = 1$
Weeks 2–3	$r_s = .81$	$r_s = .92$	$p = .73$	$p = 1$
Weeks 2–4	$r_s = .69$	$r_s = .63$	$p = .99$	$p = 1$
Weeks 3–4	$r_s = .73$	$r_s = .78$	$p = .81$	$p = 1$

Note: Spearman correlations (r_s) were computed; p -values were adjusted for Bonferroni–Holm correction.

(Bachar, 2020). While our results could provide some support for this perspective, future investigation is needed to explore associations between global self-esteem, self-conscious emotions and disordered eating behaviors in childhood and adolescence more directly.

Importantly, our analyses reveal distinct roles for guilt and shame in increasing risk for disordered eating. Shame (but not guilt) was positively associated with weight concerns (“Weighed myself”), consistent with literature on body-related shame maintaining weight concerns (e.g., Thibault et al., 2023). Conversely, guilt (but not shame) was positively associated with “Felt like I couldn’t stop eating,” but only in Week 4. This finding suggests that guilt and shame are *not* interchangeable; rather, this suggests that while shame and guilt are jointly associated with binge-eating-related disordered eating, guilt is more related to failures in restrictive eating behaviors and cognitions while shame is more related to weight concerns. This finding is consistent with recent conceptualizations of guilt as an emotion generated by evaluating specific behaviors, while shame is associated with evaluating aspects of the self, such as weight (e.g., Sheehy et al., 2019). Going beyond prior literature, our findings suggest that youth might feel guilty about binge-eating, potentially driving the behavior. Additionally, our results underscore the importance of studying these emotions separately given these differential roles of shame and guilt (Nechita & David, 2023).

Our findings show that pride was positively associated with “Exercised with the goal of losing weight,” but not mainly clustered with restrictive eating. Pride was also negatively associated with weight concerns and failures to restrict eating. This finding aligns with longitudinal studies and clinical observations that individuals who engage in restrictive eating take pride in their thinness and success at losing weight from exercise (e.g., Faija et al., 2017). It is likely that the pride associated with restriction acts as a reinforcer of that behavior, which could lead to more serious eating behaviors. Targeting pride to prevent the development of restrictive eating in youth may be particularly effective, such as helping youth find alternative sources of pride. Pride may evoke moral superiority, further reinforcing problematic eating patterns (Mortimer, 2019). As a result, pride may be an important reinforcer for other types of disordered eating behaviors, such as when an adolescent misinterprets “healthy eating” and engages in unhealthy (excessive) exercise or eating behaviors (e.g., Lebow et al., 2015). This finding extends prior qualitative studies in adults (e.g., Faija et al., 2017) because it suggests that youth may feel pride from successfully losing weight from exercise and having a thin body shape similar to adults.

Additionally, our hypothesis that pride would be independent from shame and guilt was supported. Pride, guilt, and shame involve similar cognitive skills and levels of self-evaluation (Muris & Meesters, 2014). However, pride was not connected to shame and guilt across all weeks, consistent with literature suggesting that positive and negative affect are mostly orthogonal (e.g., Nezlek & Kuppens, 2008).

Our finding extends existing research on adults by demonstrating that pride is independent from shame and guilt in youths, and in the context of disordered eating behaviors and cognitions.

Our hypothesis that networks would remain consistent over time was supported. The same disordered eating behaviors and cognitions were central across all networks, with network structure and connectivity remaining similar. This result suggests that the interplay between disordered eating and self-conscious emotions is relatively stable in youth. This finding aligns with studies that find that risk factors for other disorders are stable in adolescence (e.g., depression; Marchetti et al., 2021). Our results extend previous literature by suggesting that the interplay of emotions and disordered eating is stable across time for youth. Moreover, our results add to previous literature by showing temporal consistency in the most central nodes. Finally, our finding addresses the issue of replicability of networks by demonstrating that the same network was obtained across all weeks (Forbes et al., 2017).

Given that disordered eating and negative affect generally increased among adolescents during COVID-19 (Deng et al., 2021; Dworschak et al., 2023; Pastore et al., 2023), and positive affect decreased (Deng et al., 2021), the observed relationships of shame, guilt, and pride to various disordered eating behaviors and cognitions may have been particularly influenced by COVID-19-related stress. A key limitation of this study is that it remains unclear whether and how COVID-19-related stress may have influenced the network structure of the associations between disordered eating and shame, guilt, and pride in youth. Future studies are needed to address this limitation. In line with recent literature in a non-clinical and clinical sample of adults (e.g., Sandoval-Araujo et al., 2024), our findings underscore the importance of examining the distinct associations that shame, guilt, and pride may have with disordered eating behaviors and cognitions over time. However, these results extend previous findings by showing how shame, guilt, and pride are associated with different disordered eating behaviors and cognitions in a community sample of youth, especially during a period of increased stress using an intensive longitudinal design.

LIMITATIONS AND FUTURE DIRECTIONS

Our study has some limitations that should be acknowledged. First, we cannot determine causality from the between-person networks. Future research using experimental design is needed. Another limitation is our reliance on a community sample of youth, and the resulting lack of significant variation in disordered eating behaviors and cognitions in our sample. This limitation precluded examining contemporaneous and longitudinal networks. Future research on clinical samples is needed to ascertain the generalizability of findings. Further, we did not assess shame, guilt, and pride using a scale validated for assessing state self-conscious emotions,

such as the State Shame and Guilt Scale (SSGS; Marschall et al., 1994). Future research should examine longitudinal associations among items from validated questionnaires for the assessment of trait and state-level self-conscious emotions and disordered eating in youth. Additionally, a key limitation of the present study is that the different facets of momentary shame were not examined. Studies have shown that different facets of momentary shame, such as eating-related shame or general shame, can vary within and across individuals. Consequently, depending on the individual and the facet of shame experienced, there may be different associations between shame and disordered eating behaviors and cognitions. Future research should explore these different facets of shame and their unique associations with disordered eating behaviors and cognitions among youth. Another important limitation is the use of strength centrality for interpreting the influence of emotions and disordered eating. This method relies only on the shortest, most direct paths and overlooks important indirect paths (Bringmann et al., 2019). Finally, we assessed variables only once a day. Higher temporal resolution may be needed to better capture how variables interact during the day.

CONCLUSION

The present research sheds light on the interplay between self-conscious emotions and disordered eating in youth. Our results suggest that general positive and negative self-conscious emotions play independent roles in increasing the risk of eating pathology in youths, which are stable across time. Particularly, we show that across networks, shame and guilt are connected to eating concerns, whereas pride is mainly associated with the restrictive behavior of losing weight from exercise, along with weight concerns and failures to restrict eating. Moreover, we show that although shame and guilt are interconnected, they also play unique roles in increasing risk for disordered eating; unlike guilt, shame may be important for increasing risk for weight concerns. Our study contributes to a deeper understanding of the differential roles of shame, guilt, and pride in contributing to the risk of eating pathology in youth, offering insights into potential targets for eating disorder prevention among youth.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Data and code pertaining to the current investigation can be found in <https://osf.io/3yu5e>

PATIENT CONSENT STATEMENT

Consent for the participation of children under 18 was obtained from their parents or legal guardians. Child assent was obtained.

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