

# Body-Image, Sociocultural, and Media-Related Correlates of Cosmetic-Procedure Consideration: A Network Analysis of Iranian Adults with Prior Procedure Experience

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## Research Article

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**Body-Image, Sociocultural, and Media-Related Correlates of Cosmetic-Procedure  
Consideration: A Network Analysis of Iranian Adults with Prior Procedure Experience**

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**Ethics statement:** This study was conducted in accordance with the Declaration of Helsinki and approved by the  
Institutional Review Board of Kharazmi University (Ref No: IR.KHU.REC.1404.161). Written informed consent  
was obtained from all participants.

## Abstract

**Background:** Interest in additional cosmetic procedures may reflect interdependence among body-image, psychological, sociocultural, and media-related factors.

**Methods:** This cross-sectional study estimated their network structure in 697 Iranian adults with previous cosmetic procedure experience (69.0% women; age range = 18–55 years). Twelve scale or subscale scores were modeled using graphical LASSO with extended Bayesian information criterion model selection.

**Results:** The network contained 48 nonzero edges and three partially differentiated communities (modularity  $Q = .287$ ): clinical–sociocultural/media factors, appearance perfectionism and self-focused characteristics, and attitudes toward cosmetic surgery. The strongest edge connected the Social and Consider subscales of the Acceptance of Cosmetic Surgery Scale (weight = .614). Fear of missing out had the highest numerical strength (1.124), although bootstrap comparisons did not distinguish the leading centrality estimates. Physical appearance perfectionism showed the highest bridge strength (.641). Consideration of a subsequent procedure had the highest predictability ( $R^2 = .596$ ), with approximately 60% of its variance statistically accounted for by neighboring constructs. Network structure and global strength did not differ significantly across invasive only, non-invasive only, and combined procedure groups.

**Conclusions:** These findings distinguish globally connected constructs from those topologically closer to cosmetic-procedure consideration. Given the cross-sectional, nonprobability design, the results are hypothesis-generating and require longitudinal and cross-cultural replication.

**Trial registration:** Not applicable (this study did not involve a health care intervention on human participants).

**Keywords:** Cosmetic surgery intention; network analysis; fear of missing out; appearance perfectionism; body appreciation; social media addiction

## Background

Cosmetic procedures, encompassing both invasive surgery and non-invasive interventions such as injectables and laser treatments, have increased substantially worldwide during the past two decades [1]. This growth has also been observed across Middle Eastern and East Asian contexts [2, 3]. Iran is among the countries with a high volume of cosmetic procedures, with more than 407,000 procedures reported in 2023 [4], and the absence of formal health policy in this area underscores the necessity of local evidence [5]. However, beauty ideals and the psychological and social meanings attributed to appearance vary across cultural contexts [6, 7]. Findings obtained primarily in Western populations may therefore not fully characterize cosmetic procedure intentions among Iranian adults. Psychological outcomes associated with cosmetic procedures are heterogeneous. Although some individuals report improved appearance satisfaction following a procedure[8], people seeking cosmetic interventions may also report greater body-image concerns and psychological vulnerabilities than the general population [9]. Unrealistic expectations may contribute to persistent dissatisfaction and poorer psychological outcomes, particularly among individuals with pre-existing body-image concerns [10]. Together with the potential medical complications of invasive and non-invasive procedure [11], these findings underscore the importance of examining the psychological, sociocultural, and media-related correlates of intentions to undergo subsequent cosmetic procedures.

Previous research has commonly used regression and latent-variable approaches to examine the correlates of cosmetic procedure attitudes and intentions [12, 13]. Conventional regression models typically focus on the unique association of each predictor with an outcome and may provide limited information about the broader pattern of conditional associations among constructs. Consequently, less is known about how body-image concerns, self-evaluative

characteristics, sociocultural pressures, and media-related factors are interconnected when considered simultaneously. Although [14] compared individuals seeking invasive and minimally invasive procedures, their study examined a relatively restricted range of psychological characteristics (e.g., body image dissatisfaction, anxiety, depression, and interpersonal sensitivity) and did not evaluate the broader network structure of these constructs.

Network analysis provides a complementary approach for examining the pattern of conditional associations among multiple constructs. In a cross-sectional psychological network, nodes represent measured constructs and edges represent associations between pairs of nodes after conditioning on the remaining variables in the network [15]. This approach can be used to identify nodes with relatively high connectivity, nodes that link empirically detected communities, and the extent to which each node is statistically accounted for by its network neighbors. Node predictability, estimated via node-wise regression, quantifies the proportion of variance in each node explained by its network neighbors [16], thereby identifying constructs that are most embedded in the system. However, because cross-sectional networks do not establish temporal ordering or causality, centrality and bridge indices should be interpreted as descriptive properties of the estimated network rather than evidence that particular constructs directly influence others or constitute effective intervention targets.

In the present study, the Consider subscale of the Acceptance of Cosmetic Surgery Scale (ACSS) was specified as the focal node. This subscale assesses willingness to consider a cosmetic procedure in the future. Because all participants reported at least one previous cosmetic procedure, higher Consider scores can be interpreted as stronger intentions to consider a subsequent cosmetic procedure, although actual subsequent procedure uptake was not assessed.

Behavioral-intention theories identify intention as a theoretically relevant correlate of subsequent decision-making, although intention does not guarantee behavior and the present cross-sectional design did not assess later procedure uptake [17]. Cash's [18] cognitive-behavioral model further provides a framework for examining how appearance-related evaluations may be associated with body-image concerns and sociocultural experiences.

Variable selection was informed by four complementary theoretical frameworks. Social comparison theory [19] explains how self-evaluation is shaped by comparisons with others; the tripartite influence model [20] highlights the role of media, peers, and family in transmitting appearance ideals; objectification theory [21] elucidates how appearance-centric environments foster self-surveillance and shame; and Cash's (2012) cognitive-behavioral model emphasizes the role of cognitive schemas and information-processing biases in maintaining body-image difficulties. Together with empirical evidence linking the selected constructs to body image or cosmetic procedure attitudes, these frameworks guided the selection of 12 nodes: physical appearance perfectionism, fear of missing out (FoMO), body appreciation, body shame, body dysmorphic disorder symptoms, narcissistic traits, sociocultural appearance pressures, physical appearance comparison, social media addiction, and the Intrapersonal, Social, and Consider subscales of the ACSS. Total scores were used for physical appearance perfectionism and body dysmorphic symptoms; their respective subdimensions were not modeled as separate nodes.

For conceptual purposes, the selected nodes were organized into three broad domains. The first comprised attitudes toward cosmetic procedures, represented by the Intrapersonal and Social ACSS subscales, and future procedure intention, represented by the Consider subscale [22, 23]. The second comprised sociocultural and media-related factors: appearance comparison [24, 25], perceived family and media pressures [26, 27], social media addiction [28, 29], and FoMO [30–

32]. These constructs capture exposure and responsiveness to appearance-related social standards and digitally mediated comparison processes.

The third conceptual domain comprised self-evaluative and body-image characteristics: body dysmorphic symptoms [33, 34], body shame [35, 36], appearance perfectionism [36, 37], narcissistic traits [38, 39], and body appreciation [40–42]. Body appreciation was included as an indicator of positive body image, whereas the remaining constructs represented potentially maladaptive body-image or self-evaluative characteristics. These three conceptual domains guided variable selection only; they were not imposed on the network. Communities were subsequently identified from the estimated network using exploratory community-detection algorithms and were therefore allowed to differ from the a priori conceptual grouping.

Collectively, these frameworks support examining social, media-related, and self-evaluative constructs within a single conditional-association network; they do not, however, specify the empirical communities expected to emerge. Despite evidence linking these constructs individually to body image and cosmetic procedure attitudes, their conditional associations within an integrated network remain insufficiently understood, particularly among adults with previous cosmetic procedure experience. The present study examined the network of conditional associations among psychological, body-image, sociocultural, media-related, and cosmetic-procedure-attitude constructs in Iranian adults with previous cosmetic procedure experience. The objectives were to: (a) estimate the pattern of conditional associations among the 12 nodes; (b) explore the network's community structure; (c) identify nodes with relatively high strength, expected influence, and bridge centrality; (d) estimate node predictability, with particular attention to future procedure intention; (e) compare network structure and global strength across invasive-only, non-invasive-only, and combined-procedure groups; and (f) identify the shortest

topological paths linking each construct to future procedure intention using a distance transformation of edge weights.

Accordingly, the present study aimed to identify which psychological, sociocultural, and media-related constructs are most strongly connected to future procedure intention in Iranian adults with prior cosmetic experience—findings intended to inform future screening and prevention efforts in clinical and public health settings. Given the exploratory and cross-sectional design, no hypotheses concerning directed or causal pathways were specified. Centrality, bridge centrality, predictability, and shortest paths were interpreted as descriptive properties of the estimated network. Nodes occupying prominent structural positions were considered candidates for replication and further longitudinal or experimental investigation, rather than established causal mechanisms or intervention targets [43].

## **2. Methods**

### **2.1. Study Design and Setting**

This cross-sectional observational study examined a between-person network of psychological, body-image, sociocultural, media-related, and cosmetic-procedure-attitude constructs among Iranian adults with a history of elective cosmetic procedures. Data were collected between February 2 and May 31, 2025, using convenience sampling at six cosmetic clinics and day-surgery centers (including four clinics, one hospital, and one limited surgical center) across Tehran and Mashhad, Iran (three centers in each city). Potential participants were approached in person by the first author and trained research assistants while attending the centers for surgery or postoperative follow-up. Individuals who expressed interest received verbal and written information about the study before eligibility screening. Participation was voluntary and was not related to the clinical services received. Eligible participants were Persian-speaking adults

aged 18–55 years who self-reported undergoing at least one elective invasive or non-invasive cosmetic procedure during the previous five years. Procedures performed primarily for reconstructive or medically indicated purposes were excluded based on participants' self-report. Questionnaires were screened according to prespecified data-quality criteria. Participants were excluded if they had more than 10% missing item responses or did not satisfy the procedure-history eligibility criterion. Of the 701 questionnaires returned, 4 were excluded because of excessive missingness or ineligible procedure histories, resulting in an analytic sample of 697. All participants provided written informed consent before completing the questionnaires. Responses were collected without personally identifying information, and participation or refusal did not affect access to clinical services. The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Kharazmi University (IR.KHU.REC.1404.161).

## 2.2. Participants

A total of 701 Iranian adults were initially recruited. Of these, four were excluded because they reported neither an invasive nor a non-invasive cosmetic procedure and thus did not meet the eligibility criterion. The final analytic sample therefore consisted of 697 participants (69.0% women, 31.0% men) aged 18–55 years ( $M = 27.42$ ,  $SD = 8.46$ ), all fluent in Persian and with a history of at least one elective cosmetic procedure within the past five years. With 12 nodes in the network, the stability of the estimated network was evaluated using nonparametric bootstrap procedures. Strength and expected influence showed good stability ( $CS = 0.750$ ), while closeness showed lower stability ( $CS = 0.439$ ) and was therefore interpreted descriptively. Betweenness showed poor stability ( $CS = 0.205$ ) and was excluded from interpretation [see Section 3.6; , 44].

Among the total sample, 67.7% reported a history of invasive cosmetic procedures (procedures with incisions and anesthesia) and 64.4% reported non-invasive procedures (injectables, fillers, laser treatments) within the past five years. Invasive procedures were defined as elective procedures involving a surgical incision, typically performed with anesthesia. Non-invasive procedures were defined as appearance-enhancing interventions not involving a surgical incision, including injectables, fillers, and laser-based treatments. Based on these two indicators, participants were classified as invasive-only, non-invasive-only, or both. Of the 701 respondents initially retained, four reported neither an invasive nor a non-invasive cosmetic procedure and therefore did not satisfy the procedure-history eligibility criterion. These participants were excluded before analysis, resulting in a final analytic sample of 697 participants: invasive-only ( $n = 225$ , 32.3%), non-invasive-only ( $n = 248$ , 35.6%), and both procedure types ( $n = 224$ , 32.1%).

## 2.3. Measures

Reliability coefficients for the current study are reported in Table S3; sample items and prior reliability estimates from original and Persian validation studies are presented in Table S2.

**2.3.1. Physical Appearance Perfectionism Scale (PAPS):** Appearance perfectionism was assessed using the PAPS [45, 46], a 12-item measure rated on a 5-point Likert scale, with two subscales: Worry About Imperfection and Hope for Perfection. A total score was calculated (range: 12–60) and used as a single network node to limit model complexity and represent overall appearance perfectionism, consistent with the unidimensional factor structure supported for the Persian version.

**2.3.2. Fear of Missing Out Scale (FoMO):** FoMO was assessed using the FoMO Scale [47, 48], a 10-item measure rated on a 5-point Likert scale. A total score was computed (range: 10–50).

**2.3.3. Acceptance of Cosmetic Surgery Scale (ACSS):** Acceptance was assessed using the ACSS [22, 23], a 15-item measure rated on a 7-point Likert scale across three subscales: Intrapersonal, Social, and Consider. The Intrapersonal, Social, and Consider subscale scores were computed (range: 5–35 each) and entered as three separate network nodes. The Consider subscale was designated as the focal node representing intention to consider a subsequent cosmetic procedure.

**2.3.4. Body Appreciation Scale (BAS):** Positive body image was assessed using the BAS [49, 50], a 13-item measure rated on a 5-point Likert scale. A total score was calculated (range: 13–65).

**2.3.5. Objectified Body Consciousness Scale – Body Shame Subscale (OBCS-BS):** Body shame was assessed using the Body Shame subscale [51, 52], an 8-item measure rated on a 7-point Likert scale. A total score was computed (range: 8–56).

**2.3.6. Yale-Brown Obsessive-Compulsive Scale Modified for Body Dysmorphic Disorder (BDD-YBOCS):** BDD symptoms were assessed using the BDD-YBOCS [53, 54], a 12-item measure rated on a 5-point scale (0–4). A total BDD-YBOCS score was calculated (range: 0–48) and entered into the network as a single indicator of body dysmorphic symptom severity.

**2.3.7. Narcissistic Personality Inventory-16 (NPI-16):** Narcissistic traits were assessed using the NPI-16 [55, 56], a 16-item forced-choice measure with narcissistic responses scored as 1. A total score was computed (range: 0–16).

#### 2.3.8. *Sociocultural Attitudes Toward Appearance Questionnaire-4 (SATAQ-4):*

Sociocultural pressures were assessed using items from the family and media pressure subscales of the SATAQ-4 [57]. A total score was computed (range: 11–55), rated on a 5-point Likert scale.

#### 2.3.9. *Physical Appearance Comparison Scale-Revised (PACS-R):*

Appearance comparison was assessed using the PACS-R [58, 59], an 11-item unidimensional measure rated on a 5-point Likert scale. A total score was computed (range: 11–55).

#### 2.3.10. *Bergen Social Media Addiction Scale (BSMAS):*

Social media addiction was assessed using the BSMAS [60, 61], a 6-item measure rated on a 5-point Likert scale. A total score was computed (range: 6–30).

#### 2.3.11. *Demographic and Researcher-Designed Questionnaire:*

A researcher-designed questionnaire collected demographic and background information, including age, gender, education level, employment status, marital status, monthly household income, and history of invasive and non-invasive cosmetic procedures. These variables were used for descriptive purposes only and were not included as nodes in the network.

### 2.4. Statistical Analysis

All analyses were performed using R version 4.4.2 [62]. Network analyses were implemented using the bootnet [44] and qgraph [63] packages. Reliability analyses used the psych package [64]. Network comparison tests used the NetworkComparisonTest package [65]. Community detection and shortest path analyses used the igraph package [66].

The network was estimated from scale and subscale total scores (12 nodes) rather than individual ordinal items. Scale and subscale scores were computed for participants who completed at least 90% of the items within each measure. No imputation was applied, as all participants

retained for analysis had complete data on all 12 node scores. Participants missing one or more complete node scores were excluded. Of the 701 participants initially assessed, 697 met the eligibility and data-completeness criteria and were included in the full-sample network. The amount of missing data for each measure is reported in Table S1. Items with zero variance at the node level were removed prior to network estimation [44].

Means, standard deviations, observed ranges, skewness, and kurtosis were calculated for all node scores. Because the network was estimated from scale and subscale total scores rather than individual ordinal items, Pearson correlations were used to quantify pairwise associations among the node scores. The distributions of the node scores were examined before network estimation. The largest absolute skewness and kurtosis values were 1.220 and 1.384, respectively, both within the prespecified acceptable ranges [ $|\text{skewness}| < 2$ ;  $|\text{kurtosis}| < 7$ ; , 67]. Network stability was subsequently evaluated using nonparametric bootstrap procedures, with stability coefficients reported in Section 3.6.

Internal consistency was evaluated using McDonald's  $\omega$  [68] and Cronbach's  $\alpha$ , with 95% bootstrap confidence intervals based on 1,000 resamples [64, 69]. For the dichotomously scored NPI-16, KR-20 was calculated as the appropriate reliability coefficient [equivalent to Cronbach's  $\alpha$  for binary items; , 70]. Reliability estimates were used to describe score consistency and were not interpreted as evidence of unidimensionality.

Networks were estimated using the graphical LASSO with EBIC model selection [ $\gamma = 0.50$  71, 72]. Sensitivity was assessed by comparing networks estimated with  $\gamma = 0.25$  and  $\gamma = 0.75$  [44]. The EBICglasso warning ( $\text{lambda} < 0.1 \times \text{lambda.max}$ ) indicated that the smallest edges require cautious interpretation [73].

Node predictability ( $R^2$ ) was computed using node-wise regression [16]. Strength centrality and expected influence were calculated [74, 75]. Bridge centrality identified nodes connecting communities [76]. Robustness was assessed via non-parametric bootstrap with 1,000 iterations; correlation stability coefficients guided interpretation [44]. Centrality estimates are descriptive and do not imply causality [43].

Networks were visualized using qgraph [63] with the spring algorithm [77]. Community detection used the Louvain algorithm, with absolute edge weights preserving topological structure [78, 79]. Robustness was confirmed against Walktrap and Fast Greedy algorithms [80–82].

Shortest-path analysis. Shortest topological paths between each node and the Consider node were estimated after converting absolute edge weights into distances. For each nonzero edge, distance was defined as  $d_{ij} = 1/|w_{ij}|$ , such that stronger conditional associations corresponded to shorter distances. Zero edges were treated as absence of a direct path rather than as division by zero. Negative and positive edges with the same absolute magnitude were assigned equal distances; edge signs were retained separately when interpreting each path. Paths were estimated using Dijkstra's algorithm as implemented in the igraph package [66, 83]. Because shortest paths in cross-sectional networks are undirected and noncausal, they were interpreted only as topological routes linking constructs to future procedure intention [43].

Network comparison tests examined invariance across subgroups using permutation tests [65]. Bonferroni correction [84] and False Discovery Rate procedure [85] were applied; unadjusted p-values are also reported.

## **2.5. Use of AI-assisted translation**

During the preparation of this manuscript, the authors used ChatGPT (OpenAI, GPT-4 model) and DeepSeek to assist with the translation of the abstract and selected sections from

Persian to English. All AI-generated translations were carefully reviewed, edited, and verified for accuracy by the authors, who take full responsibility for the final content of the manuscript.

### 3. Results

#### 3.1. Descriptive Characteristics of Participants

The final sample comprised 697 participants aged 18 to 55 years ( $M = 27.42$ ,  $SD = 8.46$ ), predominantly female (69.0%). Demographic distributions are presented in Table S1. Regarding cosmetic surgery history, 67.7% reported invasive procedures and 64.4% reported non-invasive procedures (with overlapping subgroups). Surgery group classification is detailed in Table S1.

#### 3.2. Reliability and Descriptive Statistics

Internal consistency was adequate across all scales (Table S3). Cronbach's  $\alpha$  values ranged from 0.714 (ACSS-Intrapersonal) to 0.961 (PACS\_R), and McDonald's  $\omega$  values ranged from 0.738 (ACSS-Intrapersonal) to 0.962 (PACS\_R); for the dichotomously scored NPI-16, KR-20 was 0.722. Most scales demonstrated good to excellent reliability, while the ACSS subscales showed acceptable internal consistency. These coefficients describe internal consistency; they were not interpreted as evidence of unidimensionality.

Skewness and kurtosis values for all node scores fell within acceptable ranges [ $|\text{skewness}| < 2$ ,  $|\text{kurtosis}| < 7.67$ ], with the largest absolute values being 1.220 and 1.384, respectively. Descriptive statistics for all scale totals are presented in Table S4.

#### 3.3. Network Structure

The primary EBICglasso network included 12 nodes and 48 nonzero regularized partial-correlation edges out of 66 edges (72.7%; Figure 1). Of the retained edges, 41 (85.4%) were positive and seven (14.6%) were negative. The relatively high edge density was consistent with

the estimation warning indicating that the selected tuning parameter was below  $0.10 \times \lambda_{\max}$ . Consequently, the smallest edge weights were interpreted cautiously.

The ten strongest edges, ranked by absolute weight, are presented in Table S5. The strongest was between the Social and Consider subscales of the Attitudes Toward Cosmetic Surgery Scale (ACSS), with a weight of 0.614. The second strongest was between Physical Appearance Perfectionism (PAPS) and Body Appreciation (BAS), with an inverse association of -0.387. The third strongest was between Physical Appearance Comparison (PACS\_R) and Sociocultural Attitudes (SATAQ\_4), with a weight of 0.283. Other notable positive associations were observed between Social Media Addiction (BSMAS) and Fear of Missing Out (FoMO; 0.273), and FoMO and SATAQ\_4 (0.263). A negative association was found between BAS and PACS\_R (-0.235).

Edge weight precision was assessed via non-parametric bootstrap with 1,000 iterations [44]. The 95% bootstrap confidence intervals indicated precise estimation (see Figure 2), with the narrowest intervals observed for the strongest edges and wider intervals for weaker edges. The mean width of the 95% bootstrap intervals was 0.237. Although the network is relatively dense, regularization was applied to shrink small edge weights toward zero. However, consistent with the warning noted in the Methods section, the smallest edges should be interpreted with particular caution.

### 3.4. Sensitivity Analyses

To assess the stability of the network structure across different regularization parameters, networks were estimated with  $\gamma = 0.25$  and  $\gamma = 0.75$ . The edge-weight matrix correlation between  $\gamma = 0.25$  and  $\gamma = 0.50$  was  $r = 0.878$ , and between  $\gamma = 0.50$  and  $\gamma = 0.75$  was  $r = 0.853$ . The number of retained edges was 49 for  $\gamma = 0.25$  and 45 for  $\gamma = 0.75$ , compared to 48 for  $\gamma = 0.50$ . The primary

network ( $\gamma = 0.50$ ) retained 89.6% of its edges when compared with  $\gamma = 0.25$  and 93.8% when compared with  $\gamma = 0.75$ . These findings indicate that the network structure was largely stable across different gamma specifications, with the primary network ( $\gamma = 0.50$ ) used for all subsequent analyses.

### 3.5. Community Detection

The Louvain algorithm identified three communities with a modularity score of 0.287; the resulting community structure was additionally examined using Walktrap and Fast Greedy algorithms (Figure S1, Table S6). Community 1 contained six nodes representing 50% of the network, including Body Dysmorphic Disorder (BDD\_YBOCS), Body Shame (OBCS\_BS), Social Media Addiction (BSMAS), Fear of Missing Out (FoMO), Physical Appearance Comparison (PACS\_R), and Sociocultural Attitudes (SATAQ\_4). Community 2 contained three nodes representing 25% of the network, including Physical Appearance Perfectionism (PAPS), Body Appreciation (BAS), and Narcissistic Personality Inventory (NPI\_16). Community 3 contained three nodes representing 25% of the network, comprising all three subscales of the Attitudes Toward Cosmetic Surgery Scale (ACSS\_Intrapersonal, ACSS\_Social, ACSS\_Consider). The relatively modest modularity value ( $Q = 0.287$ ) suggests that the community differentiation in this network is limited, consistent with the relatively dense network structure (72.7% density).

### 3.6. Centrality Analysis

The correlation stability coefficient for strength centrality was 0.750, indicating good stability. Expected influence also showed a stability coefficient of 0.750. Closeness showed a stability coefficient of 0.439, below the recommended threshold of 0.50 for drawing strong

conclusions; therefore, closeness estimates were interpreted descriptively. Betweenness showed a stability coefficient of 0.205 (below 0.25) and was excluded from interpretation [Table S7; , 44].

Centrality estimates are presented in Figure S2 and Table 1. Strength centrality values ranged from 0.598 to 1.124 (raw values, not standardized). The highest numerical strength centrality estimate was observed for Fear of Missing Out (FoMO; 1.124), followed by Physical Appearance Perfectionism (PAPS; 1.109), the Consider subscale of ACSS (1.090), Physical Appearance Comparison (PACS\_R; 1.034), and Body Appreciation (BAS; 1.005).

The lowest strength centrality was observed for ACSS\_Intrapersonal (0.598), followed by NPI\_16 (0.645). Based on 95% bootstrap confidence intervals, none of the differences among the top centrality nodes reached statistical significance, indicating that the numerical ordering should be interpreted with caution.

Expected influence values ranged from -0.489 to 1.124. Fear of Missing Out (FoMO) demonstrated the highest positive expected influence (1.124), followed by ACSS\_Consider (1.090), ACSS\_Social (0.880), SATAQ\_4 (0.857), and OBCS\_BS (0.784). Body Appreciation (BAS) showed negative expected influence (-0.489), indicating predominantly negative associations with other nodes.

Bridge centrality analysis identified nodes connecting communities (Figure S3, Table 2). Bridge strength values (raw, not standardized) ranged from 0.066 to 0.641. The highest bridge strength was observed for Physical Appearance Perfectionism (PAPS; 0.641), followed by Physical Appearance Comparison (PACS\_R; 0.371), Body Appreciation (BAS; 0.368), Narcissistic Personality Inventory (NPI\_16; 0.343), and Fear of Missing Out (FoMO; 0.297). The lowest bridge strength was observed for Sociocultural Attitudes (SATAQ\_4; 0.066) and Social Media Addiction (BSMAS; 0.121). Bridge strength (CS = 0.750) and bridge expected influence

(CS = 0.750) demonstrated good stability. Bridge closeness showed limited stability (CS = 0.439) and was interpreted descriptively, whereas bridge betweenness (CS = 0.000) was excluded from interpretation.

### 3.7. Predictability

Node predictability values (Figure S4, Table 3), representing the proportion of variance in each node statistically accounted for by other nodes in the network, ranged from 0.167 to 0.596, with a mean of 0.413. The highest predictability was observed for ACSS\_Consider (0.596), followed by ACSS\_Social (0.560), PAPS (0.504), PACS\_R (0.489), and FoMO (0.474). The lowest predictability was observed for NPI\_16 (0.167), followed by ACSS\_Intrapersonal (0.275) and BDD\_YBOCS (0.334). The ACSS cluster showed the highest mean predictability, followed by the social media and behavioral constructs group. The psychological constructs group showed the lowest mean predictability.

### 3.8. Shortest Paths to ACSS\_Consider

Shortest topological paths between each node and the Consider node were estimated after converting absolute edge weights into distances. For each nonzero edge, distance was defined as  $d_{ij} = 1/|w_{ij}|$ , such that stronger conditional associations corresponded to shorter distances. Zero edges were treated as absence of a direct path (i.e., infinite distance in Dijkstra's algorithm).

The shortest paths to ACSS\_Consider varied from  $d = 1.630$  to  $21.303$  (Table S8). Network pathways and direct associations are visualized in Figures S5 and S6, respectively; Figure S7 presents the bar plot of distances. The closest node to ACSS\_Consider was ACSS\_Social ( $d = 1.630$ ), followed by ACSS\_Intrapersonal ( $d = 4.383$ ) and PAPS ( $d = 11.598$ ). The most distant

nodes were FoMO ( $d = 21.303$ ), SATAQ\_4 ( $d = 20.209$ ), and NPI\_16 ( $d = 19.561$ ). The mean shortest path distance was 14.83.

Notably, ACSS\_Social showed the shortest distance to ACSS\_Consider through a direct pathway ( $d = 1.630$ ), consistent with the theoretical overlap between social and general appearance evaluation. ACSS\_Intrapersonal also showed a direct pathway ( $d = 4.383$ ). BAS (Body Appreciation Scale) showed a distance of  $d = 14.182$  from ACSS\_Consider, with the shortest topological path passing through PAPS. This represents topological proximity within the estimated cross-sectional network and should not be interpreted as evidence of mediation, indirect effects, or temporal ordering.

FoMO and SATAQ\_4 showed the longest distances ( $d = 21.303$  and  $20.209$ , respectively), suggesting that fear of missing out and sociocultural attitudes toward appearance have weaker topological connections to appearance evaluation compared to other constructs in the network. This may indicate that appearance evaluation is more strongly associated with body-related and self-perception factors than with social media-specific constructs.

Edge signs along each path are reported separately because the distance transformation was based on edge magnitude. These paths represent undirected topological proximity within the cross-sectional network and should not be interpreted as temporal or causal pathways to subsequent cosmetic-procedure consideration[43].

### 3.9. Network Comparison Tests

Network comparison tests examined whether network structure differed across demographic, gender, and surgery-related subgroups (Table S9, Figure S8). For each comparison, the network structure invariance test statistic ( $M$ ) and global strength invariance are reported.

For demographic comparisons, no significant network differences were observed for age ( $M = 0.201$ ,  $p = 0.277$ ; global strength:  $0.510$ ,  $p = 0.337$ ), education ( $M = 0.219$ ,  $p = 0.416$ ; global strength:  $0.180$ ,  $p = 0.693$ ), or income (all  $p > 0.05$ ; see Table S9). For gender comparison, no significant network differences were observed between females and males ( $M = 0.193$ ,  $p = 0.208$ ; global strength:  $0.017$ ,  $p = 0.970$ ).

For surgery group comparisons, no significant network differences were observed between Invasive Only and Non-Invasive Only ( $M = 0.230$ ,  $p = 0.248$ ; global strength:  $0.327$ ,  $p = 0.584$ ), Invasive Only and Both ( $M = 0.157$ ,  $p = 0.792$ ; global strength:  $0.011$ ,  $p = 0.990$ ), or Non-Invasive Only and Both ( $M = 0.167$ ,  $p = 0.723$ ; global strength:  $0.316$ ,  $p = 0.396$ ).

All nine tests were subjected to Bonferroni correction ( $\alpha = 0.0056$ ) and False Discovery Rate procedures; none remained significant. The absence of statistically significant differences indicates that no statistically detectable subgroup differences were observed in the present sample. However, this should not be interpreted as evidence of network equivalence or invariance; rather, the current data did not provide sufficient evidence of subgroup differences.

#### 4. Discussion

The present study examined a cross-sectional network of conditional associations among body-image, psychological, sociocultural, media-related, and cosmetic-procedure-attitude constructs in Iranian adults with previous cosmetic procedure experience. Three partially differentiated communities were identified: a clinical–sociocultural/media community, a self-evaluative characteristics community, and an ACSS attitudes and intention community. FoMO had the highest numerical strength estimate, whereas ACSS\_Consider showed comparable expected influence, and physical appearance perfectionism had the highest numerical bridge-strength

estimate. Intention to consider a subsequent cosmetic procedure, represented by the ACSS-Consider subscale, had a predictability estimate of  $R^2 = .596$ .

Network comparison tests did not detect significant differences across the three procedure history groups. These findings characterize the structural positions of the included constructs but do not establish temporal, causal, or intervention-related relationships.

#### 4.1. Theoretical Implications

Body dysmorphic symptoms and body shame were assigned to the same exploratory community as FoMO, social media addiction, appearance comparison, and sociocultural appearance pressures. This configuration is broadly compatible with theoretical models that situate body-image concerns within sociocultural and appearance-comparison contexts, including the tripartite influence and objectification models [20, 21]. However, community membership does not establish that sociocultural or media-related factors precede or produce clinical symptoms. Moreover, because community detection was based on absolute edge weights and the modularity value was modest ( $Q = .287$ ), the identified grouping should be interpreted as a descriptive feature of this network rather than as confirmation of a specific theoretical structure.

The assignment of body dysmorphic symptoms and body shame to the clinical–sociocultural/media community differed from the a priori conceptual grouping, in which these constructs had been classified as individual clinical characteristics. One possible interpretation is that, within this sample, these symptoms shared stronger conditional associations with appearance comparison, sociocultural pressures, and media-related experiences than with some of the other self-evaluative constructs. This interpretation is compatible with ecological accounts emphasizing that body-image concerns occur within broader social contexts [86, 87], but the direction and temporal ordering of these associations cannot be determined from the present data.

Body appreciation was assigned to the same community as appearance perfectionism and narcissistic traits. This assignment appears to have been influenced partly by the comparatively strong inverse edge between body appreciation and appearance perfectionism (weight = -0.387). Because community detection was performed using absolute edge weights, strong inverse and positive associations contributed equally to community assignment. Accordingly, this result should not be interpreted as evidence that body appreciation and appearance perfectionism constitute the same psychological process or that body appreciation actively counteracts perfectionism. Instead, it indicates that the two constructs were closely connected in magnitude while showing an inverse conditional association. This pattern is consistent with evidence that positive body image is related to, but not merely the opposite of, negative appearance evaluation [40, 88]. Replication using signed community-detection approaches and multiple methods of assessment is warranted.

Physical appearance perfectionism had the highest numerical bridge-strength estimate in the exploratory community structure (bridge strength = 0.641). This finding indicates that, relative to the other nodes, appearance perfectionism had comparatively large conditional associations with nodes assigned to other communities. It should not be interpreted as evidence that perfectionism causally transmits sociocultural influences to body-image concerns or cosmetic procedure intention. The result differs from [89], who found a more peripheral position for general perfectionism and a stronger bridging role for sociocultural pressures. Differences in sample characteristics, cultural context, included nodes, and the use of an appearance-specific rather than general perfectionism measure may contribute to this discrepancy. Direct comparison remains tentative because bridge estimates depend on the variables included and the community solution obtained in each study.

The ACSS community was consistent with the scale's three-factor structure, with the three subscales forming a distinct cluster. The strongest direct edge to ACSS\_Consider was from ACSS\_Social (weight = 0.614), followed by ACSS\_Intrapersonal (weight = 0.228). This indicates that ACSS-Social showed the strongest conditional association with intention to consider a subsequent cosmetic procedure among the three ACSS-related nodes included in the network.

Extending this, the shortest path analysis revealed that ACSS\_Social ( $d = 1.630$ ) and ACSS\_Intrapersonal ( $d = 4.383$ ) were topologically the closest nodes to ACSS\_Consider, reinforcing the scale's structural coherence. Notably, Physical Appearance Perfectionism (PAPS) ranked third in topological proximity ( $d = 11.598$ ), and Body Appreciation (BAS) reached ACSS\_Consider indirectly through PAPS ( $d = 14.182$ ). The shortest-path analysis placed PAPS between BAS and ACSS\_Consider in the estimated network, indicating greater topological proximity of these constructs through PAPS. This pattern describes the structure of conditional associations in the cross-sectional network and should not be interpreted as evidence of statistical mediation, indirect effects, or temporal ordering.

#### **4.2. Centrality, Predictability, and Robustness**

FoMO had the highest numerical strength and expected-influence estimates and showed comparatively large conditional associations with social media addiction, appearance comparison, and sociocultural appearance pressures. This pattern is consistent with previous studies reporting associations between FoMO, social media engagement, and body-image concerns [30, 31]. The present findings extend this literature by showing that, when modeled alongside clinical symptoms (BDD), self-evaluative traits (PAPS, BAS), and sociocultural pressures (SATAQ-4), FoMO showed high global connectivity within the estimated network, while remaining topologically less proximate to intention to consider a subsequent cosmetic procedure. This distinction suggests that

a node may be highly connected within the broader network without being directly proximal to the focal outcome. However, these topological properties should not be interpreted as evidence of indirect effects, mediation, or causal influence. Longitudinal studies are needed to determine whether within-person changes in FoMO are temporally associated with subsequent changes in appearance comparison or cosmetic-procedure consideration.

A critical dissociation emerged when comparing global centrality with outcome-specific topological proximity. Despite FoMO having the highest numerical strength centrality (1.124), the shortest path analysis placed FoMO as the most distant node from ACSS\_Consider ( $d = 21.303$ ), alongside SATAQ\_4 ( $d = 20.209$ ). This indicates that although FoMO showed high global connectivity within the overall network structure, it was topologically less proximate to intention to consider a subsequent cosmetic procedure than several other nodes, including ACSS-Social and PAPS. The shortest-path analysis does not establish that these associations are indirect effects or that appearance comparison or perfectionism function as mediators.

Conversely, PAPS and ACSS\_Social, which showed moderate to high global strength, demonstrated much shorter distances to the intention node. This dissociation underscores the importance of distinguishing between a node's general connectivity within the entire system and its specific structural proximity to a clinically or behaviorally relevant outcome. High centrality does not automatically translate into direct relevance for a particular dependent construct, and topological paths provide complementary information that should not be conflated with centrality indices. The relative ordering of these distances should be interpreted with particular caution, given the sensitivity of the distance transformation to the magnitude of individual edge weights.

The predictability estimates for ACSS\_Consider was  $R^2 = .596$ , indicating that approximately 60% of the variance in future cosmetic procedure intention was statistically

accounted for by its network neighbors. The elevated predictability of ACSS\_Consider is consistent with its relatively strong direct conditional association with ACSS\_Social (weight = 0.614), as well as its direct associations with ACSS\_Intrapersonal (weight = 0.228) and PAPS (shortest-path distance = 11.598). These structural associations indicate that intention to consider a subsequent procedure is closely embedded within the network, but they do not establish that these constructs causally account for or produce the observed variance.

This value substantially exceeds the average predictability of the network ( $M = .413$ ) and suggests that future intention is deeply connected to the broader network of psychological, sociocultural, and media-related constructs. However, because predictability reflects shared variance among constructs in a cross-sectional network, it should not be interpreted as evidence that neighboring nodes directly shape or cause intention, nor does it provide a direct basis for clinical intervention recommendations.

Bootstrap analysis provided information on edge-weight precision, with the strongest retained edges (Table S5) showing confidence intervals that did not cross zero, suggesting acceptable estimation precision. Weaker edges showed wider confidence intervals, consistent with the regularization warning that smaller edge estimates should be interpreted cautiously. Because bootstrap confidence intervals do not constitute formal significance tests, these findings should be interpreted as evidence of estimation precision rather than statistical significance, and replication in independent samples is warranted. The relatively high network density (72.7%) and the EBICglasso tuning warning ( $\lambda < 0.1 \times \lambda_{\max}$ ) further suggest that smaller edge estimates may be sensitive to model specification and should therefore be interpreted with particular caution. Correlation stability coefficients for strength centrality and expected influence (CS = 0.750) supported the interpretability of these centrality estimates, although closeness and

betweenness indices were treated with caution given their lower stability. Collectively, these checks support the stability of the estimated parameters but should not be overinterpreted as strong evidence of a uniquely robust network structure.

### **4.3. Subgroup network comparisons**

Network comparison tests did not detect statistically significant differences in overall network structure or global strength between the invasive-only, non-invasive-only, and both-procedure groups. Similarly, no statistically significant network differences were detected across the examined gender, age, education, or household-income categories after correction for multiple testing. These findings indicate an absence of statistically detectable differences in the present sample, rather than evidence that the corresponding networks are equivalent or invariant.

Several considerations may account for the nonsignificant results. Network comparison tests may have limited power when subgroup sample sizes are modest, particularly for detecting differences in individual edges. Classification based on broad procedure-history categories may also obscure heterogeneity in the number, recency, type, and outcome of previous procedures. In addition, demographic categories may contain substantial within-group variation. Consequently, the findings do not rule out clinically meaningful subgroup differences. Larger studies using more detailed procedure histories and formal equivalence-testing approaches are needed before concluding that a common network structure generalizes across groups. The absence of a detectable gender difference is broadly consistent with some previous body-image network research [e.g., 90], although differences in populations and included constructs limit direct comparison.

### **4.4. Clinical implications**

The present findings offer several preliminary directions for clinical and public health practice. First, given that physical appearance perfectionism (PAPS) showed the highest bridge strength and greater topological proximity to procedure consideration than several globally central nodes, screening for perfectionistic appearance beliefs in pre-surgical psychological consultations may help identify individuals who are more likely to consider additional procedures. Second, the strong conditional association between the Social and Consider subscales of the ACSS (weight = .614) suggests that clinicians should explicitly assess social motivations—such as desire for social approval or perceived peer expectations—during pre-procedure counseling, as these may be more directly linked to future procedure intention than general body dissatisfaction. Third, despite FoMO showing the highest global centrality, its greater topological distance from ACSS-Consider implies that public health messages and media literacy interventions aimed at reducing cosmetic procedure seeking might be more effective if they target appearance comparison and perfectionistic self-evaluation directly, rather than focusing primarily on social media-related fear of missing out. However, because these interpretations derive from a cross-sectional network, they should be considered hypothesis-generating and require prospective validation before implementation in clinical settings.

#### **4.5. Limitations and Boundary Conditions**

Several limitations should be considered. First, the cross-sectional between-person network cannot establish temporal ordering, causal effects, feedback processes, or within-person dynamics. Longitudinal and intensive repeated-measures designs are needed to determine whether changes in one construct precede changes in another. Second, the ACSS Consider subscale assessed intention to consider a future cosmetic procedure rather than subsequent behavior; participants were not followed to determine whether they underwent another procedure. Third,

604 convenience sampling from cosmetic clinics and day-surgery centers in two Iranian cities limits  
 605 generalizability. All participants had previous cosmetic procedure experience, and the findings  
 606 may not generalize to individuals considering their first procedure, people not seeking clinic-based  
 607 services, or populations in other cultural settings. Procedure histories were self-reported and  
 608 categorized broadly; information about the number, recency, satisfaction, complications, and  
 609 specific types of procedures was not fully incorporated into the network. Fourth, reliance on  
 610 self-report measures collected using a common response format may have contributed to  
 611 shared-method variance. The use of scale totals also obscured potentially distinct associations  
 612 involving subdimensions such as worry about imperfection and hope for perfection. Fifth, the  
 613 network is conditional on the included nodes, scoring decisions, and estimation method. The  
 614 relatively high edge density (72.7%) and EBICglasso tuning warning ( $\lambda < 0.1 \times \lambda_{\max}$ )  
 615 indicate that smaller edge estimates may be sensitive to model specification. Sixth, the community  
 616 solution had modest modularity ( $Q = .287$ ) and was obtained using absolute edge weights, which  
 617 treat positive and negative associations equivalently. Community labels and corresponding bridge  
 618 indices should therefore be viewed as exploratory. Seventh, the shortest path analysis, while  
 619 informative, is inherently sensitive to the distance transformation applied ( $d_{ij} =$   
 620  $1/|w_{ij}|$ ). This transformation treats positive and negative associations equivalently,  
 621 meaning that inverse edges contribute equally to proximity as positive edges do. Consequently,  
 622 the identified pathways to ACSS\_Consider represent magnitude-based topological closeness  
 623 rather than the valence or direction of influence. Additionally, because the network is undirected,  
 624 these paths should not be misconstrued as sequential routes, temporal cascades, or evidence of  
 625 mediation. They merely describe which nodes are more conditionally proximate to the intention  
 626 node within the estimated cross-sectional system, and their interpretation must remain strictly

descriptive. Finally, subgroup analyses may have had insufficient power to detect small or edge-specific differences, and nonsignificant comparison tests should not be interpreted as evidence of network equivalence.

#### **4.6. Alternative Explanations**

Shared-method variance and conceptual overlap offer alternative explanations for some network features. Because all constructs were assessed by self-report at a single occasion, part of the observed covariance may reflect response styles or overlapping item content. The inverse edge between body appreciation and appearance perfectionism does not eliminate this possibility. FoMO's comparatively high connectivity may similarly reflect substantive associations with social comparison and media engagement, conceptual overlap across measures, or both. Future studies using clinician-administered measures, behavioral indicators, temporal assessments, and explicit evaluation of item overlap are needed to distinguish these explanations. Specifically, the short topological distances observed among the three ACSS subscales, and the relatively longer distances for FoMO and SATAQ, may partly reflect common method effects due to similar item wording and response formats within the ACSS, rather than purely substantive theoretical proximity. Without multimethod assessments, it remains difficult to disentangle whether the topological closeness of ACSS\_Social and ACSS\_Intrapersonal to ACSS\_Consider is driven by construct overlap, shared scale variance, or genuine psychological proximity.

#### **4.7. Directions for future research and potential implications**

The present findings provide several directions for future research. Intensive longitudinal studies could examine whether within-person fluctuations in FoMO precede changes in appearance comparison, body dissatisfaction, or thoughts about additional cosmetic procedures, extending previous evidence linking FoMO with social media engagement and adverse body-image

experiences [30–32]. Prospective studies could similarly test whether appearance perfectionism predicts subsequent changes in cosmetic procedure intention after accounting for satisfaction with previous procedures, body dysmorphic symptoms, and sociocultural pressures [36, 37]. Experimental research would then be needed to determine whether modifying FoMO, appearance comparison, or perfectionistic beliefs affects body-image outcomes or procedure intentions.

Moreover, the observed topological proximity between Body Appreciation, Physical Appearance Perfectionism, and ACSS\_Consider could motivate future longitudinal studies using mediation or dynamic network approaches to test whether changes in these constructs show a temporal ordering consistent with the pattern observed in the present cross-sectional network. Such designs would provide a more rigorous test of the sequential hypothesis suggested by the shortest-path analysis.

The present findings do not justify the immediate use of FoMO, appearance comparison, or appearance perfectionism as clinical screening indicators. However, the present findings can inform the selection of candidate constructs for future screening research. Specifically, PAPS and PACS-R, which showed high bridge centrality and topological proximity to ACSS\_Consider, may warrant psychometric evaluation as potential screening indicators in prospective studies, provided they demonstrate incremental validity over established measures. Centrality and bridge-centrality estimates describe structural positions within an estimated network but do not identify causal mechanisms or effective intervention targets [43]. Before clinical application, prospective studies should establish whether these constructs provide incremental validity beyond established measures of body dysmorphic symptoms, body-image disturbance, and unrealistic procedure expectations and whether they predict subsequent procedure uptake or postoperative outcomes [9, 10]. Psychoeducational approaches addressing idealized media content and appearance

comparison may also warrant evaluation, given evidence linking social media exposure with body dissatisfaction and greater acceptance of cosmetic procedures [13].

Cross-cultural replication is also needed because sociocultural appearance pressures may differ in meaning and measurement across cultural settings. Evidence of SATAQ-4 measurement non-invariance between Iranian and US women indicates that future cross-cultural network comparisons should establish at least partial measurement invariance before interpreting network differences as culturally meaningful [91]. Replication across populations with different appearance ideals, media environments, and cosmetic-procedure practices would help distinguish context-specific findings from more generalizable network features.

#### **4.8. Conclusions**

This study characterized a cross-sectional network of body-image, psychological, sociocultural, media-related, and cosmetic-procedure-attitude constructs among Iranian adults with previous cosmetic procedure experience. FoMO had the highest numerical strength estimate, whereas physical appearance perfectionism had the highest numerical bridge-strength estimate. Body appreciation showed comparatively strong inverse conditional associations with appearance perfectionism and appearance comparison. Intention to consider a subsequent cosmetic procedure, represented by the ACSS\_Consider subscale, was statistically embedded within the broader network and had a predictability estimate of  $R^2 = .596$ . No statistically significant network differences were detected across invasive-only, non-invasive-only, and both-procedure subgroups, although these findings do not establish equivalence.

The findings indicate that positive and negative body-image characteristics were interconnected within a broader self-evaluative network rather than operating as independent dimensions. Physical appearance perfectionism and social appearance concerns showed greater

topological proximity to intention to consider a subsequent cosmetic procedure than did globally central constructs such as FoMO. At the same time, these structural properties should not be interpreted as evidence of temporal ordering, causal influence, mediation, or established intervention targets.

Overall, FoMO and physical appearance perfectionism warrant further investigation as structurally prominent constructs in preregistered longitudinal, experimental, and cross-cultural research. The distinction between global network centrality and outcome-specific topological proximity highlights the importance of examining both properties when identifying constructs potentially relevant to cosmetic-procedure consideration. The present findings should therefore be regarded as hypothesis-generating structural associations that require replication and prospective validation before informing clinical screening or intervention strategies.

#### **List of abbreviations**

ACSS: Acceptance of Cosmetic Surgery Scale; BAS: Body Appreciation Scale; BDD-YBOCS: Yale-Brown Obsessive-Compulsive Scale Modified for Body Dysmorphic Disorder; BSMAS: Bergen Social Media Addiction Scale; FoMO: Fear of Missing Out; NPI-16: Narcissistic Personality Inventory-16; OBCS-BS: Objectified Body Consciousness Scale – Body Shame Subscale; PACS-R: Physical Appearance Comparison Scale-Revised; PAPS: Physical Appearance Perfectionism Scale; SATAQ-4: Sociocultural Attitudes Toward Appearance Questionnaire-4.

#### **Declarations**

#### **Ethics approval and consent to participate**

This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Kharazmi University (Ref No: IR.KHU.REC.1404.161). Written informed consent was obtained from all participants prior to their participation. All participants

719 were adults aged 18 years or older and provided informed consent for their anonymized data to be  
 720 used for research purposes.

## 721 **Consent for publication**

722 Not applicable. This manuscript does not contain any individual person's data (e.g., images, videos,  
 723 or clinical details) in any form that would require consent for publication.

## 724 **Availability of data and materials**

725 The datasets generated and analysed during the current study are not publicly available due to  
 726 privacy restrictions but are available from the corresponding author on reasonable request, subject  
 727 to institutional ethical guidelines and participant confidentiality requirements. R scripts used for  
 728 network estimation and stability analyses are also available from the corresponding author upon  
 729 request.

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731 The authors declare that they have no competing interests.

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## 735 **Authors' contributions**

736 HZB: Investigation, Writing – Original Draft, Visualization. MA: Supervision, Conceptualization,  
 737 Methodology, Writing – Original Draft, Validation, Writing – Review & Editing. SB: Formal  
 738 Analysis, Software, Data Curation, Methodology (statistical consultation), Writing – Review &  
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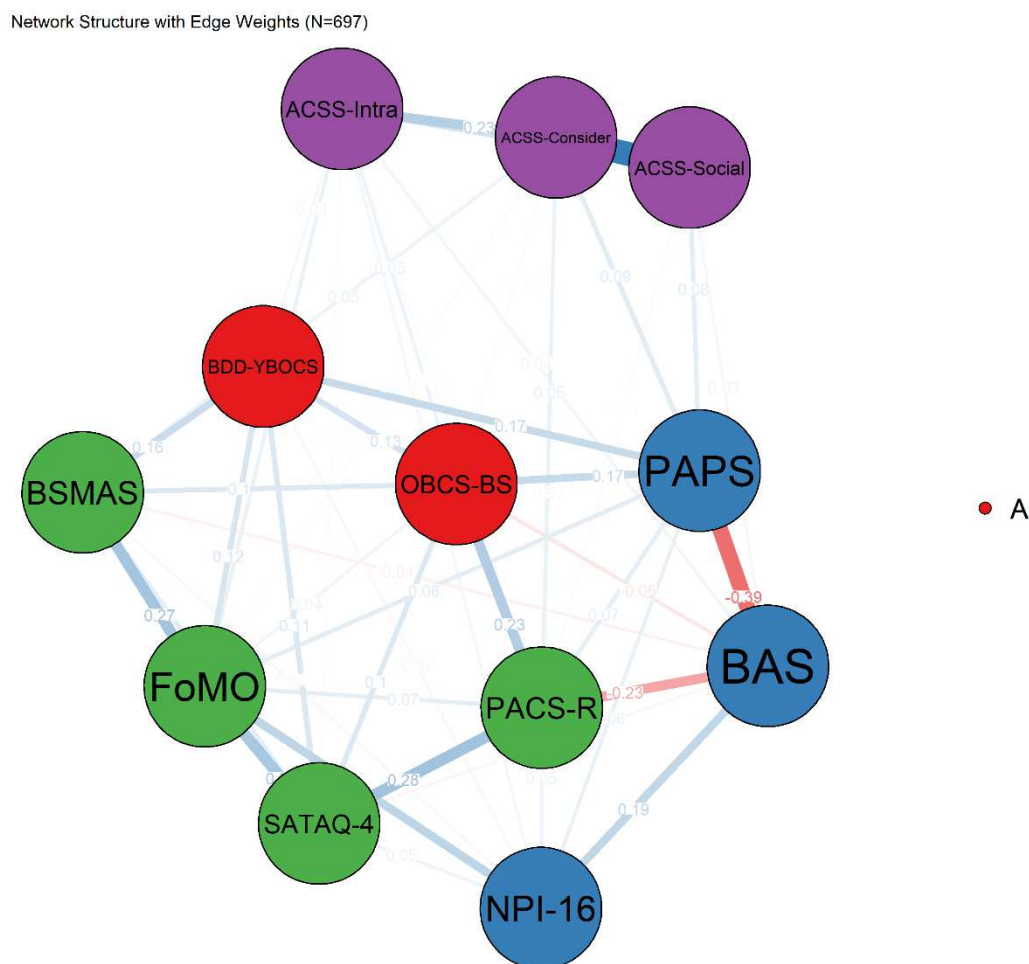
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# 997 **Figure 1**

## 998 *Network Structure of Psychological and Behavioral Constructs*

999 *Note.* Network visualization of the 12 nodes representing psychological and behavioral constructs related to cosmetic  
 1000 surgery intention. Blue edges represent positive associations; red edges represent negative associations. Edge thickness  
 1001 corresponds to weight magnitude. ACSS = Attitudes Toward Cosmetic Surgery Scale; PAPS = Physical Appearance  
 1002 Perfectionism Scale; BAS = Body Appreciation Scale; PACS-R = Physical Appearance Comparison Scale; FoMO =  
 1003 Fear of Missing Out Scale; BSMAS = Social Media Addiction Scale; SATAQ-4 = Sociocultural Attitudes Toward  
 1004 Appearance Questionnaire; BDD-YBOCS = Body Dysmorphic Disorder Scale; OBCS-BS = Body Shame Scale; NPI-  
 1005 16 = Narcissistic Personality Inventory.

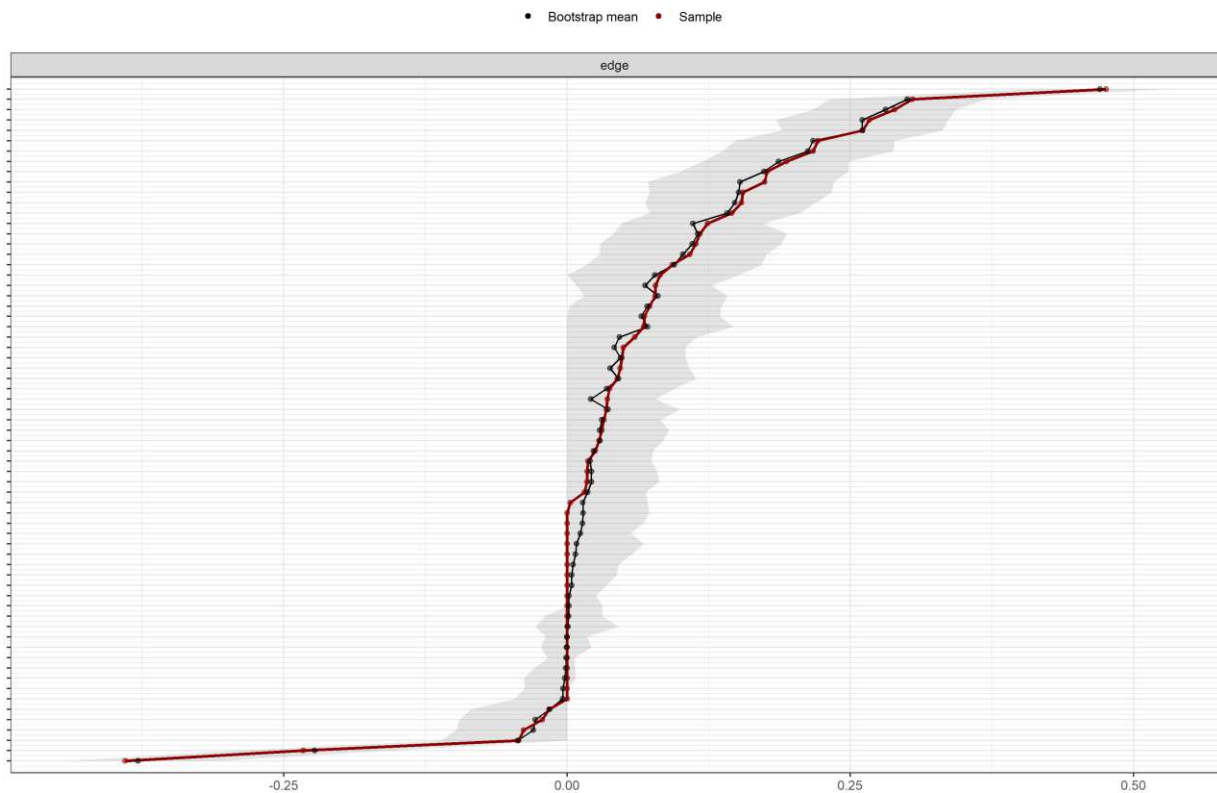


**Figure 2**

*Bootstrapped 95% Confidence Intervals for All Edge Weights*

*Note:* Blue points represent sample edge weights; black lines represent bootstrap 95% confidence intervals. Edges are ordered by weight magnitude. All 48 edges had confidence intervals that did not cross zero, indicating precise estimation. ACSS = Attitudes Toward Cosmetic Surgery Scale; PAPS = Physical Appearance Perfectionism Scale; BAS = Body Appreciation Scale; PACS-R = Physical Appearance Comparison Scale; FoMO = Fear of Missing Out Scale; BSMAS = Social Media Addiction Scale; SATAQ-4 = Sociocultural Attitudes Toward Appearance Questionnaire; OBCS-BS = Body Shame Scale; NPI-16 = Narcissistic Personality Inventory; BDD-YBOCS = Body Dysmorphic Disorder Scale.

**Table 1. Full Centrality Measures for All Nodes (N=697)**

| Node                                                    | Strength | Betweenness | Closeness | Expected Influence |
|---------------------------------------------------------|----------|-------------|-----------|--------------------|
| Fear of Missing Out Scale                               | 1.124    | 12          | 7.656     | 1.124              |
| Physical Appearance Perfectionism Scale                 | 1.109    | 44          | 10.402    | 0.335              |
| ACSS_Consider                                           | 1.090    | 0           | 6.157     | 1.090              |
| Physical Appearance Comparison Scale                    | 1.034    | 14          | 9.223     | 0.564              |
| Body Appreciation Scale                                 | 1.005    | 30          | 9.960     | -0.489             |
| Sociocultural Attitudes Toward Appearance Questionnaire | 0.924    | 6           | 8.434     | 0.857              |
| Body Shame Scale                                        | 0.910    | 6           | 9.018     | 0.784              |
| ACSS_Social                                             | 0.880    | 26          | 6.917     | 0.880              |
| Body Dysmorphic Disorder Scale                          | 0.743    | 6           | 8.316     | 0.697              |
| Social Media Addiction Scale                            | 0.729    | 0           | 7.201     | 0.656              |
| Narcissistic Personality Inventory                      | 0.645    | 10          | 7.738     | 0.600              |
| ACSS_Intrapersonal                                      | 0.598    | 0           | 6.071     | 0.582              |

*Note.* Strength = sum of absolute edge weights; Expected Influence = sum of signed edge weights; Closeness = inverse of average shortest path distance; Betweenness = number of shortest paths passing through the node. Values are raw (not standardized). Based on 95% bootstrap confidence intervals, none of the differences among the top centrality nodes reached statistical significance.

**Table 2. Full Bridge Centrality Measures for All Nodes (N=697)**

| Node                                                    | Bridge Strength | Bridge Betweenness | Bridge Closeness | Bridge EI1 |
|---------------------------------------------------------|-----------------|--------------------|------------------|------------|
| Physical Appearance Perfectionism Scale                 | 0.641           | 15                 | 0.097            | 0.641      |
| Physical Appearance Comparison Scale                    | 0.371           | 6                  | 0.062            | -0.020     |
| Body Appreciation Scale                                 | 0.368           | 0                  | 0.047            | -0.300     |
| Narcissistic Personality Inventory                      | 0.343           | 6                  | 0.063            | 0.336      |
| Fear of Missing Out Scale                               | 0.297           | 11                 | 0.062            | 0.343      |
| Body Shame Scale                                        | 0.212           | 8                  | 0.068            | 0.212      |
| ACSS_Consider                                           | 0.244           | 0                  | 0.050            | 0.244      |
| Body Dysmorphic Disorder Scale                          | 0.164           | 3                  | 0.068            | 0.164      |
| ACSS_Social                                             | 0.177           | 12                 | 0.052            | 0.177      |
| ACSS_Intrapersonal                                      | 0.154           | 0                  | 0.047            | 0.154      |
| Social Media Addiction Scale                            | 0.121           | 0                  | 0.060            | 0.044      |
| Sociocultural Attitudes Toward Appearance Questionnaire | 0.066           | 4                  | 0.058            | 0.023      |

*Note.* Community membership identified via Louvain algorithm. Bridge Strength = sum of absolute edge weights to nodes in other communities; Bridge Betweenness = number of shortest paths between communities passing through the node; Bridge Closeness = inverse of average distance to nodes in other communities; Bridge EI1 = difference between number of edges to other communities and same community divided by total degree. Values are raw (not standardized).

**Table 3. Predictability ( $R^2$ ) with Regularization Parameters (N=697)**

| Node                                                    | $R^2$ |
|---------------------------------------------------------|-------|
| ACSS_Consider                                           | 0.596 |
| ACSS_Social                                             | 0.560 |
| Physical Appearance Perfectionism Scale                 | 0.504 |
| Physical Appearance Comparison Scale                    | 0.489 |
| Fear of Missing Out Scale                               | 0.474 |
| Sociocultural Attitudes Toward Appearance Questionnaire | 0.455 |
| Body Appreciation Scale                                 | 0.430 |
| Body Shame Scale                                        | 0.428 |
| Social Media Addiction Scale                            | 0.340 |
| Body Dysmorphic Disorder Scale                          | 0.334 |
| ACSS_Intrapersonal                                      | 0.275 |
| Narcissistic Personality Inventory                      | 0.167 |

*Note.*  $R^2$  values represent the proportion of variance in each node statistically accounted for by other nodes in the network, computed using node-wise regression.

1038 **Additional files 1**

1039 Additional file 1 (Word format). Title: Supplementary figures and tables. Description: This file  
1040 contains supplementary figures (Figures S1–S8) and supplementary tables (Tables S1–S9)  
1041 providing additional details on community detection, centrality analysis, bridge centrality,  
1042 predictability, shortest paths, network comparison tests, and descriptive statistics.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1.docx](#)