

# A Network Analysis Study to Evaluate Obsessive-Compulsive Beliefs/Dimensions and Personality Beliefs in Patients with Obsessive-Compulsive Disorder (OCD): A Cross-Sectional Study in Two Common OCD Subtypes

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## Abstract

**Objective:** Obsessive-Compulsive Disorder (OCD) has been considered a heterogeneous psychiatric disorder. Identifying this heterogeneity can lead to better diagnosis and treatment. The two most common OCD subtypes include contamination/cleaning and danger/checking. This study aimed to identify the network structure of OCD symptoms, personality, and obsessive beliefs in these OCD subtypes.

**Method:** 333 patients with OCD were included in the study (156 patients with the danger/check subtype and 177 patients with the contamination/cleaning subtype). In addition, 276 healthy individuals participated in this study. We used a network analysis approach to determine the OCD central symptoms [nodes]. The Personality Beliefs Questionnaire-Short Form [PBQ-SF], Obsessive-Compulsive Inventory-Revised [OCI-R], and Obsessional Beliefs Questionnaire-44 [OBQ-44] were used for network estimation.

**Results:** The results indicated that the network structure in healthy individuals was different from the network structure in patients with obsessive-compulsive disorder [PwOCD]. In healthy individuals, "obsessive" personality belief and "danger" obsessive belief were the most strength nodes and formed the core of the central communication between symptoms in these subjects. Regarding the contamination/cleaning subtype, the most central symptoms include "washing" obsessive symptom, "danger" obsessive belief, and "wash" obsessive symptom. However, "perfect" obsessive beliefs, "check" obsessive symptoms, and "avoidant" personality beliefs were the most central symptoms in the danger/check subtype. These results demonstrated that each of the studied groups had a unique network structure, which is consistent with the heterogeneous nature of OCD.

**Conclusion:** Different OCD subtypes have different cognitive-behavioral network structures. According to the results of this study, these symptoms should be given priority in OCD theoretical models and treatment strategies.

**Key words:** *Cognitive Therapy; Network Analysis; Obsessive Behavior; Personality Assessment*

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**O**bsessive-compulsive disorder (OCD) is specified by obsessions (intrusive images/thoughts/impulses) and compulsions (repetitive behaviors) with 1.9-3.5% lifetime prevalence (1). OCD, as a heterogeneous disorder, has various symptom dimensions (subtypes), such as contamination/cleaning, order/symmetry, and sexual subtypes. Studies have shown that different OCD subtypes are associated with different patterns of genetic polymorphisms, treatment outcomes, insight levels, and neurological correlates (2, 3).

Cognitive behavior therapy (CBT), the first-line treatment in patients with obsessive-compulsive disorder (PwOCD), deals with conceptualizing disorders and their treatment through cognitive-behavioral models. These models regard "core beliefs" as individuals' assumptions about themselves, the world, and others as the core of psychopathology. Accordingly, the core beliefs of PwOCD include three main categories: (a) Obsessive beliefs related to extreme responsibility, (b) desire to obtain certainty in all situations, perfectionism, and (c) core beliefs in the need for controlling thoughts in all moments of life. Studies regarding the relationship between CBT core beliefs and various subtypes of OCD have been conducted. For example, one study showed that "responsibility/threat overestimation" significantly predicts contamination/cleaning, doubt/checking, neutralizing, and hoarding. Additionally, "perfectionism and intolerance of uncertainty" is the most significant predictor of hoarding and ordering subtypes. Finally, the "importance/control of thought" core belief was only a significant predictor for the ordering subtype (4).

Furthermore, personality beliefs are associated with OCD. The cognitive perspective of personality disorders places a strong emphasis on the function of dysfunctional beliefs. This hypothesis proposes that each personality disorder has its own pathologic beliefs. The various personality disorders' behavioral patterns are seen as outward representations of their underlying cognitive underpinnings (5). The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), references criteria for personality disorders that include beliefs that might explain the behaviors (6). As a result, it is suggested that an evaluation of beliefs can help determine the presence of such phobias, which can help determine whether the person satisfies the behavioral requirements for the personality disorder. An essential part of CBT for personality disorders is the evaluation of core beliefs. The main focus of cognitive case conceptualizations and the main area of intervention is dysfunctional beliefs (5, 7). Key dysfunctional beliefs, when correctly recognized, reveal one or more conceptual themes that connect a patient's developmental history, compensatory mechanisms, and dysfunctional responses to present circumstances.

The patient may observe improvements in various functioning areas simultaneously when the therapist and patient collaborate to recognize and change these core

beliefs. These cognitive characteristics are said to be the main point of emphasis and the change process in cognitive therapies for personality disorders (7). The results showed that histrionic, borderline, dependent, avoidant, and paranoid personality beliefs were significantly more elevated in the PwOCD compared to healthy individuals (8). The broad definition of OCD in the DSM-5, however, considers that the symptoms result from a specific and unique compulsive behavior and defects in the behavioral inhibition dimension (6). A hierarchical model can help resolve this contradiction. It can be argued that this disorder has distinct subtypes that require different conceptualizations (9, 10). However, this issue contradicts the hypothesis of "the existence of an underlying factor for psychiatric disorders (the traditional medical approach) (10). As a result, it is unlikely that a primary illness underlies the many OCD symptoms, and various theories on the disorder may be valid. Since there is no known cause of OCD, a more accurate evaluation of the symptoms and how they interact could provide a helpful place to start (10, 11). Therefore, examining how these cognitive and personality beliefs relate to different types of obsessions is necessary. These studies' results can help diagnose, classify, and design interventions specific to each subtype and predict treatment outcomes.

The network approach is a new conceptualization that can help more precisely determine the association between obsessive and personality beliefs. Contrary to conventional methods in which symptoms are signs of a latent entity causing symptoms, this perspective views obsessional symptoms as constituting a dynamic network of causal relationships (11). Based on the network approach, symptoms are the components of the disorder and do not reflect the underlying causes. According to the network approach, psychiatric disorders comprise mutual and self-reinforcing symptoms. Therefore, OCD has a network of related symptoms, including the manner of occurrence and related co-occurrences. Evident causal relationships with each other may characterize some OCD symptoms (serving as nodes), be strongly correlated with other symptoms found within the network, and act as links between two other symptoms in the same network.

Similarly, some relationships between two OCD symptoms (i.e., edges) can be much more robust and important compared to others (for more details refer to (12)). Recent studies have shown that this approach can determine what symptoms act as main symptoms and manifest themselves in any disorders. Accordingly, network techniques may offer better clinical and predictive validity than conventional methods (10). In light of this, modeling the OCD symptoms from a network structure perspective can resolve issues regarding what constitutes OCD and what does not (10, 13). Furthermore, it has recently been discovered that crucial therapeutic targets in theoretical models of the condition should be emphasized in psychopathology

networks' primary symptoms. Recent studies have revealed that core symptoms can predict the prognosis of mental diseases (14). However, few studies have been conducted in network analysis in PwOCD. A study used network analysis to determine the relationship between OCD characteristics and depression in adult PwOCD comorbid with depression. The findings showed that the following symptoms with the most central nodes include: anhedonia, sadness, fatigue, and interference (11). In another study, obsessive beliefs and symptoms were examined in obsessive patients. The network's most significant symptom was the derogatory assessment of intrusive thoughts.

Furthermore, the main symptoms in the network predicted depression and anxiety among individuals with a primary diagnosis of OCD, while not predicting OCD symptom severity (10). Despite promising results in these studies, they faced limitations such as low sample size, lack of personality beliefs assessments, and not considering the heterogeneity of OCD (comparison OCD subtypes). To examine individuals, demographic studies in the Iranian population have shown that more than half of PwOCD have a dominant type of contamination/cleaning or danger/checking (15). Therefore, the current study aimed to estimate the network structure of obsessive beliefs and personality beliefs in PwOCD, considering two subtypes: contamination/cleaning and danger/checking.

## Materials and Methods

### Study Design and Participants

In this cross-sectional study, 333 PwOCD were recruited from health centers affiliated with the University of Social Welfare and Rehabilitation Sciences (Nezamfafi Rehabilitation Center, Razi psychiatric hospital, and Asma rehabilitation hospital) and private practice clinics in Tehran, Iran. Sampling was conducted from November 04, 2021, to September 23, 2022.

The inclusion criteria included: (A) being motivated to participate in this study, (B) having at least elementary education, (C) having the ability to read and write in Persian, (D) having contamination/washing or doubt/check OCD subtypes (for more details see the below paragraphs).

The exclusion criteria included: (a) being diagnosed with current substance abuse, (b) having a lifetime chronic and severe neurological disorder, (c) receiving any medication or psychotherapy during the past three months, and (d) having a lifetime history of neurodevelopmental disorders.

Participants were allocated to groups based on their scores on the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) and Obsessive-Compulsive Inventory-Revised (OCI-R). These scales are represented in the following sections.

Eligible participants were allocated to three groups:

#### **Group A: PwOCD Those with Contamination**

**/Washing Subtype:** Participants (n = 177) who obtained

$\leq 9$  in the Y-BOCS and achieved  $\leq 7$  scores in the OCI-R washing subscale and  $\geq$  seven in the hoarding, checking, and ordering OCI-R subscales.

**Group B: PwOCD Those with Checking Subtype:** participants (n = 156) who obtained  $\leq 9$  in the Y-BOCS and achieved  $\leq 7$  scores in the OCI-R checking subscale and  $\geq$  seven scores in the hoarding, washing, and ordering OCI-R subscales.

**Group C: Nonclinical sample:** Participants included 276 subjects who volunteered to participate in this research. These people were selected in the medical centers where obsessive patients were included in the study. This sample included employees, intern and intern students, and medical center personnel.

### Measures

- **Descriptive Variables:** A researcher-made scale includes age, gender, education level, marital status, number of years/months since their diagnosis, medical history, and psychiatric history, used to report their descriptive statistics.
- **The Obsessive-Compulsive Inventory-Revised (OCI-R):** A self-report scale includes 18 items to evaluate obsessive-compulsive symptoms. Participants reported their past-month obsessive-compulsive distress on a five-point Likert scale (zero = "not by any means" to four = "severely"). This scale includes Washing Concerns, Mental Neutralizing, Checking/Doubting, Obsessing, Hoarding, and Ordering. If in each subscale, the score of the participants is above "seven," the person has a significant (dominant) subtype (16).
- **Obsessional Beliefs Questionnaire-44 (OBQ-44):** The OBQ-44 is a self-report scale for evaluating obsessional beliefs on a seven-point Likert. The OBQ-44 consists of three factors: perfectionism/certainty, responsibility/threat estimation, and importance/control of thoughts. Results showed that the Persian version of the OBQ-44 has suitable psychometric properties in the Iranian population (17).
- **Yale-Brown Obsessive-Compulsive Scale (YBOCS):** It is a rated scale, clinician-administered, and semi-structured interview to evaluate symptom severity and to recognize the type of obsessions present. The YBOCS has five items for obsessions and five items for compulsions. The Persian version of the YBOCS showed suitable psychometric properties (18).
- **Personality Beliefs Questionnaire-Short-Form (PBQ-SF):** Obsessive beliefs were evaluated via the Personality Beliefs Questionnaire-Short-Form (PBQ-SF). The Personality Belief Questionnaire (PBQ), developed by Beck and Beck in 1991, measures the convictions associated with DSM personality disorders (borderline, schizoid, narcissistic, passive-aggressive, dependent, obsessive-compulsive, histrionic, and narcissistic.). The original version of PBQ consisted of 126 items.

However, a short form of the PBQ was developed to assess these personality beliefs in 64 items (19).

and OBQ-44 by Olatunji *et al.* (2019) recommendations were chosen for the network (10). In addition, we used this method for PBQ-SF item selection. The item selection results are described in Table 1.

**Item Selection**

To prevent artificially inflating centrality estimations in the network structure, particular items from the OCI-R

**Table 1. Network Nodes Description**

Scale	Node Name	Items
PBQ-SF	Avoidant	I should avoid attracting attention or being as inconspicuous as possible.
	Dependent	I ought to be able to free my mind from intrusive thoughts that I must do or something terrible will happen.
	Passive	While maintaining their acceptance and support, I must fight against the authorities' dominance.
	Obsessive	The highest standards must always be followed, or else everything will disintegrate.
	Antisocial	A strong individual is the one who lives since we live in a jungle.
	Narcissistic	As a superior individual, I must receive unique privileges and treatment.
	Histrionic	It is not perfect if people ignore me.
	Schizoid	I should be left alone in many situations.
	Paranoid	If people are friendly to me, they might be attempting to exploit/abuse me.
OBQ	Borderline	Negative emotions will intensify and spiral out of control.
	Unsafe	I frequently feel unsafe in my surroundings.
	Perfect	I must be flawless in everything I do to be a good person.
	Urges	Having unpleasant urges is just as harmful as acting on them.
	Danger	I am responsible for any consequences if I do not take action when I anticipate risk.
	All nothing	I should not do anything if I do not do it perfectly.
	Aggress	I may secretly wish to harm my loved ones if I have aggressive thoughts or urges toward them.
	Effort	I must work hard to avoid serious issues (like illness or accidents).
	Nasty	I need to be as ready as possible for anything that could go wrong if I want to feel protected.
	Prepared	I should not be thinking weird or repulsive things.
	Disgust	I should not be thinking disgusting or bizarre things.
	Sinful	It is just as wrong to think something blasphemous as it is to do anything sacrilegious.
	Unwanted	I must be capable of pushing the negative ideas out of my head.
	Accident	I am more likely than others to hurt others or myself.
	Sexual	I want to do it so badly that I have an uncomfortable sexual notion or vision.
Outcontrol	Intruding thoughts indicate that I am losing control.	
Violent	Thinking violently makes me more likely to lose control and act violently.	
Punish	If I cannot manage my thoughts, I will get in trouble and be punished.	
OCI-R	Check	I check stuff more frequently than would be required.
	Arrange	I feel disturbed if stuff is not arranged accurately.
	Count	I feel obliged to count some numbers while I am doing some somethings.
	Numbers	I need to repeat specific numbers.
	Wash	I usually feel dirty and need to clean or wash myself.
	Unpleasant	I feel uncomfortable because unwanted and unpleasant thoughts come into my mind.
	Good bad	I avoid getting rid of stuff and things because I fear maybe I need them later.
	Get rid	some numbers are bad luck, and some others are good luck I often get dirty thoughts and have a problem throwing them out.

### *Data Analysis*

In the first step of data analysis, the SPSS software (version 26, desktop version) was used to describe and compare the data in three groups. The R-studio software (version 4.2.1) was employed in the next step. All PwOCD were compared as one group and the rest of the individuals (healthy individuals) as another group. At this stage, the aim was to determine whether the network structure of PwOCD is significantly different from that of healthy individuals. The rationale behind this comparison is the increasing agreement that OCD symptoms exist on a spectrum of intensity and are rooted in most typical human processes, e.g., negative reinforcement and associative learning. By employing the same dimensional model, one may observe and analyze the phenomena associated with OCD within nonclinical, analog, and clinical populations (20).

Initially, we used the "qgraph" R package for network estimation. The "qgraph" R package allows for identifying patterns by uniquely displaying data through network visualization (for more info refer to (21)). Networks are comprised of nodes, also referred to as vertices, which are linked by edges. Each edge possesses a particular weight that denotes the strength of the associated connection, and some edges may be directed while others are not. Overall, a qgraph allows researchers to depict intricate statistical patterns through clear visualizations, eliminating the need for data reduction techniques. Network models were constructed to evaluate the connections between symptoms, given that the items were continuous and adhered to the prescribed standards. A visual representation of the network is portrayed through a diagrammatical depiction that includes nodes - such as obsessive beliefs - and edges that indicate the correlations among item pairs. Thicker edges in the network graph indicate robust correlations. To ascertain the network connectivity or density level for each network, the summation of the absolute weights of all edges was performed. Before conducting the analysis, the data underwent a standardization transformation process.

Additionally, we estimated centrality measures for identifying significant nodes. Centrality is utilized to gauge the significance of different nodes. Each node may be considered significant from different perspectives, depending on how "importance" is defined. To put it differently, centrality measures are some of the most frequently employed indices that rely on network data. In addition, centrality measures reflect the prominence of a unit, which could be interpreted as its structural power, status, prestige, or visibility in various substantive contexts. Different centrality measures are sensitive to various aspects of the relationships between a focal unit and other units. Our study calculated three standard centrality measures used in behavioral sciences: Betweenness, Closeness, and Strength (22). These measures evaluate the importance of nodes in a graph and can capture different aspects of a node's connections

to other nodes. The concept of Betweenness centrality pertains to a technique that gauges a node's influence regarding the flow of information within a graph. Frequently, this measure is employed to identify nodes that act as a connector between different graph segments. The process computes the most direct routes connecting every node pair in a graph. It is computed by averaging the shortest distance between the node and every other node in the network. On the other hand, the measure of strength centrality indicates the degree to which a node in the network is linked to other nodes. The estimates are shown in a Z-standardized format, where greater values suggest greater centrality.

In summary, Betweenness measures the effectiveness with which a node connects other nodes, while Closeness measures the ease with which information travels to all other nodes from a given node. Finally, the strength metric signifies a node's connectivity level with the entire OCD network. These three indicators pinpoint which nodes are the most central and more likely to impact the rest of the network.

Furthermore, we calculated a new measure of centrality known as "expected influence." The expected influence is characterized by the total number of a node's linkages and presents its significance in the network. This importance is relative because, even in networks with low overall edge weights, there will always be a node with strong expected influence, assuming standardized outcomes (21). Moreover, a discernment examination utilizing the "NetworkComparisonTest" (NCT) package was performed to ascertain the statistical significance of dissimilarity between the networks affiliated with clinical and nonclinical specimens. The NCT performs two types of analyses: assessment of network invariance, which determines if there are any significant variations in the configuration of the networks, and evaluation of global strength invariance, which assesses if there are any notable disparities in the overall strength (aggregate of edge strength) of the networks (23).

In the third stage, it was first determined by NCT that there is a difference between the two subtypes in the overall structure of symptoms in the network. Therefore, network structures were investigated by separating the two subtypes of OCD. At this stage, in the first step, the network structure was drawn separately for each of the three scales. The purpose of this work is to describe more precisely the structure of each scale according to the subscale related to it. To do this, the "qgraph" package was applied. The information concerning this package has been explained in the previous paragraphs. Then, centrality measures were used for both visual and numerical descriptions for each scale.

To gauge the extent and nature of the role of distinct nodes in facilitating the interconnectivity between the obsessive-compulsive trait, personality, and obsessive beliefs, the R package "network tools" was utilized (24). A pertinent metric in this regard is the Bridge-Expected Influence (BEI). This node-oriented measure denotes the

quantity and intensity of favorable links connecting a node to nodes from a divergent community of nodes. Therefore, this measure signifies the significance of a node in facilitating the interconnectivity between its respective network community and other network communities. In the current investigation, the nodes affiliated with the obsessive-compulsive dimension, personality, and obsessive beliefs were treated as a unified symptom cluster during the calculations, where the interlinks between the obsessive-compulsive dimension, personality, and obsessive beliefs were scrutinized. Therefore, in the current study, the measure of BEI signifies the extent to which a specific node associated with the obsessive-compulsive dimension is interlinked with the nodes about obsessive beliefs and personality and, conversely, the extent to which nodes related to obsessive beliefs and personality are connected to the node linked to the obsessive-compulsive dimension. The normalization algorithm of the network tools package was implemented to compensate for the varied number of nodes in disparate communities. This algorithm partitions the obtained BEI score of each node by the highest possible BEI value for that node. Therefore, this method offers a projection that factors in every community's varied count of nodes. Each node's unadjusted BEI score, i.e., the summation of all affirmative cross-community edges, is documented in its original form (23, 25).

**Ethical Consideration**

The ethics committee of the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran (IR.USWR.REC.1400.150) approved this study. Moreover, all patients received written informed consent before the research procedures were operated. In addition, we informed them that they could leave the project whenever they wanted without any consequences.

**Results**

**Sample Characteristics**

Among the participants, 156 were in the danger/checking subgroup, and 177 were in the contamination/cleaning subgroup. The rest of the participants (n = 276) were healthy individuals. Table 2 describes the demographic characteristics of the participants. The results showed a significant difference between the three groups in terms of age. Tukey's post hoc test results demonstrated that the contamination/cleaning group had the highest average. The danger/checking and healthy individual groups were ranked second and third, respectively. Also, there was no significant difference among the three groups in gender, marital status, and economic status (P > 0.5). Furthermore, the age of onset of OCD symptoms in two OCD subgroups was investigated. Finally, the results indicated that the age of onset of symptoms of this disorder in the contamination/cleaning subtype is significantly higher than the danger/checking subtype (P < 0.05).

**Table 2. Comparison Sample Characteristics among Study Groups (N = 609)**

Variable		PwOCD- Checking	PwOCD-Washing	Healthy Individuals	P Value
Age		28.6 ± 7.35	32.12 ± 8.20	26.64 ± 8.53	0.001
Gender	Male	83	66	116	0.001
	Female	73	117	160	
Age of onset		21.26 ± 4.23	22.77 ± 4.61		0.052
Marital status	Single	72	93	124	0.001
	Married/In a relationship	81	83	149	
	Divorced/window	3	1	3	
Economic Status	Very bad	34	36	70	0.001
	Bad	31	46	77	
	Medium	29	29	58	
	Good	36	30	66	
	Very good	26	36	62	

### *Network Estimation of Overall Patients*

In the first stage of network analysis, the network structure of PwOCD (both subgroups combined) was compared with healthy individuals. Based on NCT, the network structure values (value: 0.360,  $P < 0.05$ ) and global strength (value: 4.162,  $P < 0.05$ ) are significantly different between healthy individuals and PwOCD, suggesting that symptom connectivity is different between groups and that every group shows different patterns of network structure.

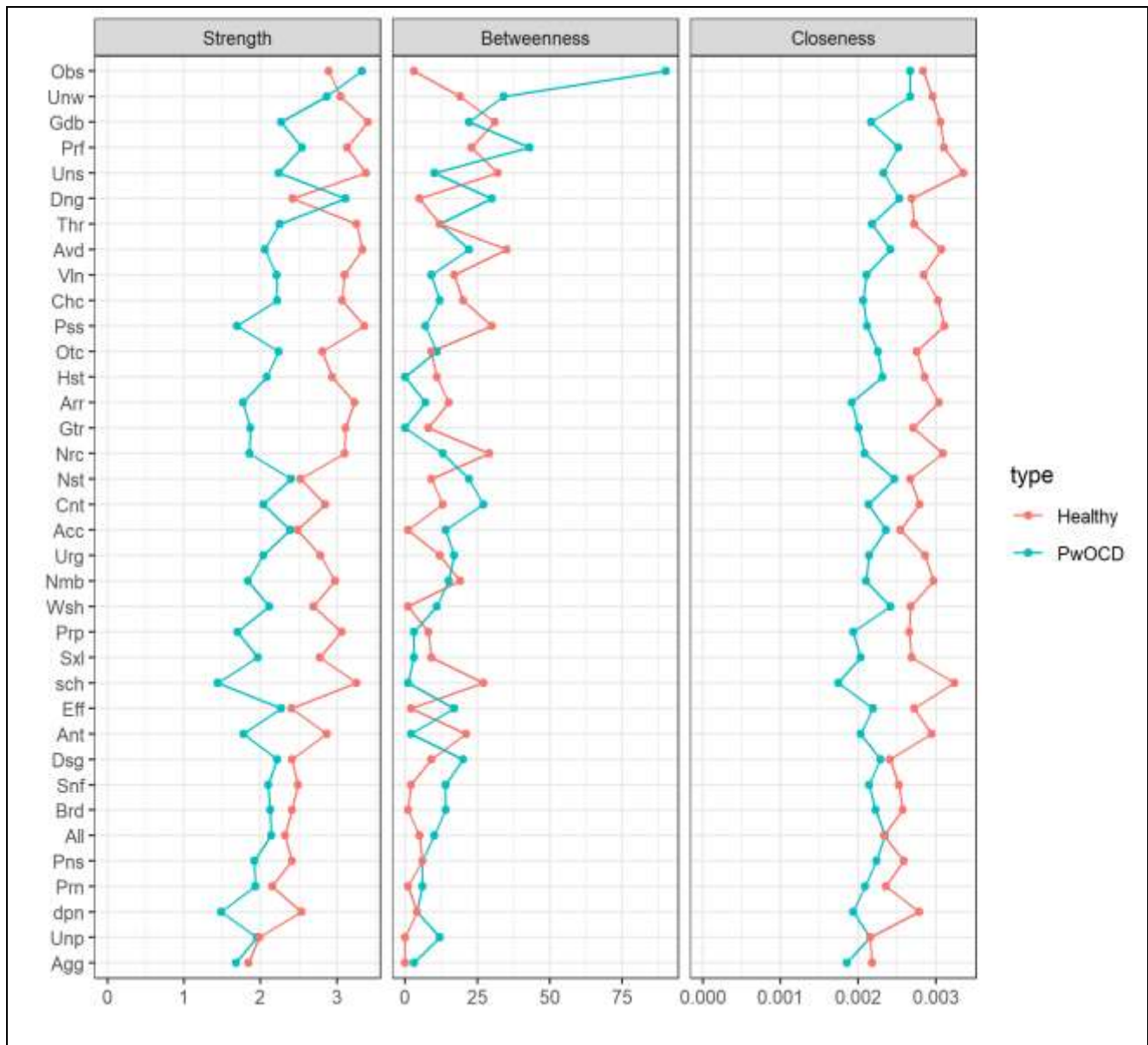
Figure 1 shows a difference in the network structure between the two groups. For example, in healthy individuals, borderline personality beliefs are related to broad personality beliefs. In contrast, this personality belief is one of the marginal nodes in the PwOCD network. To measure the nodes more accurately, the centrality measure was calculated. The most strength nodes in PwOCD were "obsessive" personality belief (value = 3.068) and "danger" obsessive beliefs (value = 2.522). Therefore, "obsessive" personality beliefs (value = 3.068) and "danger" obsessive beliefs are nodes that are more connected with other nodes than other nodes in the entire network. They form the core of the main communication between symptoms. The most strength nodes in healthy individuals were "unsafe" obsessive beliefs (value = 1.4077) and "good-bad" obsessive symptoms (value = 1.4741). The PwOCD group nodes have higher values than the healthy individuals' group, indicating a more continuous and broader connection between different symptoms. Regarding Betweenness, the results showed that the "obsessive" personality belief (value = 4.638) and "perfect" obsessive beliefs (value =

1.728) were the highest values. With regard to the healthy individuals, "unsafe" obsessive beliefs (value = 1.86) and "avoidant" personality beliefs (value = 2.151) showed the highest values. It represents the degree to which nodes stand between each other.

### *Networks Structure of Contamination/Cleaning*

The NCT confirmed that the network structures differed between OCD subtypes ( $M: 0.5570882$ ,  $P < 0.05$ ). Thus, we analyzed OCD subtypes separately. Figure 2 presents the network structure and centrality measures separately for each scale. This work will reduce unnecessary complexity and provide a more accurate interpretation of the results. Regarding the network of obsessive beliefs, "danger" obsessive belief showed the highest scores in all three centrality measures (strength = 1.687, Betweenness = 2.11, and Closeness = 2.0903). Concerning OCD dimensions, the most central node was "washing" obsessive symptom. Centrality measures showed "2.29", "1.830", and "2.141" values for Betweenness, Closeness, and Strength, respectively. Regarding personality beliefs, the results indicated that the "obsessive" personality belief was the most central belief in personality belief structure (strength = 2.79, Betweenness = 2.36, and Closeness = 2.73).

Furthermore, we estimated "Expected Influence (EI)," in Figure 3. As described in the methodology section, EI represents the importance of a node in a network. Based on our result, the "wash" obsessive symptom and "obsessive" personality belief have the most important factors in this network structure.



**Figure 1. Centrality Measures of the Study Variables in Healthy Individuals and Patients with Obsessive-Compulsive Disorder**

Uns = unsafe Obsessive belief, Prf = perfect Obsessive belief, Urg = urges Obsessive belief, Dng = Danger Obsessive belief, All = All nothing Obsessive belief, Agg = aggression Obsessive belief, Eff = effort Obsessive belief, Nst = nasty Obsessive belief, Prp = prepare Obsessive belief, Dsg = Disgust Obsessive belief, Snf = sinful Obsessive belief, Unw = unwanted Obsessive belief, Acc = accident Obsessive belief, Sxl = sexual Obsessive belief, Otc = out control Obsessive belief, Vln = violent Obsessive belief, Pns = Punish Obsessive belief, Chc = Check obsessive symptom, Arr = Arrange obsessive symptom, Cnt = Count obsessive symptom, Nmb = Numbers obsessive symptom, Wsh = Wash obsessive symptom, Unp = Unpleasant obsessive symptom, Thr = Throwaway obsessive symptom, Gtr = Get rid obsessive symptom, Gdb = Good-bad obsessive symptom, Avd = Avoidant personality belief, dpn = dependent personality belief, Pss = Passive personality belief, Obs = Obsessive personality belief, Ant = Antisocial personality belief, Nrc = Narcissistic personality belief, Hst = Histrionic personality belief, sch = schizoid personality belief, Prn = Paranoid personality belief, Brd = Borderline personality belief.

Regarding BEI, the Figure 3 showed that there is a relationship among obsessive beliefs, personality beliefs, and obsessive symptoms which occurs through "disgust" obsessive belief (BEI value = 0.186), "wash" obsessive dimension (BEI value = 0.2157), and "obsessive"

personality belief (BEI value = 0.3536). These are key symptoms that connect three outcome variables. BEI indicates the importance of a node in linking the symptom clusters.



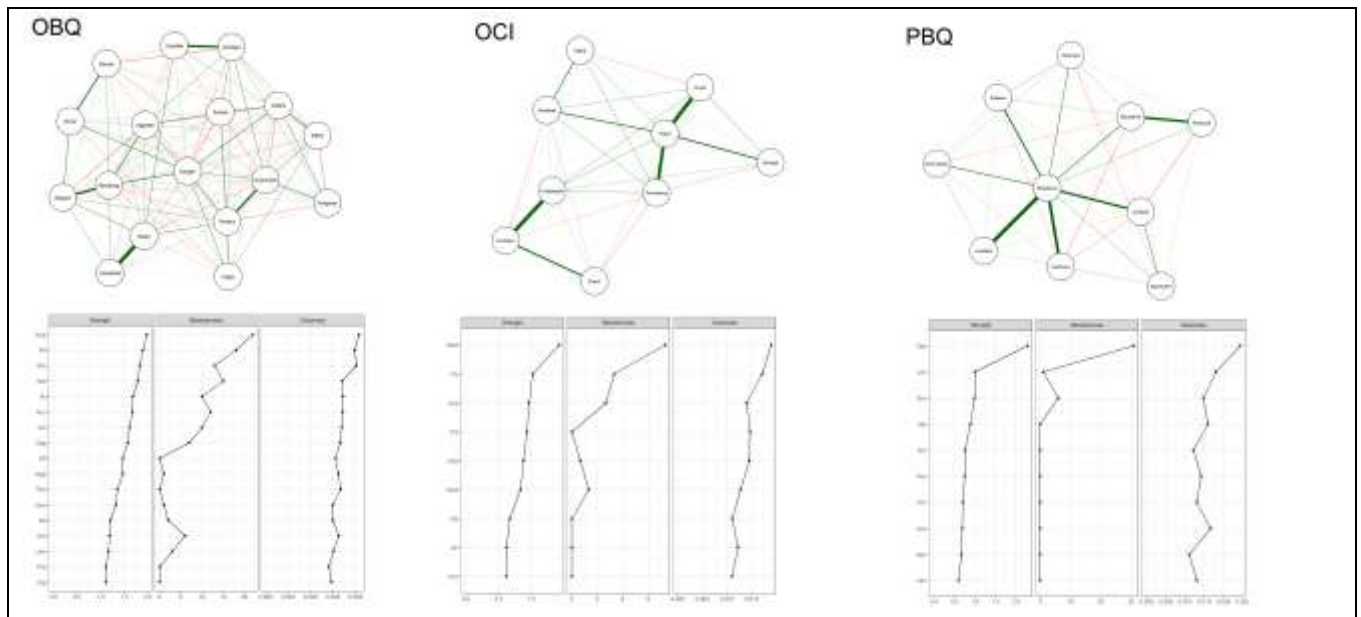


Figure 2. Network Structure and Centrality Measures of the Study Variables in Contamination/Cleaning OCD Subtype.

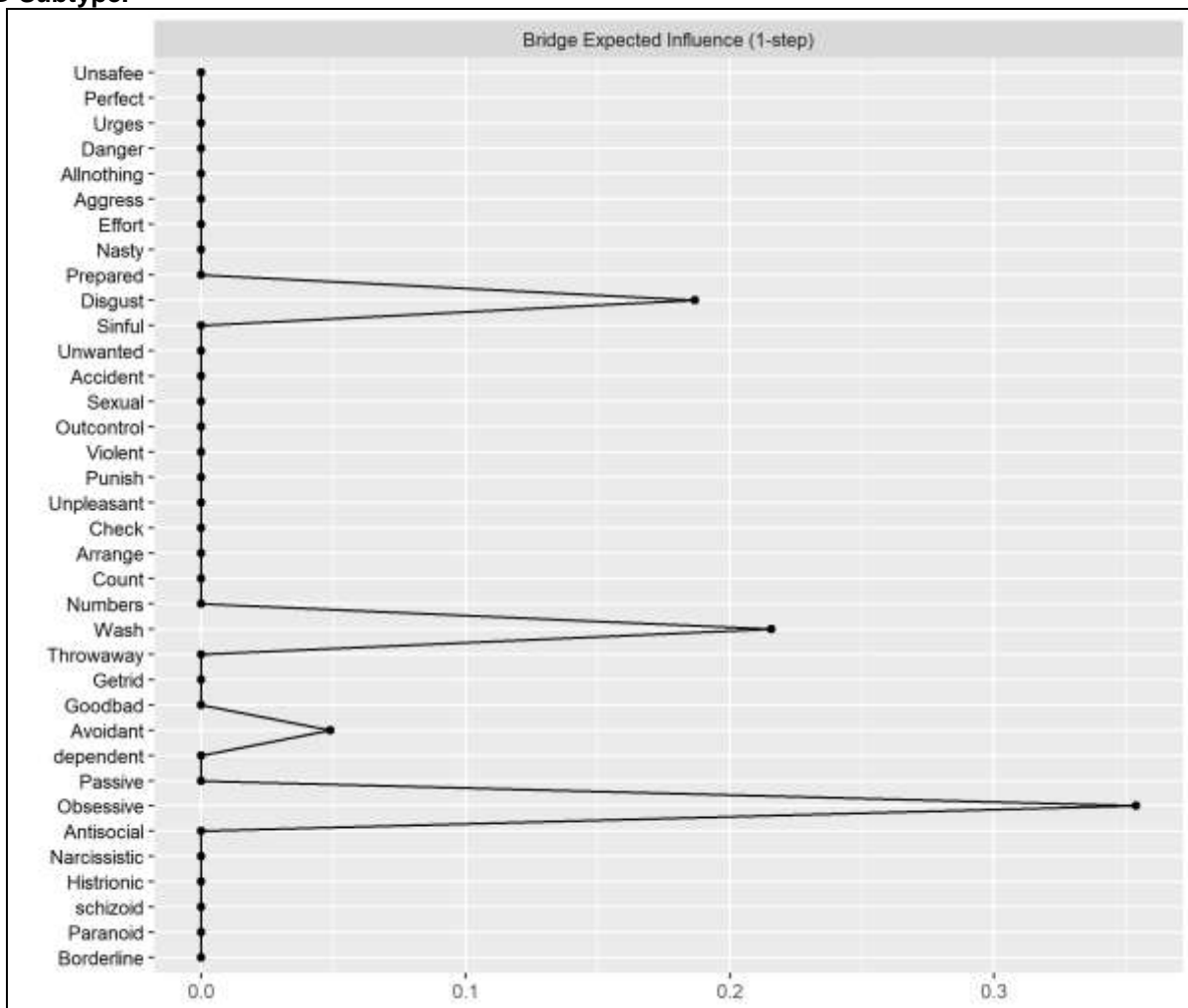
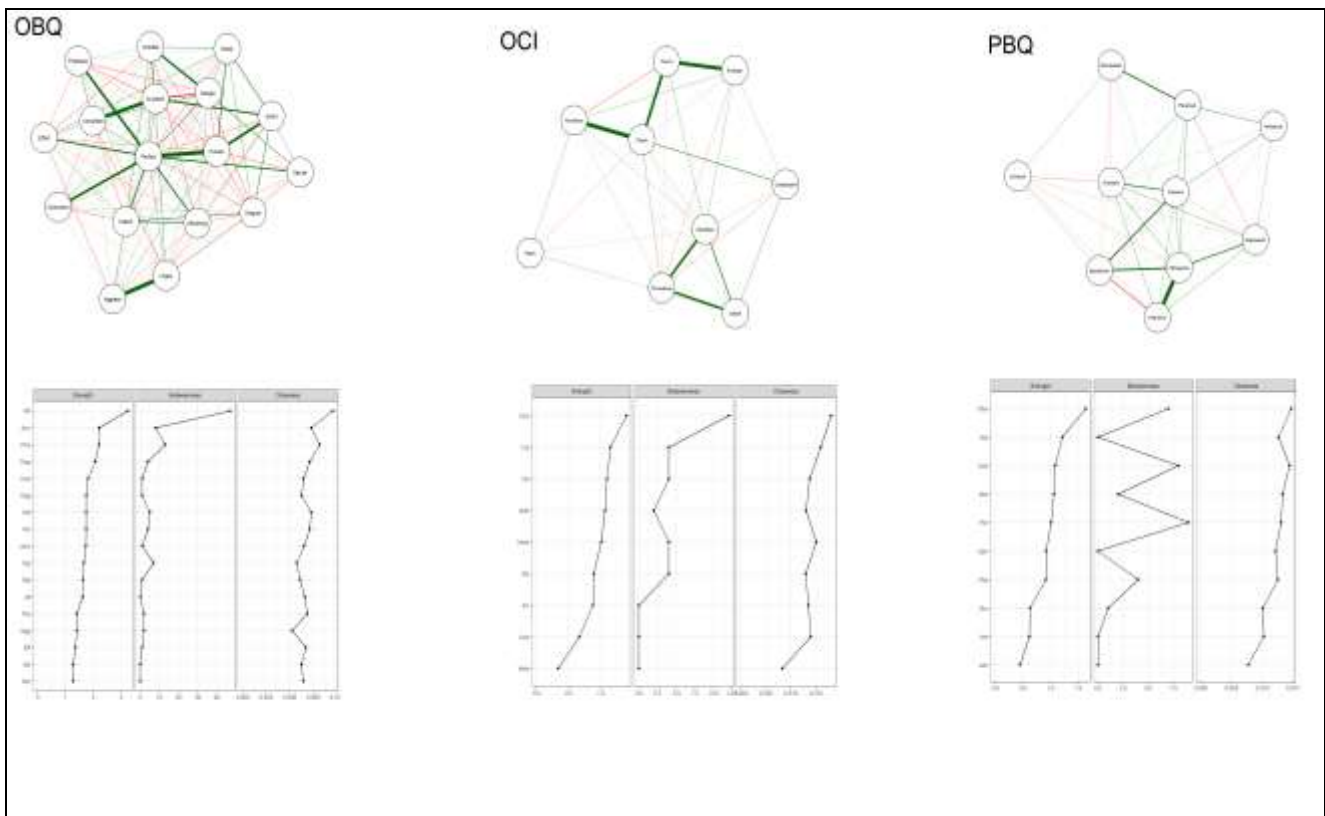


Figure 3. Normalized Bridge Expected Influence (2-Step) Across Symptom Dimensions for Contamination/Cleaning Subtype

**Networks Structure of Danger/Checking**

Figure 4 presents the network structure and centrality measures separately for each scale. This work aimed to reduce unnecessary complexity and provide a more accurate interpretation. Regarding the network of obsessive beliefs, "Perfect" belief showed the highest scores in all three centrality measures (strength = 3.090, Betweenness = 3.686, and Closeness = 2.836). Regarding OCD dimensions, the most central node was "check" obsessive symptoms. Centrality measures showed "2.3162", "1.592", and "1.503" values for Betweenness, Closeness, and Strength, respectively, about personality beliefs. The findings demonstrated that "avoidant" personality belief was the most central belief

in personality belief structure (strength = 0.38694437, Betweenness = 1.3481, and Closeness = 1.0844).



**Figure 4. Network Structure and Centrality Measures of the Study Variables in the Danger/Checking Subtype.**

Regarding the bridge expected to influence, the results (in the figure 5) showed that there is a relationship among obsessive beliefs, personality beliefs, and obsessive symptoms which occurs through "perfect" obsessive belief (BEI value = 0.36328), "number"

obsessive dimension (BEI value = 0.1308), and "obsessive" personality belief (BEI value = 0.301339). These are key symptoms that connect three outcome variables. BEI indicates the importance of a node in linking the symptom clusters.

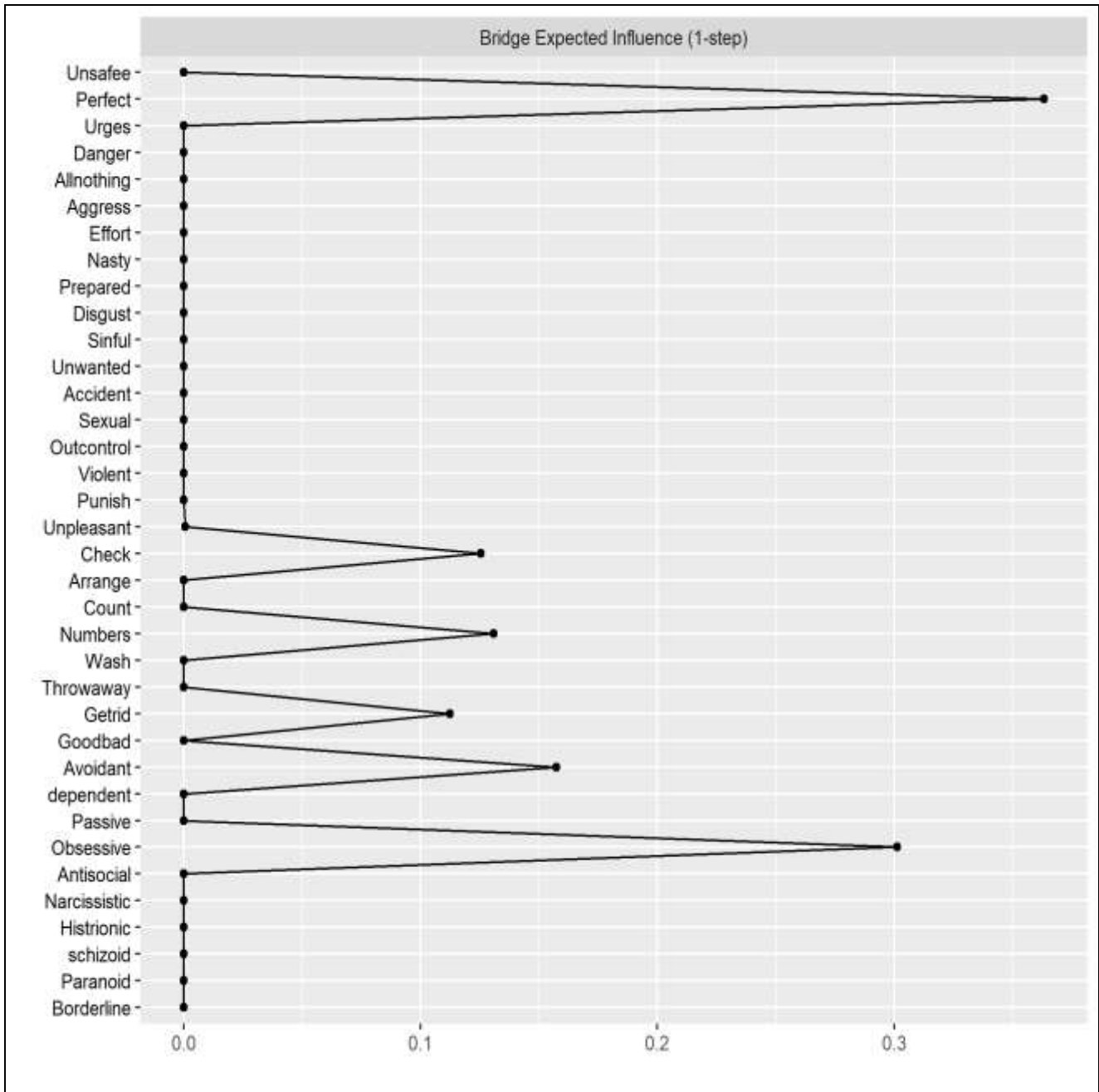


Figure 5. Normalized Bridge Expected Influence (2-Step) Across Symptom Dimensions for Danger/Check Subtype

## Discussion

The present study investigates obsessive beliefs, personality beliefs, and obsessive dimensions in two subtypes of OCD, namely contamination/cleaning and danger/checking. Based on the results, the network structure between the two subtypes of OCD is different. Additionally, the age of onset of symptoms in the contamination/cleaning subgroup is significantly higher compared to the danger/checking subgroup. In addition, the core symptoms were examined in the two stages of the study. First, comparing the healthy individuals' network with the OCD group, considering both subgroups, a difference in network structure between these two groups was found.

Furthermore, when the network structure of contamination/cleaning was compared with danger/checking in PwOCD, the results showed a difference in network structure between these two groups. Below, each of these results is described and explained. The results demonstrated that in the general population, "unsafe" obsessive beliefs and "avoidant" personality beliefs are the core and most important nodes in the network structure of these individuals. In contrast, "obsessive" personality and "perfect" obsessive beliefs had the highest values in PwOCD. Extensive studies have shown that obsessive-compulsive symptoms have a continuum nature. These results showed that intrusive thoughts and other symptoms of obsessive thinking are similar in form and content among the OCD and general population. However, the present study showed that important symptoms in the network of patients and the general population differ. Previous studies only compared clinical symptoms associated with OCD in the general population and PwOCD, while in the present study, the compared variables were obsessive beliefs and personality beliefs. The continuum nature of OCD can be present in clinical symptoms and not in other characteristics such as beliefs.

Certain types of dysfunctional beliefs, according to cognitive-behavioral models of OCD, lead to the development of psychiatric disorders (26). Therefore, the presence or absence of certain obsessive and personality beliefs can result in the onset of OCD or at least increasing the likelihood of vulnerability to this disorder (26). In this regard, a study compared obsessive beliefs in PwOCD, university students, patients with major depression, and patients with an anxiety disorder. This study's results indicated no significant difference in the OBQ-44 total score of the three groups of psychiatric patients (MDD, OCD, and anxiety disorders). The student group scored significantly lower than the three other groups (27). Based on this and other similar studies, it can be concluded that obsessive beliefs can be a transdiagnostic variable in the onset and severity of psychiatric disorders. Therefore, psychiatric patients may experience different levels of these beliefs than the general population. Despite the evidence of qualitative

differences in the types of obsessive and personality beliefs between the general population and PwOCD, future studies can more precisely examine the nature of differences between these two groups regarding cognitive beliefs and other variables related to the cognitive-behavioral perspective.

As the results demonstrated, "unsafe" obsessive beliefs were the most prevalent factor in the general population. No study was found on this finding. This study was the first to analyze symptoms extensively in the form of nodes in a network analysis structure. However, in explaining this finding, it is important to mention that the present study was conducted during the global pandemic of COVID-19. At that time, Iran was also affected by this disease, and the government had imposed extensive health restrictions on the community. Thus, individuals may be expected to experience concerns about their health and that of their loved ones. They may also perceive the world as unsafe due to the death of loved ones. In support of this explanation, studies have also been conducted. For example, in the study by Mindel *et al.* (2022), the understanding of the experiences of vulnerable youth in accessing web-based therapeutic support during the COVID-19 pandemic and quarantine was investigated. The results showed that these youths experienced feelings of being unnoticed, insecurity, and lack of community support regarding COVID-19 (28). In accounting for this finding, it can be said that individuals tend to feel anxious and insecure when the environment changes. In the case of infectious diseases, rumors grow when the cause or progress of the disease and its consequences are unclear, and inflated attitudes toward the risk of its occurrence emerge (29). Among personality beliefs, "avoidant" belief was the most prevalent personality belief in the general population as well as among the most important nodes in the healthy individuals' network structure. This finding was consistent with the information provided on the feelings of insecurity mentioned above. The uncertain conditions resulting from COVID-19 could have led to hypervigilance and avoidance of various situations, which are part of the definition of various avoidance behaviors (30).

In the first stage, all OCD patients were compared with the general population. Given that in the present study, one of the fundamental assumptions was the heterogeneous nature of OCD, and the goal of the first stage was to identify the difference between OCD and the general population, the network structure results were not described. Instead, the description of the network analysis was based on the comparison between the two OCD subgroups. The results of the NCT showed that the network structures of these two subtypes are different from each other. Therefore, the main hypothesis of the present study about the difference in the network structures of OCD subtypes was confirmed. In the contamination/cleaning subtype, the results

indicated that the core symptoms in the network structure of this subtype include obsessive personality belief, the obsessive belief of danger, and obsessive signs of washing.

As mentioned above, the present study is the first to examine the core cognitive symptom network structure in OCD subgroups. Therefore, no study has been found that confirms or rejects the present findings. However, studies that are to some extent conceptually similar to the present study have shown findings consistent with the present results. For example, a study showed that in pregnant women with obsessive-compulsive personality traits, the most common compulsions were related to cleansing/washing (31). This finding is consistent with the present study, which showed that in the network structure of the contamination/cleaning subtype, the obsessive signs of washing and obsessive personality belief were interconnected and among the most important nodes.

Another research found that PwOCD may unnecessarily focus their attention away from the threat during the late processing stage. This is likely because they processed the stimuli intensely or overestimated them during the early automatic processing period (32). However, this study does not clarify the OCD subtypes, and the finding can be controversial. It can be concluded that the surrounding environment is full of contamination for these patients, and pollution can be dangerous. Therefore, these patients overestimate the risk of danger in their daily life. Regarding obsessive symptoms in these patients, the “wash” obsessive symptom was one of the most central nodes. PwOCD with contamination/cleaning subtype uses washing as a compulsion in response to their obsessions about contamination (33). Moreover, “obsessive” personality belief was one of the most central symptoms in this subtype. The literature has shown that obsessive-personality disorder (OCPD) is one of the most prevalent personality disorders in PwOCD. For example, a study indicated that 47.3% of PwOCD were diagnosed with OCPD (48). However, one study showed that participants with OCPD had significantly more frequent hoarding compulsions and obsessions involving a need to collect and keep objects (34). This result is not in line with the findings the present study. One reason for this discrepancy is the type of covariance analysis. These mentioned studies have examined the coexistence between these two disorders. At the same time, the present study investigates personality beliefs related to this disorder. Personality beliefs related to OCPD are not necessarily equal to a diagnosis of OCPD. This issue needs to be investigated more carefully in future studies. The BEI results showed that obsessive beliefs of disgust, washing OCD symptoms, and obsessive personality beliefs were the links between obsessive beliefs, personality beliefs, and obsessive symptoms. Based on research guidelines, breaking down these links can disrupt the main network structure and have therapeutic

effects. As mentioned, no study was found to investigate the role of these variables as bridges in OCD subgroups. However, previous studies have obtained relatively similar results to the present study. For instance, a study by D'Mello and Kumar (2022) showed that disgust sensitivity was significantly associated with washing symptoms in the contamination/cleaning subgroup (35). This finding is consistent with the present study's finding that the bridge between obsessive symptoms and obsessive beliefs is created by washing OCD symptoms and obsessive beliefs of disgust. It also found that disgust is involved in the avoidance of contaminated objects and individuals (36).

Regarding the danger/checking subtype, the results demonstrated that “perfect” obsessive and “avoidant” personality beliefs were the network structure's central symptoms. These findings are also in line with previous studies. For example, a study showed that maladaptive perfectionism plays an important role in checking subtype psychopathology (37). According to these findings, perfectionism has a particular role in some forms of obsessive-compulsive symptoms, and the OCD model necessitates modification to include this specificity (37). Such a notion follows our hypothesis for considering every OCD subtype as a unique nature. Salkovskis and colleagues (2000) proposed that interpretations of unwanted thoughts as representative of personal responsibility for several harmful outcomes for oneself/others are linked causally with the disorder characteristics (38). The same beliefs about responsibility are hypothesized to cause increased attempts to force control over cognition, more discomfort/anxiety, and the covert and overt neutralizing activity, which characterizes such a disorder. Based on the same theory, PwOCD needs everything to be right in the perfect and best order. Thus, they believe being perfect is one of the prerequisites to the peace of mind. Additionally, “avoidant personality belief” was one of the most central symptoms in patients with the checking subtype. Previous research showed that avoidant personality beliefs were significantly higher in the OCD group than healthy individuals. However, no research about avoidant personality beliefs found in the danger/checking subtype (8). The results of the BEI showed that obsessive perfection beliefs and obsessive personality beliefs were the links between obsessive beliefs and personality beliefs. The previous paragraphs discussed obsessive the role of perfection beliefs in the danger/checking subgroup. The role of obsessive personality beliefs in this disorder was also discussed. The present study was the first to use a network approach to show the CBT core of OCD subtypes. This study was in-line with the heterogeneous nature of OCD. This study illustrates that one way to increase the effectiveness of cognitive-behavioral therapies is to align them with the subgroup network structure in which the patient is located. According to cognitive-behavioral approaches, core beliefs play a fundamental role in the

onset, maintenance, and severity of psychological disorders. Therefore, by targeting the most critical core beliefs in each subtype of OCD, potentially higher efficacy compared to standard CBT can be expected.

### Limitation

Despite promising results, this research faced some limitations. First, because of the cross-sectional nature of the present study, authors could not show causal relationships among the nodes and make conclusions about the directions of relationships among symptoms and beliefs. Second, OCD includes various subtypes (such as aggressive and relationship-based OCD) and may have different network structures. Finally, network structure is estimated by self-report scales and thus has issues in real-life and daily conditions for PwOCD. Based on these limitations, future longitudinal studies should examine whether there are changes in the networks and centralities of personality beliefs and OCD cores. Furthermore, to decrease response bias and enhance assessment precision, using ecological momentary assessments would be helpful. Finally, it is suggested that future studies focus on customizing CBT based on the central core of each OCD subtype and examine the effectiveness of this perspective.

### Conclusion

The network structure of the obsessive beliefs, obsessive-compulsive symptoms, and personality beliefs differed between OCD subtypes. In fact, each subtype has its pattern in the composition and structure of nodes and bridges. These findings were another confirmation of the heterogeneous nature of OCD.

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### Conflict of Interest

None.

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