

# A Network Perspective on Marital Satisfaction among Older Couples

**Fengzhan Li**

Air Force Medical University <https://orcid.org/0000-0003-3834-4872>

**Lei Ren**

Air Force Medical University

**Xiuchao Wang**

Air Force Medical University

**Yinchuan Jin**

Air Force Medical University

**Zhujing Ma**

Air Force Medical University

**Qun Yang**

Air Force Medical University

**Dahua Wang** (✉ [wangdahua@bnu.edu.cn](mailto:wangdahua@bnu.edu.cn))

Beijing Normal University

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## Research

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# Abstract

## Background

As the world's population is getting older, it will be helpful for older people to maintain good mental health by targeting their marital satisfaction. The present study aims to investigate how the concepts of marital satisfaction are related to each other and reveal the key concepts for older people.

## Methods

Four hundred ninety-four older people (247 couples aged  $68.19 \pm 5.45$ ) participated in the study. Marital satisfaction was assessed by the 10-item marital satisfaction subscale of the ENRICH (Evaluation and Nurturing Relationship Issues, Communication and Happiness) scale. We used network analysis to estimate the network structure of these 10 items and calculated the strength centrality for each item.

## Results

The results showed that all items were positively associated in the final network, and the whole network was relatively high-connected. Four edges with the strongest regularized partial correlations appeared between "*leisure activities and spending time together*" and "*emotional expression*" ( $r=0.33$ ), "*personality and habits*" and "*communication and understanding*" ( $r=0.30$ ), "*economic status and the manner of determining economic affairs*" and "*relationship with relatives and friends*" ( $r=0.24$ ), and "*make decisions and resolve conflict*" and "*emotional expression*" ( $r=0.22$ ). "*Emotional expression*" was the most connected node in the network. "*Communication and understanding*" and "*views are consistent*" had the second and third highest node strength values, respectively. Thus, it will be the best way to promote marital satisfaction by prioritizing the improvement of "*emotional expression*" for older couples.

## Conclusions

The present study offers a new perspective on the marital satisfaction of older couples using network analysis for the first time. It carefully explores several links among specific concepts of the whole network and found it was relatively high-connected. "*Emotional expression*" is the central concept in marital satisfaction. "*Communication and understanding*" and "*views are consistent*" have the second and third highest node strength values in the network. These results might provide potential targets for the improvement of marital satisfaction among older couples.

## Background

As the world's population is getting older, mental health problems among older people are gradually increasing (Peterson & Ralston, 2019; McDonough & Allen, 2019; Heine, Gong, & Browning, 2019). It is important to not only improve quality of life but also to maintain good mental health for older people for family happiness and social harmony (Kamp Dush, Taylor, & Kroeger, 2008). The famous Grant study shows that intimacy is the most important ingredient for happiness (Vaillant, 2012). Among intimate

relationships, the most intimate and lasting is the marital relationship (Levenson, Carstensen, & Gottman, 1993). According to socioemotional selectivity theory, people will pay increasing attention to the quality of intimate relationships with aging, especially when they perceive their lifetime to be limited (Carstensen, 1995; Carstensen, Fung, & Charles, 2003; Carstensen, Gottman, & Levenson, 1995). Therefore, improving marital satisfaction could help older people maintain good mental health.

There are a large number of studies on marital relationships for older people, and psychologists offer guidance for them to improve marital satisfaction based on the results. For example, many studies have shown that some factors, such as family coping strategies (Murphy et al., 2015), health problems (Korporaal, Broese Van Groenou, & Tilburg, 2013), marital interaction (Schmitt, Kliegel, & Shapiro, 2007), social support (Acitelli & Antonucci, 1994; Polenick et al., 2017), sexual satisfaction (Guo & Huang, 2005), and others have a close relationship with marital satisfaction in older people. The results of these studies may be illuminating for helping older couples improve their marital satisfaction. For instance, we could do so by providing social support. However, this approach is indirect. It may not directly improve marital satisfaction itself. In addition, researchers usually use the marital satisfaction scale as an indicator of the quality of marital relationships. For example, the marital satisfaction subscale of the Evaluation and Nurturing Relationship Issues, Communication and Happiness (ENRICH) scale has been commonly used (Zarei et al., 2019; Shareh & Sani, 2019; Yoshany et al., 2017; Naghiyae et al., 2014). This scale includes 10 items that evaluate 10 aspects of marriage, such as the partner's personality, the responsibilities they have, the way they make decisions and resolve conflicts, and other topics. The total score on the 10 items is used as a measure of marital satisfaction.

However, there are two potential problems with the above approach. First, there are many different combinations to achieve a specific total score. This situation means that individuals with the same score may have completely different marital experiences. Second, the model of calculating the total score treats all items as equivalent and interchangeable variables. It ignores a phenomenon in which the items may interact with each other, and some specific items may have a strong impact on others. This phenomenon has been confirmed in an increasing number of studies related to scales (Marcus, Preszler, & Zeigler-Hill, 2018; Wechsler et al., 2018). In other words, the 10 aspects may have different importance in marital satisfaction, and they may include one or several central aspects.

For the above potential problems, network analysis methods could give some answers. Network analysis is a rapidly-emerging analytical method that can describe the relationships among psychological variables. In network analysis, the observational variables are regarded as nodes, and the between-node edges are regarded as the correlations between observational variables. Under the drive of data, a network composed of nodes and edges can visualize the relationships among variables (Borsboom, 2008). Besides, an unweighted association network only considers whether there is association between nodes, but a weighted association network also considers whether the between-node association is strong or weak. For instance, the mainstream Gaussian graphical model is a weighted association network (Drton & Perlman, 2007). In psychology research, due to the presence of numerous nodes, "false" correlations easily exist: if two nodes are both correlated with a third node, even these two nodes are not

directly related, they may still be analyzed as “significant correlation” statistically (Pourahmadi, 2011). To avoid the misguidance, Pourahmadi (2011) proposed a solution and used the partial correlation coefficient in network analysis to more accurately reflect the real between-node associations. Partial correlation networks which have also been called Gaussian graphical models (GGMs) can offer routes to accurately explore the between-node relationships (Borsboom & Cramer, 2013; Epskamp & Fried, 2018). In addition, network analysis allows to assess the importance of each variables in the network by providing some centrality indices. A node with high centrality may play an important role in activating or maintaining network as well as providing potential targets for related intervention. In centrality analysis, the commonly-used indices include strength, closeness, and betweenness. Recent research shows that strength centrality is more stable and reliable than closeness and betweenness centrality, and closeness and betweenness centrality seem especially unsuitable as assessments of node importance in psychological networks (Bringmann et al., 2019; Epskamp, Rhemtulla, & Borsboom, 2017).

Network analysis does not necessarily depend on the definitions of latent variables, or namely it is not based on the hypothesis that the observed variables are related due to they shared a common latent variable. Therefore, network analysis will offer some new perspectives for studies on marital satisfaction among older couples. Traditionally, marital satisfaction research viewed the items on the scale to be static and studied it as a reductionist model that isolates items. However, according to network analysis theory, the items on one scale should be considered a complex causal system in which the variables are related to each other rather than isolated (Borsboom, & Cramer, 2013). In addition, it is purely based on the data, and the relationships among variables can be directly analyzed (Clifton & Webster, 2017). In brief, network analysis could offer a new perspective (i.e., the concept of marital satisfaction may emerge from its items’ direct interaction) for the study of older couples’ marital satisfaction. However, there is no related study at present.

In summary, the present study aims to investigate how the 10 items in the marital satisfaction subscale of the ENRICH are related to each other in older people and to reveal the central items by network analysis, which might be of great significance for directly targeting marital satisfaction among older couples.

## **Methods**

### **Subjects**

The data sourced the first batch of paired data from a study on the stability of attachment in older Chinese couples, which was granted by the Chinese Ministry of Education Humanities and Social Sciences. Four hundred ninety-four older people (247 couples) participated in the project and came from the communities of Haidian District, Beijing. They were  $68.19 \pm 5.45$  years old on average and married for  $42.49 \pm 7.09$  years on average. They had  $1.83 \pm 0.81$  children, and the monthly household income was 5000 ~ 8000 RMB. Their average education levels were high school and above.

### **Measurement**

The marital satisfaction subscale of the ENRICH was applied. It was designed by Olson et al. (1981). The Chinese version was revised by Li (1999) and includes 10 items, such as “*I am satisfied with the way we make decisions and resolve conflicts*” (Table 1). Each item has a 5-point score ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The internal consistency was good ( $\alpha = .83$ ).

Table 1  
The results of each item’s descriptive statistics.

Item	<i>M</i>	<i>SD</i>	<i>Str<sup>a</sup></i>	<i>Pred</i>
<b>MS1.</b> I don’t like my partner’s <i>personality and habits</i>	3.39	1.27	-1.31	0.31
<b>MS2.</b> I am satisfied with our <i>responsibilities</i> in our marriage	4.50	0.68	-0.65	0.29
<b>MS3.</b> I am not satisfied with the <i>communication</i> between us, my partner does not <i>understand me</i>	3.62	1.26	0.87	0.40
<b>MS4.</b> I am satisfied with the <i>way we make decisions and resolve conflicts</i>	4.00	0.96	-0.12	0.35
<b>MS5.</b> I am not satisfied with our <i>economic status</i> and the <i>manner of determining economic affairs</i>	4.24	1.00	0.02	0.28
<b>MS6.</b> I am very happy with how we manage our <i>leisure activities</i> and the time we <i>spend together</i>	4.13	0.93	-0.20	0.38
<b>MS7.</b> I am satisfied with the <i>emotional expression</i> between us	4.11	0.83	2.21	0.50
<b>MS8.</b> I am not satisfied with the <i>division of responsibilities</i> in dealing with children’s problems	3.87	1.10	-0.66	0.26
<b>MS9.</b> I am not satisfied with our <i>relationship with relatives and friends</i> on both sides	4.10	1.02	-0.67	0.23
<b>MS10.</b> Our <i>views</i> on issues <i>are</i> often <i>consistent</i> , and I feel good	3.93	0.93	0.51	0.41

## Procedures

We received approval from the Haidian District Government first before starting the project. Then, the government helped us contact the communities, and the communities arranged the study in neighborhood committees. Finally, the researcher visited the subject’s home to fill out a one-on-one questionnaire in a separate and soundproofed room. The researcher read aloud the items one by one, and the subjects answered successively. If the subjects did not understand an item or did not hear clearly, the researcher provided some explanation or repeated it. The subjects were invited to sign one informed consent form before the questionnaire.

## Network analysis

In the present network, nodes represent the items on the marital satisfaction subscale of the ENRICH, and edges represent the relationships between two items. Gaussian graphical models were used to estimate the networks (Lauritzen & Wermuth, 1989; Epskamp, et al., 2018). Therefore, the edges in the network

depict partial correlations between each pair of items after controlling statistically for all other items in the network (Epskamp & Fried, 2018). The nonparametric Spearman rho correlation matrices were used as input to estimate the GGMs. In addition, the present study applied a graphical least absolute shrinkage and selection operator (LASSO) algorithm to regularize the GGMs (Epskamp & Fried, 2018). This algorithm shrinks all edges and sets small edges to zero to obtain sparse networks that are easier to interpret and more stable (Friedman, Hastie, & Tibshirani, 2008). We set the tuning parameter to 0.5 to balance the sensitivity and specificity of identifying true edges (Foygel & Drton, 2010). The layout of the network was based on the Fruchterman–Reingold algorithm, which locates nodes with stronger connections near the center of the network and nodes with weaker connections near the periphery of the network (Fruchterman & Reingold, 1991). Blue edges in the network depict positive partial correlations, whereas red edges depict negative partial correlations. The thicker the edges are, the stronger the partial correlations between the nodes.

The strength centrality, which sums the absolute value of the edge weights connected to a node and is the most reliable centrality index, was used to assess and quantify the importance of each node in the present network (Bringmann, et al., 2019). The higher the strength value is, the greater the relative importance of the node in the network. We conducted network estimation and visualization and centrality analysis using the R package *qgraph* (Epskam, et al., 2012). Moreover, the predictability of each node was calculated by running the R package *mgm* (Haslbeck & Fried, 2017). Predictability is defined as the variance of a node that is explained by all its neighboring nodes. This absolute measure characterizes the controllability (or determination) of a node: the higher predictability a node has, the more we can control it by its neighboring nodes in the network (Haslbeck & Fried, 2017).

We used the R package *bootnet* to examine the robustness of the present network (Epskamp, Borsboom, & Fried, 2018). First, we constructed 95% confidence intervals (CIs) using a nonparametric bootstrap approach with 2,000 samples to evaluate the accuracy of edge weights. Second, we calculated the correlation stability (CS) coefficient using a case-dropping bootstrap approach with 2,000 samples to evaluate the stability of node strengths. This coefficient should not be below 0.25 and preferably should be above 0.5 (Epskamp, Borsboom, & Fried, 2018). Third, we performed bootstrapped difference tests with 2,000 samples for edge weights and node strengths to determine whether two edge weights or two node strengths differ significantly from one another.

## Results

### Results of descriptive statistics

The results of descriptive statistics for each item in the marital satisfaction subscale of the ENRICH are shown in Table 1. In addition, the nonparametric Spearman rho correlation matrix among the items is shown in Table S1 (see Supplementary Materials).

#### Results of network analysis

As can be seen in the final network (Fig. 1), several characteristics were immediately obvious. First, 36 (80.0%) out of the 45 possible edges were nonzero, and they were all positively correlated with each other. Second, four edges with the strongest regularized partial correlations appeared between MS6 "*leisure activities and spending time together*" and MS7 "*emotional expression*" ( $r = 0.33$ ), MS1 "*personality and habits*" and MS3 "*communication and understanding*" ( $r = 0.30$ ), MS5 "*economic status and the manner of determining economic affair*" and MS9 "*relationship with relatives and friends*" ( $r = 0.24$ ), and MS4 "*make decisions and resolve conflict*" and MS7 "*emotional expression*" ( $r = 0.22$ ). Third, the mean node predictability ranges from 0.23 to 0.50, with an average value of 0.34. This finding indicates that 34% of the variance in a node is explained by its neighboring nodes on average. MS7 had the highest predictability, which means that MS7 shares 50% of the variance with its neighboring nodes. MS9 had the lowest predictability, which means that MS9 shares 23% of the variance with its neighboring nodes. The values of predictability are shown in Table 1.

The node strengths (z-scores) are shown in Fig. 2 and Table 1. MS7 "*emotional expression*" had the highest strength value, which suggested that MS7 was the most connected node in the network from a statistical perspective. MS3 "*communication and understanding*" and MS10 "*views are consistent*" had the second and third highest node strength values, respectively. In addition, MS1 "*personality and habits*" had the lowest strength value, which suggested that MS1 was the least connected node in the network from a statistical perspective.

The CI of edge weights derived from 2000 bootstrap samples is shown in Fig. 3. This relatively small CI means that the estimation of edge weights was accurate. The CS coefficient of node strengths was 0.67 (see Fig. 4). This value means that the estimation of node strengths was adequately stable.

The red line represents the average correlation between strength in the original sample and subsamples, with the red area representing the 2.5th quantile to the 97.5th quantile.

The bootstrapped difference tests for edge weights and node strengths both showed significant differences among edge weights and node strengths in the present network, and the proportion of the differences ranged from small to moderate (see Fig. S1 and Fig. S2 in Supplementary Materials). There were significant differences between the strength of MS7 "*emotional expression*" and the strengths of all the other items.

## Discussion

For several decades, the issue about the quality of marital relations has been an important, intensely explored field in social sciences, including psychology. However, a large number of research have focused mainly on couples in early and middle adulthood. Consequently, there exists a considerable research blind spot when it comes to marital satisfaction in people aged 60 to 75.

There are numerous reasons to explore the factors that contribute to happiness in marriage among older couples. First, the world's population is getting older. Experts estimate that by 2030 elderly people will

make up to 30% of the global population. Thus it can be expected that the number of married couples aged more than 60 will increase. Second, marital satisfaction is an important contributor to the psychological well-being. This applies also to elderly couples. There is an extensive body of research whose results indicate a strong correlation between the quality of a relationship, the perceived quality of life, happiness and the psychological and physical health in the elderly. Third, according to lifespan psychology, late adulthood is a period of substantial changes in the psychological life of humans. This fact implies the necessity to develop a dedicated psychological approach towards this age group, where the typical factors determining their marital satisfaction will be investigated and elaborated upon. Therefore, the present study uses network analysis to investigate the network structure of these 10 aspects of marital satisfaction in older people and calculate the strength centrality for each concept, which aims to explore the main factors determining older couples' marital satisfaction and the relationships among them. The results revealed that older couples' marital satisfaction can be deconstructed into a network of many specific aspects, and they are complexly correlated with each other. Specifically, the present study graphically presented the regularized partial correlations among 10 concepts by network analysis. Both network edges and the strength centrality metric were stable, which made the conclusions more credible.

The present study showed that all nodes in the network of marital satisfaction were positively associated, and the whole network was relatively high-connected. The results of the edges showed that MS6 "*leisure activities and spending time together*" and MS7 "*emotional expression*" were the most closely related. That is, when the score on MS6 was high, the score on MS7 was high. This relation indicates that if older couples are happy with how they manage their leisure activities and the time they spend together, they are satisfied with their emotional expression. A previous study revealed that leisure plays a positive role in marital life (Sharaievska, Kim, & Stodolska, 2013). Leisure strengthened couples' marriages and provided opportunities for healthy communication and spending quality time together (Johnson, Zabriskie, & Hill, 2006). Similarly, close associations were also found between MS1 "*personality and habits*" and MS3 "*communication and understanding*", indicating that partners' personality and habits may be the basis for communication and understanding each other. As Wang et al. (2018) noted, being similar in personality may be a benefit to older couples' marriages. In addition, the reason for the close association between MS5 "*economic status and the manner of determining economic affairs*" and MS9 "*relationship with relatives and friends*" may be that economic affairs usually involve relatives and friends for older Chinese couples. Finally, the close association between MS4 "*make decisions and resolve conflict*" and MS7 "*emotional expression*" is consistent with previous studies (Schmitt, Kliegel, & Shapiro, 2007; Du Plooy & de Beer, 2018), indicating that if older people express more emotion in making decisions and resolving conflict, they are happier.

The main purpose of the present study was to identify the central concepts in the marital satisfaction subscale of the ENRICH, which might be helpful for improving older couples' marital satisfaction directly and effectively. In fact, it is feasible to intervene on any item of marital satisfaction for improving marital satisfaction. But when we want to achieve the maximum effect, why not consider the item with the highest centrality? The activation of the items with high centrality is more likely to propagate the

activation to the whole network through general connections with other items. Item MS7 "*emotional expression*" has the highest centrality which indicates this item play the most important role in activating and maintaining the network of marital satisfaction. Therefore, related interventions targeting "*emotional expression*" might maximize the overall level of marital satisfaction in older couples. As older people perceive their lifetime to be limited, life goals shift from expansive goals to emotionally meaningful goals (Carstensen & DeLiema, 2018). Intimate partners provide benefits beyond emotionally meaningful interactions (Carstensen, Fung, & Charles, 2003). Spending time with their partner may offer a sense of continuity in one's life or provide comfort during difficult times (Carstensen, Fung, & Charles, 2003). In addition, negative emotional behavior decreased and positive emotional behavior increased with aging (Acitelli & Antonucci, 1994). Therefore, it was not surprising to find that MS7 "*emotional expression*" had the highest strength in the network. This finding indicates that MS7 may play an essential role in influencing other aspects of marital satisfaction, which is consistent with a previous study (Ingoldsby, et al., 2005). Nevertheless, the previous study used traditional statistical methods, while the present studied used network analysis, which is completely driven by the data, and the conclusions may be more reliable. This is because a certain psychological construct does necessarily not act as a latent factor that generates reflective indicators, but it may emerge from the putatively causal interaction among different performances of this construct based on the network perspective. That is, in the present study, items of the marital satisfaction scale may be not the passive indicators of marital satisfaction itself, but the marital satisfaction emerged from the items' putatively causal interactions. Therefore, this results may have implications for family therapists to improve older people's marital satisfaction by targeting "*emotional expression*". At the same time, it may provide some evidence for socioemotional selectivity theory.

In addition, the present study found that MS3 "*communication and understanding*" and MS10 "*views are consistent*" have the second and third highest node strength values in the network. This finding shows once again that marital interactions are important for older couples. Similarly, it means that family therapists could also improve older people's marital satisfaction by targeting "*communication and understanding*" and "*views are consistent*" except for targeting "*emotional expression*". In other words, older people's marital satisfaction could also be greatly improved by targeting "*communication and understanding*" and "*views are consistent*".

## Conclusion

The present study offers a new perspective on the marital satisfaction of older couples using network analysis for the first time. It carefully explores several links among specific concepts of the whole network and found it was relatively high-connected. "*Emotional expression*" is the central concept in marital satisfaction. "*Communication and understanding*" and "*views are consistent*" have the second and third highest node strength values in the network. These results might provide potential targets for the improvement of marital satisfaction among older couples. However, there are also some limitations in the present study. First, it is a secondary study based on cross-sectional data and uses exploratory statistical tools such as network analysis. As cross-sectional data, it is impossible to determine the causal

relationships among these items, because there are many possibilities, such as the central items activate the other items, or the other items activate the central items, or they activate each other. Second, the resulting network structure and related indicators (such as the strength centrality and predictability of each item) here investigated between-subject effects on a group level. This means that within a single individual, the network structure and related indicators may not be replicated in the same way. Third, we analyzed only the items on the marital satisfaction subscale of the ENRICH. As the results are strongly dependent on the items, the present study does not consider all concepts in marital satisfaction. Fourth, it is worth mentioning that the results from older Chinese people may not be applicable to those in other nations since the factors affecting marital relationships obviously vary in different cultures (Shen, 2005). Finally, we did not consider gender differences in marital satisfaction in the network analysis. Previous studies have shown that females and males have different experiences in marriage (Acitelli & Antonucci, 1994; Chipperfield & Havens, 2001). These findings should be further explored in future research.

## **Abbreviations**

Cis

confidence intervals; CS:correlation stability; ENRICH:Evaluation and Nurturing Relationship Issues, Communication and Happiness; GGMs:Gaussian graphical models.

## **Declarations**

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### **Authors' contributions**

Study design: LFZ, RL; guide for investigation: WXC; Data collection: JYC, MZJ; Analysis and interpretation of data: RL; First drafting of the manuscript: LFZ, RL; revision for data and important content: YQ, WDH. All authors are responsible for their work. All authors read and approved the final manuscript.

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

The data used or analyzed during the current study are available from the corresponding author on reasonable request.

## Ethics approval and consent to participate

The present study was in accordance with the ethical standards of the Ethics Committee of Beijing Normal University. Written informed consent was obtained from all the participants included in the study.

## Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

## Author details

<sup>1</sup>Department of Military Medical Psychology, Air Force Medical University, PLA, Xi'an 710032, China.

<sup>2</sup>Institute of Developmental Psychology, Beijing Normal University, Beijing 100875, China

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## Figures



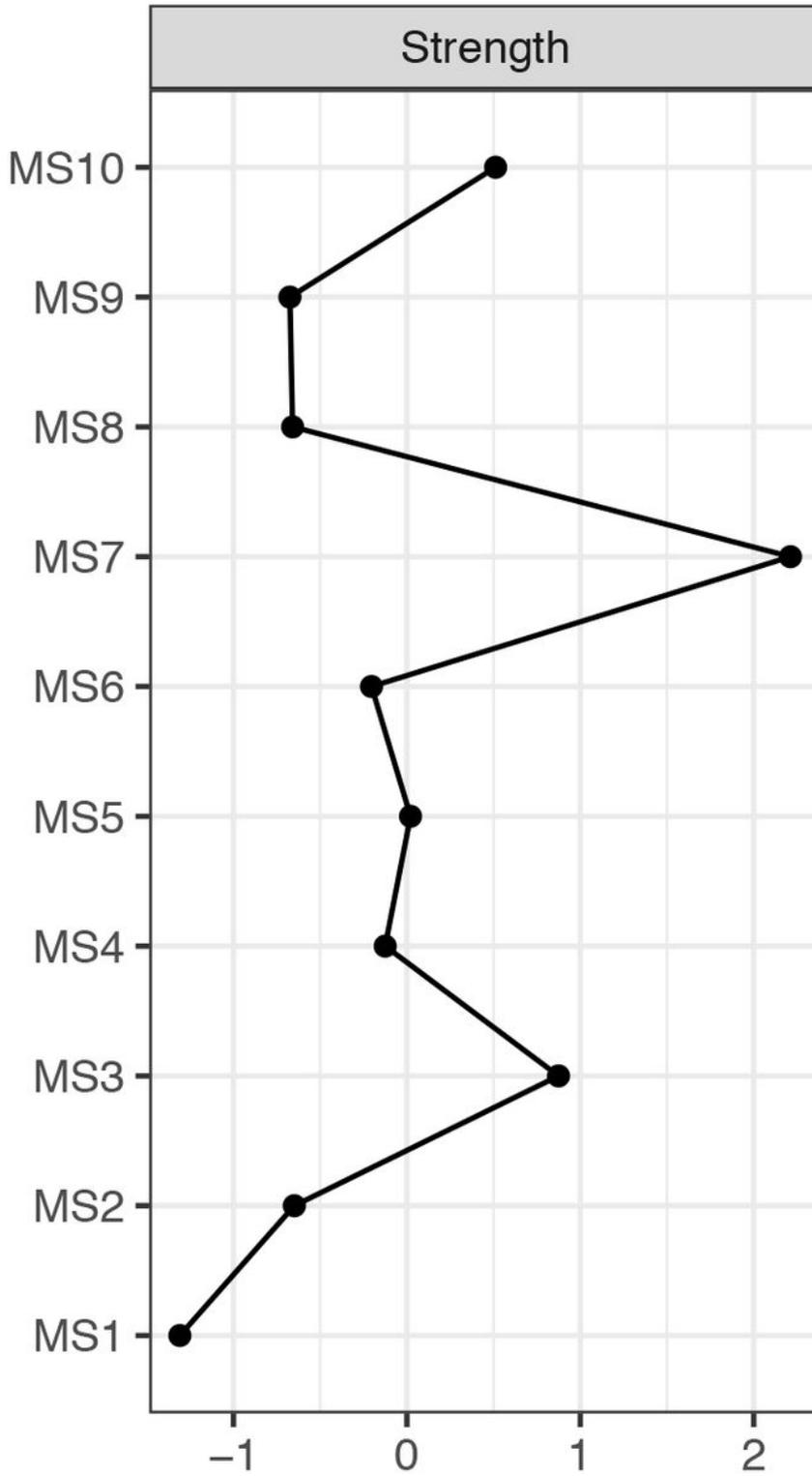


Figure 2

Z-scored node strength of each item.

● Bootstrap mean ● Sample

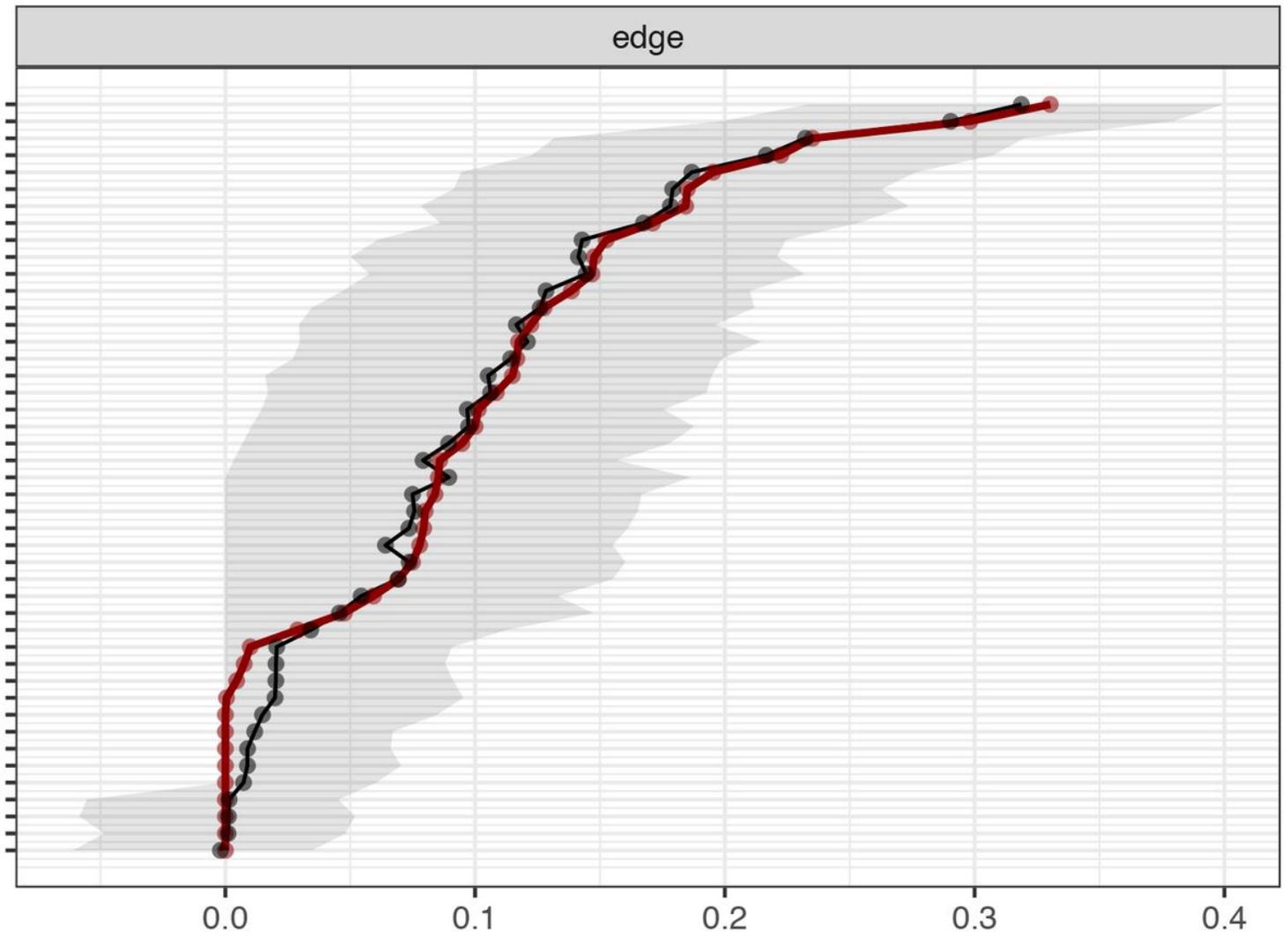
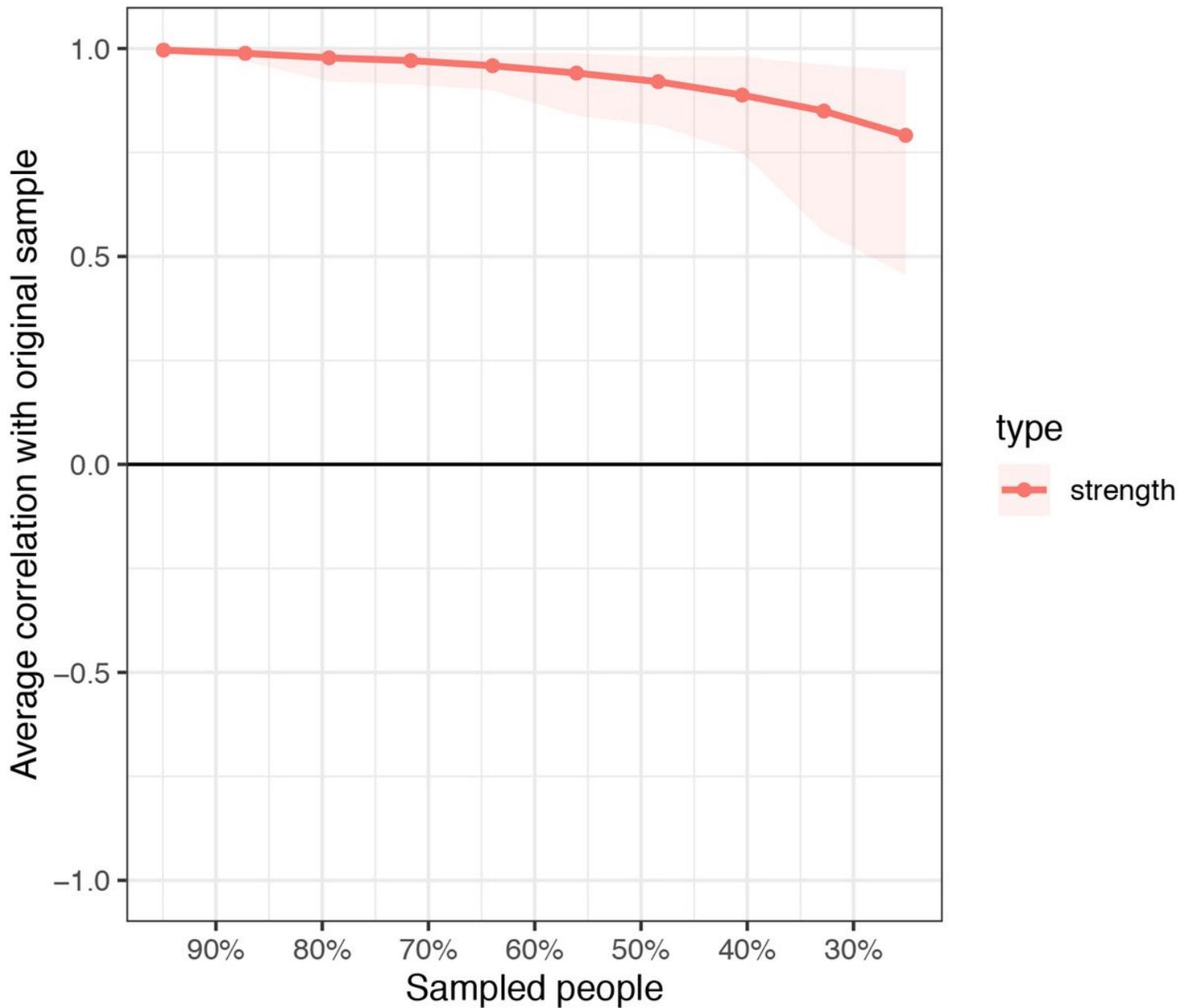


Figure 3

The accuracy of edge weights.



**Figure 4**

Strengths stability.

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