



# The relationship between nurses' social network degree centrality and organizational citizenship behavior: The multiple mediating effects of job satisfaction and work engagement

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## ABSTRACT

**Background:** In nursing care organizations, nurses' social networks affect their behavior and play an important role in nursing practice. This study aimed to explore the relationships among social network degree centrality, job satisfaction, work engagement and organizational citizenship behavior (OCB) among nurses.

**Methods:** A cross-sectional survey design (one-on-one investigation) was used. The study was conducted among 254 nurses working in 10 nursing units in two hospitals in China from November 2019–February 2020. The participants completed a paper questionnaire that measured social network degree centrality, job satisfaction, work engagement and organizational citizenship behavior. A structural equation model (SEM) was used to analyze the mediating effects of job satisfaction and work engagement. SPSS 22.0 and Amos 21.0 software were used, and the significance level was set at 5% for all analyses.

**Results:** Social network degree centrality was positively associated with job satisfaction, work engagement and organizational citizenship behavior, and job satisfaction and work engagement had significant positive relationships with organizational citizenship behavior. In addition, social network degree centrality influenced organizational citizenship behavior through the multiple mediating effects of job satisfaction and work engagement.

**Conclusions:** Improving job satisfaction and work engagement can boost the positive effect of social network degree centrality on OCB.

## 1. Introduction

At present, the nursing industry should not only actively respond to the new challenges brought by population aging, chronic disease prevention and control, and birth policy adjustment but also accelerate the provision of high-quality services covering the whole life cycle and promote the transformation of the service mode from cooperative treatment to meeting the physical and mental health needs of patients. In addition, the increasingly complex and changeable market competition environment and the flexibility and

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adaptability of the organization have put forward higher requirements for nurses. Nurses are the most direct and important guarantee of the quality of nursing services, but the staffing shortage of nurses has been a health problem worldwide. According to a World Health Organization report, the global shortage of nurses will reach 5.7 million by 2030 [1]. Although the total number of registered nurses in China reached 4.7 million in 2020, there are 3.34 registered nurses per 1000 people nationwide [2]. However, there is still a large gap with the requirements of the "Healthy China 2030" Plan outline [3]. Moreover, the regional distribution of nursing human resources in China is unbalanced [4], and the internal structure is not reasonable [5]. In general, although the allocation of nursing human resources in China has been optimized year by year, the growth rate is slow [6], and it still cannot meet the growing diversified needs of society.

In the era of the knowledge economy, human capital has become one of the most important forms of capital of organizations in the face of fierce market competition. Organizational citizenship behavior as developmentally available human capital is particularly important in this context. Organizational citizenship behavior is a voluntary extrarole behavior that is not directly or explicitly confirmed by formal work requirements and remuneration systems but can accelerate the achievement of organizational goals and performance improvement [7]. The majority of the nursing workforce in China is female, and women are more concerned with social support and approval and more likely to be satisfied with their career achievement [8], so they are more willing to show compassion and concern for colleagues and help each other in work. Previous studies have shown that OCB has a positive relationship with high-quality care, individual-level performance and unit-level performance but a negative correlation with job stress and turnover intention [9–12].

In prior studies of promoting nurses' OCB strategies, researchers have focused on influencing factors, such as individual factors and organization-related factors [13]. Tsang et al. [14] suggested that social relationship situational factors, such as social networks, could promote the OCB of nurses. This approach may help develop more effective strategies to promote nurses' OCB. A social network is a collection of social actors and their interactions, which are visualized as a network diagram featuring multiple points (social actors) and connections among points (relationships among actors) [15]. Nurses' social networks are formed by their communication and interaction with coworkers within the unit who have similar backgrounds in terms of work experience. Such networks constitute an important social resource [16,17] that can help nurses complete their work smoothly, meet others' communication needs, and achieve individual goals. Social network degree centrality refers to the number of direct connections maintained by each member of the network [18]. The greater the degree centrality is, the more connected one member is to the others. A survey of employees working in Chinese enterprises revealed [19] that social network degree centrality plays a positive role in all dimensions of OCB. A survey conducted in the nursing workplace also suggested [14] that social network degree centrality (in both work and friendship networks) positively promotes OCB in organizations.

Personal interactions, which can foster social support in the nursing unit and social support from social networks, can motivate nurses to exhibit high levels of job satisfaction and work engagement [20,21]. Job satisfaction refers to employees' positive emotional state toward their jobs [22]. Work engagement is an indicator of the individual's positive state in three respects: vigor, dedication and absorption [23]. Job satisfaction and work engagement are indeed major indicators of well-being, and they are regarded as key to motivating employees to devote themselves to improving their work performance. Job satisfaction and work engagement have been found to be direct predictors of nurses' OCB [24,25]. Moreover, the mediating role of work engagement in the relationships between psychological capital and organizational citizenship behavior and between job satisfaction and organizational citizenship behavior [26,27] has been reported in the extant literature.

In summary, previous studies have found that social network degree centrality and OCB are closely related, but the exact way in which social network degree centrality affects OCB remains unclear. It has been found that social networks are positively correlated with job satisfaction and work engagement, job satisfaction is positively correlated with OCB, and work engagement is positively correlated with OCB. Therefore, this study aims to investigate whether job satisfaction and work engagement play a mediating role in the relationship between social networks and OCB.

### 1.1. Theoretical framework

Social network theory helps explain why nurses' social networks constitute a social resource. The theory suggests that individual behavior exists within social networks and that social networks affect individuals' behavior; individuals can build relationships with others and access resources through social network interactions [28], thus promoting cooperation among individuals. Social networks can help us understand the phenomenon of mutual support among nurses [16]; the more frequently nurses communicate with other nurses in the nursing unit, the more social support they receive, and the more conducive their situation is to the completion of work and emotional communication. This benign interaction can create a good working environment for nurses.

Self-determination theory is a motivational process theory of human self-determination behavior [29]. According to this theory, human beings have three basic psychological needs: autonomy, competence and relatedness. These three needs are innate and universal in humans. The need for autonomy, that is, the need for self-determination, refers to individuals' ability to make choices according to their own will when engaging in various activities. The need for competence refers to individuals' ability to succeed in challenging tasks and achieve the desired results. The need for relatedness refers to the need for care, understanding and support from the surrounding environment or others with the goal of experiencing a sense of belonging. When environmental factors support the satisfaction of these three psychological needs, individuals are motivated to engage in positive behaviors [30].

Social network theory suggests that the more frequently nurses communicate with other nurses within the organization, the more resources they have, which is more conducive to the completion of their work and emotional communication. This positive interaction can create a good working environment for nurses. Self-determination theory suggests that a good working environment can stimulate

nurses' work motivation by constantly satisfying their three basic psychological needs, thereby encouraging them to take the initiative to work and engage in more organizational citizenship behaviors. The application of self-determination theory in the field of management pertains mainly to the question of how to stimulate employees' work motivation, which has led to the emergence of a theoretical model of "supportive environment → need satisfaction → work motivation → organization results" [31]. Therefore, the current study intends to explain the multiple mediating effects of job satisfaction and work engagement on the relationship between nurses' social network degree centrality and organizational citizenship behavior in line with the theoretical analysis discussed above. Examples of such a "supportive environment" included nurses' social network degree centrality, job satisfaction was used to measure "need satisfaction", work engagement was used to measure "work motivation", and organizational citizenship behavior was used to measure "organization results". Based on a literature review and a corresponding theoretical foundation, the proposed mediation model is shown in Fig. 1. If this model were to be confirmed, more efficient strategies could be employed to improve nurses' OCB.

## 2. Methods

### 2.1. Study population

Structural equation model analysis needs to meet the requirement of sample size. According to Rules of Thumb, minimum sample sizes usually require >200 participants [32]. A total of 275 nurses from 12 nursing units of 2 tertiary general hospitals were selected for this cross-sectional study by a convenience sampling method. Inclusion criteria: ① Nurses: held a nurse practice certificate of the People's Republic of China and were officially registered, were engaged in clinical nursing and provided informed consent; ② Nursing unit: had more than 10 nurses. Exclusion criteria: external training nurses (including external hospitals and other nursing units). A total of 275 questionnaires were distributed. Two nursing units in Hospital 1 had questionnaire response rates below 80%, so data from these two nursing units were removed; accordingly, data for 254 respondents (10 nursing units) were eligible for analysis, including data collected from 110 nurses working in hospital 1, i.e., 83.97% of the total (n = 131), and 144 nurses working in hospital 2, i.e., 100% of the total (n = 144).

### 2.2. Data collection

The data were collected from November 2019–February 2020. The overall social network research required all nurses in the nursing unit to complete the network questionnaire to form a complete matrix in the final statistical analysis. Each network was required to have a response rate of more than 80%; otherwise, the network was regarded as an invalid questionnaire. The number of nurses in the selected nursing unit could not be too small, as a network structure of fewer than 10 people is relatively simple, which is too different from large groups. Additionally, the network size could not be too large; for example, more than 100 people would affect the accuracy of the survey object when completing the questionnaire [33]. The number of nurses in the nursing unit investigated in this study ranged from 15 to 31, thus meeting the requirements mentioned above.

When completing the social network questionnaire, participants needed to complete the names or codes of their colleagues. The results are only available to the researcher. The questionnaire was distributed one-to-one so that the researcher could confirm that all nurses completed it. After obtaining informed consent, a list of nurses was obtained, the names of the nurses were randomly numbered to form a paper list, the list of nurses was attached to each questionnaire, and the documents were placed in an envelope. The participants were informed of the research purpose, time, and methods, and the questionnaire was completed independently at a convenient time. Subsequently, the list was removed, and the questionnaire was placed back in the envelope, which was sealed on the spot. In this study, all methods were implemented in accordance with the relevant guidelines and regulations.

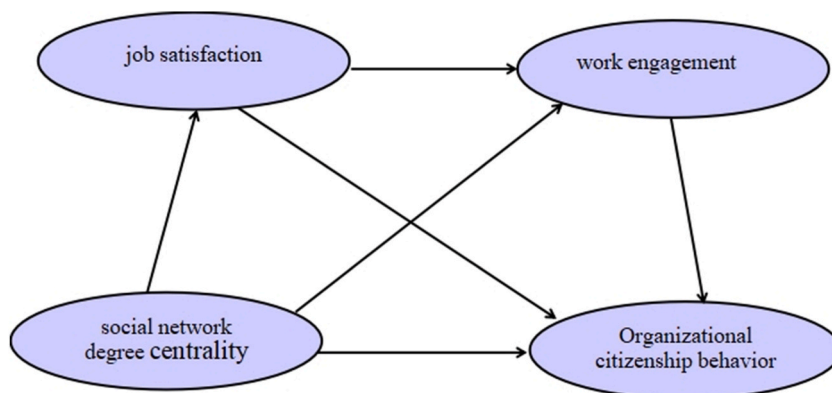


Fig. 1. Research model.

### 2.2.1. Organizational citizenship behavior

The Nurses' Organizational Citizens' Behavior Scale [34] was used. This 24-item scale assesses self-development, sense of responsibility, active service, helping colleagues and organizational identity. It was a 5-point Likert scale, scored from 1 ("very inconsistent") to 5 ("very consistent"); the higher the score, the more organizational citizenship behavior there is. The Cronbach's alpha was 0.953.

### 2.2.2. Work engagement

The Utrecht Work Engagement Scale 9 Item (UWES-9 item) [23] was used to evaluate work engagement, a scale that has been widely used in China. It is scored on a 7-point Likert scale from 0 ("very strongly disagree") to 6 ("very strongly agree"), and the subdimensions include vigor, dedication and absorption. The Cronbach's alpha was 0.961.

### 2.2.3. Job satisfaction

Job satisfaction was measured using the Short Form Minnesota Satisfaction Questionnaire [35]. The Chinese version was adopted in this study. It used a 5-point Likert scale, from 1 ("very dissatisfied") to 5 ("very satisfied"), with higher scores indicating higher job satisfaction. It included two dimensions of intrinsic and extrinsic satisfaction. The Cronbach's alpha was 0.909.

### 2.2.4. Social network degree centrality

This variable was assessed using 7 items [33] across two dimensions: work network and friendship network. A work network refers to nurses' connections with colleagues who can provide work resources and help for them. A friendship network is a private network between nurses that provides emotional support. An example question is "When encountering difficulties at work, which colleague will you ask for advice? (please fill in the coworker code)". When completing the questionnaire, respondents were required to use the coworker code form and choose the member code that met the requirements stipulated by the questions. The selection of a member code was scored as 1, while an unselected member code was scored as 0. The Cronbach's alpha of this scale in this study was 0.949.

## 2.3. Statistical analyses

UCINET software was used to calculate the standard values of social network degree centrality. The social network questionnaire used in this study consists of 7 items, and 7 standard values of social network degree centrality were calculated for each respondent. All the standard values associated with the social network degree centrality of each respondent were entered into SPSS 22.0 and analyzed alongside other variables. Descriptive data analysis as well as the calculation of Pearson correlations among variables and Cronbach's alpha coefficient for each measure were performed. SEM was used to test the proposed relationships among variables. Bias-corrected bootstrapping (2000 replications) was performed to test the indirect effects of job satisfaction and work engagement. SEM analyses were employed using AMOS 21.0. Given the sensitivity of the chi-square to sample size, a good model fit was indicated by  $\chi^2/df < 3$ . Certainly, several other indices were also considered. For example, the root mean square error of approximation (RMSEA)  $\leq 0.08$ , goodness-of-fit index (GFI), comparative fit index (CFI) and Tucker–Lewis index (TLI) were all  $\geq 0.90$ . A probability of  $p < 0.05$  was considered statistically significant.

## 2.4. Ethical considerations

The participating hospitals' research ethics committees approved this study (the ethics code was 2019014). Before inclusion, all participants were informed of the relevant information and research purposes.

## 3. Results

### 3.1. Descriptive data

Of the 254 pieces of data analyzed, the mean age of the participants was  $29.64 \pm 5.48$  years (range 20–51), and 97.2% of the sample was female. A total of 26.0% of the participants had graduated from a junior college in nursing, 70.1% of the participants held a bachelor's degree in nursing, and 3.9% of the participants held master's degrees or above. A total of 75.2% of nurses had primary titles, while 24.8% had intermediate titles or above. A total of 15.4% of nurses came from intensive care units, 36.2% came from surgical departments and 48.4% came from internal medicine. A total of 21.3% of nurses had been working in their present department for less

**Table 1**

Means, standard deviations and correlations of study variables.

	MEAN	SD	1	2	3	4
1.Social network degree centrality	36.14	10.49	1			
2.Job satisfaction	3.91	0.52	0.341**	1		
3.Work engagement	3.86	0.96	0.357**	0.500**	1	
4.Organizational citizenship behavior	4.09	0.32	0.330**	0.529**	0.482**	1

\*\* $P < 0.01$ .

than 3 years, 41.7% of nurses had been working in their present department for more than 3 years, 22.8% of nurses had been working in their present department for more than 6 years, and 14.2% of nurses had been working in their present department for more than 10 years. A total of 40.2% of nurses had a monthly income of less than 7000 ¥, while 59.8% of nurses had a monthly income of more than 7000 ¥.

### 3.2. Mean scores and correlations among variables

The mean scores and correlations for the variables are shown in Table 1. Social network degree centrality ( $r = 0.330, p < 0.01$ ), job satisfaction ( $r = 0.529, p < 0.01$ ), and work engagement ( $r = 0.482, p < 0.01$ ) had significant positive correlations with OCB.

### 3.3. Mediating effects analyses

As shown in Fig. 2, the measurement model was acceptable, GFI = 0.975, AGFI = 0.959, NFI = 0.971, CFI = 1.000, TLI = 1.011, IFI = 1.007, RMSEA = 0.000. The direct effects of social network degree centrality on job satisfaction (Est. = 0.431,  $P < 0.01$ ) and work engagement (Est. = 0.348,  $P < 0.01$ ) were significant, and the direct effect of job satisfaction on work engagement was significant (Est. = 0.413,  $P < 0.01$ ). Job satisfaction had the strongest direct protective impact on OCB (Est. = 0.429,  $P < 0.01$ ), and work engagement had the second strongest (Est. = 0.304,  $P < 0.01$ ). Social network degree centrality had no direct effect but had a significant indirect protective effect on organizational citizenship behavior by the three-path mediation model, and the total indirect effect was significant (Est. = 0.345,  $P < 0.01$ ) (see Fig. 2 and Table 2). Therefore, the total protective effect of social network degree centrality on OCB exceeded that of work engagement and was thus identified as the second most important protective factor for OCB.

## 4. Discussion

This study expanded on the findings of previous researchers and clarified the relationship between social network degree centrality and organizational citizenship behavior by reference to the variables of job satisfaction and work engagement. The multiple mediating effects of job satisfaction and work engagement were also verified.

First, nurses' social network degree centrality had a positive effect on job satisfaction and work engagement. A previous study of health care professionals working in primary care clinics [36] discovered that communication connections regarding patient care with other care team members and job satisfaction were closely related factors and mentioned that interventions targeting professional communication networks might improve job satisfaction. Some researchers have also argued that social networks are an important factor that positively or negatively influences job satisfaction [37]. In addition, personal interactions foster resource support in the social network, and social support from coworkers can motivate employees to exhibit a high level of work engagement [20]. Kiema-Junes et al. [38] revealed that high social support at work and in one's private life were associated with higher work

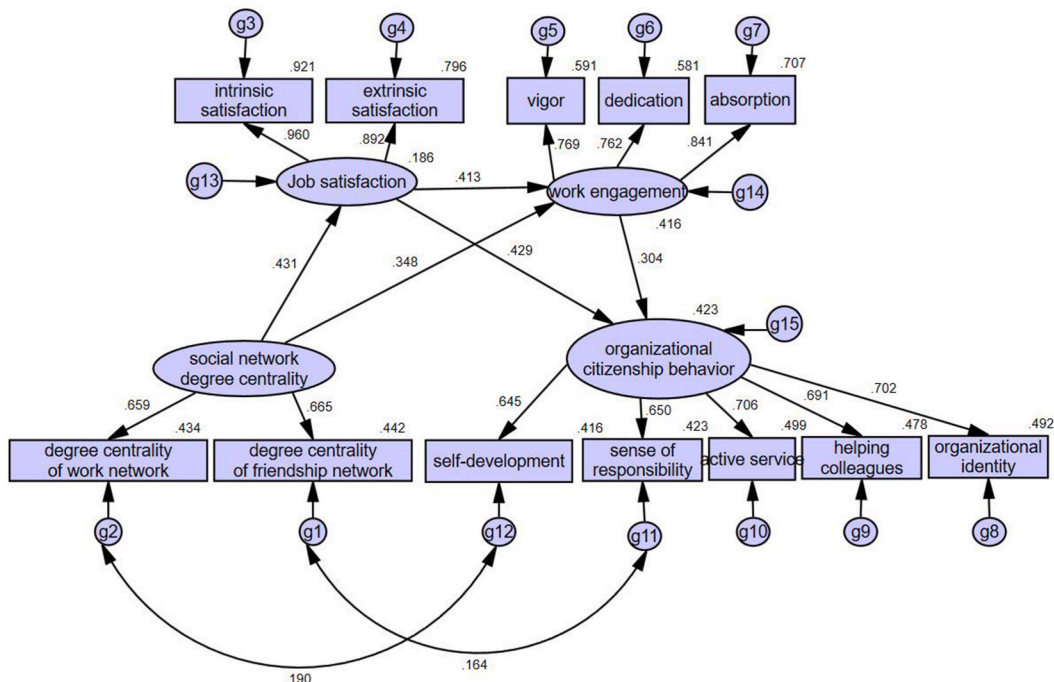


Fig. 2. Standardized coefficients of the final model. Note: Bias-corrected bootstrap with 2000 replications using maximum likelihood estimation.

**Table 2**  
Effect tested through bootstrap procedure.

Effect	Pathway	Bootstrap			
		Est.	SE	p	CI 95%
Direct effect	1 → 4	–	–	–	–
Indirect effect	1 → 2→4	0.345	0.059	0.001	0.285,0.403
	1 → 3→4				
	1 → 2→3 → 4				
Total effect	–	0.345	0.059	0.001	0.285,0.403

Note: All parameter estimates are presented as standardized coefficients. CI, confidence interval; Est., estimation; SE, standard error. 1 = social network degree centrality, 2 = job satisfaction, 3 = work engagement, 4 = organizational citizenship behavior.

engagement. Therefore, social network degree centrality is a positive factor in promoting nurses' job satisfaction and work engagement. However, in this study, social network degree centrality had no direct positive effect on OCB. These results differed from those found by a previous study, which reported that social network degree centrality positively affected OCB<sup>[14]</sup>. However, in this study, there was a significant positive correlation between social network degree centrality and organizational citizenship behavior ( $r = 0.330, P < 0.01$ ). The possible reasons for this finding are that the OCB of nurses is affected by various factors, and a high level of OCB can be attributed not only to the level of social network degree centrality but also to the complete mediating roles of job satisfaction and work engagement. According to the findings of our study, the positive correlation between these factors is completely mediated by job satisfaction and work engagement. This finding suggests that clinical nursing managers should pay particular attention to the task of improving nurses' job satisfaction and work engagement. Although these factors are not directly related, the mediating effect is established, indicating that efforts to improve social network degree centrality can affect OCB through job satisfaction and work engagement.

According to our study, job satisfaction and work engagement have mediating effects on the relationship between social network degree centrality and OCB. Ng LP [27] revealed that work engagement had a mediating effect on the relationship between job satisfaction and OCB, which is consistent with the results of this study. The mediating role of job satisfaction in the relationship between social network degree centrality and organizational citizenship behavior was confirmed in this study. The mediating role of job satisfaction in the relationships between independent variables (e.g., self-control) and OCB has previously been verified [39], but social network degree centrality has rarely been included as an independent variable; thus, this study reports a new finding that has rarely been reported in the extant literature. More interestingly, the findings of this study indicated that job satisfaction and work engagement have a serial mediating effect on the relationship between social network degree centrality and organizational citizenship behavior. The direct effect of social network degree centrality on OCB has been confirmed [14], but how social network degree centrality affects OCB remains unclear. The serial mediating effect of job satisfaction and work engagement provides a path for explaining individuals with high social network degree centrality who are more willing to engage in organizational citizenship behavior, which could help us understand the pathway of social network degree centrality on OCB. Overall, these findings demonstrated the importance of job satisfaction and work engagement in the effect of social network degree centrality on OCB. This finding is thus a useful supplement to previous studies and may indicate a more effective strategy for promoting nurses' OCB, and it can greatly highlight the study's theoretical contribution.

Third, job satisfaction and work engagement had a positive effect on nurses' organizational citizenship behavior; the higher their level of job satisfaction is, the higher their level of work engagement, and the higher their organizational citizenship behavior. Job satisfaction and work engagement are regarded as the keys to motivating employees to perform better at work, which is consistent with earlier studies [24,25], which have reported that work engagement is positively related to OCB and that more job satisfaction promotes more OCB. Moreover, job satisfaction had a positive effect on nurses' work engagement, which suggested that taking measures to improve job satisfaction can simultaneously increase nurses' work engagement and organizational citizenship behavior. Studies of nurses have also shown that job satisfaction has a positive effect on work engagement and organizational citizenship behaviour [24]. Based on these results, it is necessary to identify further educational programs to improve nurses' job satisfaction and work engagement.

According to social network theory [28], nurses obtain resources from their social network. Self-determination theory [29] also provided a theoretical basis for understanding this finding. Nurses obtain resources from their social network to meet their basic needs (e.g., material support, moral reward, and sense of accomplishment), which can stimulate intrinsic motivation and increase job satisfaction and work engagement. Work engagement contributes to increased positive outcomes and decreased negative outcomes for nurses, patients, organizations and nursing practice [40]. The literature has confirmed that work engagement has a positive effect on OCB [27]. This helps to explain why nurses with high social network degree centrality are willing to engage in organizational citizenship behavior. It is suggested that if nurses' social networks can be actively developed and fully exploited so that benign interactions between nurses become an important driving force to promote nursing work and form an atmosphere of mutual help and mutual assistance, nurses' needs could be continuously met, stimulating their work motivation and promoting their OCB.

## 5. Limitations

This paper had some limitations. First, it employed a cross-sectional design, and the directions of the causal relationships among the



variables were based on theoretical explanations. Second, this study used convenience sampling, thus making it difficult to generalize the data collected as part of this study to other nurses in other Chinese health care settings. A small sample size can also affect the universality of this study, and although confidentiality was guaranteed, nurses in this study may have been concerned that the disclosure of their information would affect their work. Fourth, research data were collected by self-report questionnaires, which may have led to response bias. Moreover, it is possible that the findings were influenced by culture; thus, the replication of this study in other cultural contexts is necessary.

Longitudinal studies or randomized controlled trials (RCTs) are also necessary to provide further confirmation of our results. Our research was based mainly on quantitative methods. Qualitative or mixed research methods should be considered to explore the relationships among social network degree centrality, job satisfaction, work engagement and organizational citizenship behavior.

## 6. Implications for nursing management

Our findings suggest that two types of measures can be taken to promote positive interactions among nurses to improve social network degree centrality, increase job satisfaction and work engagement and thus augment OCB.

First, it could be useful to establish positive and interactive working relationships. The work network is a link between nurses through interpersonal interactions in nursing practice, which is critical for nurses' teamwork. Nurses are able to share useful information for patient care with good communication and cooperation [41]. Simultaneously, it could be useful for managers to take interventions on key factors to improve nurses' job satisfaction (e.g., psychological empowerment) [42] and work engagement (e.g., nursing practice environment) [43] in daily clinical practice, both of which are helpful for nurses' organizational citizenship behavior.

The friendship networks of nurses should be accounted for, which can provide nurses with emotional support. Emotional support is one type of social support, and it involves the expression of concern and love, such as listening and reflective understanding [44]. Emotional support is positively associated with nurses' job satisfaction and work engagement [45]. More effective interventions are needed to improve nurses' emotional support in their work, which can enhance nurses' OCB.

## 7. Conclusion

The relationships among the four variables mentioned above were considered simultaneously in this study, which complements previous literature by examining the structural relationships among them and elucidating the multiple mediating effects of job satisfaction and work engagement in this relationship among nurses. This approach is conducive to enriching and expanding the theory of the organizational citizenship behavior of nurses.

Social networks in nursing units were an important resource for nurses. A high level of social network degree centrality was associated with high levels of job satisfaction, work engagement and organizational citizenship behavior. The positive effects of social network degree centrality on organizational citizenship behavior may be enhanced by improving job satisfaction and work engagement. Developing intervention programs to promote OCB among nurses, improving the healthy development of nurses' work and friendship networks and improving nurses' job satisfaction and work engagement may be useful strategies in this context.

## Author contribution statement

- 1 - Conceived and designed the experiments;
- 2 - Performed the experiments;
- 3 - Analyzed and interpreted the data;
- 4 - Contributed reagents, materials, analysis tools or data;
- 5 - Wrote the paper.

## Data availability statement

Data will be made available on request.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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