


BMJ Open Mediation role of work motivation and job satisfaction between work-related basic need satisfaction and work engagement among doctors in China: a cross-sectional study

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ABSTRACT

Objectives This study aims to examine the association of work-related basic need satisfaction (W-BNS) with doctors' work engagement and explore the mediating role of work motivation and job satisfaction between the two variables.

Design This was a cross-sectional study.

Setting The study was conducted in four public grade A tertiary hospitals in China.

Participants A total of 1000 doctors were invited to participate; 849 doctors completed questionnaires validly.

Primary and secondary outcome

measures Questionnaires were administered online and offline to collect data, consisting of six parts: social demographic characteristics, work-related characteristics, and scales related to W-BNS, work motivation, job satisfaction and work engagement. One-way analysis of variance, Pearson correlation analysis were performed using SPSS, and mediation analysis was carried out via PROCESS macro.

Results Our research showed that W-BNS, work motivation, job satisfaction and work engagement were positively correlated. Work engagement was significantly predicted by W-BNS ($\beta=0.15$, $p<0.001$) through motivation at work ($\beta=0.23$, $p<0.001$) and job satisfaction ($\beta=0.44$, $p<0.001$), respectively. Compared with work motivation, the mediating effect of job satisfaction was stronger (95% CI -0.22 to -0.06).

Conclusion The findings suggest that job satisfaction and work motivation may be important pathways through which doctors' W-BNS may influence their work engagement. In order to maintain and promote doctors' work engagement, hospital administrators should consider strengthening the internal motivation of doctors and improving their job satisfaction.

INTRODUCTION

Doctors comprise the core of hospital human resources and play a key role in providing high-quality and stable medical and health services, maintaining the smooth operation of medical and health service systems, and protecting people's health and safety. For

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Structural equation modelling is used to analyse the associations among work-related basic need satisfaction, work motivation, job satisfaction and work engagement.
- ⇒ This study is a cross-sectional survey and therefore cannot make causal inferences.
- ⇒ Survey data from only one region may limit the generalisability of our findings.

a long time, Chinese doctors have faced long working hours, heavy workload and demanding management requirements, especially in public grade A tertiary hospitals.¹⁻³ The outbreak of COVID-19 has brought a higher risk of infection to doctors, which will affect the quality and efficiency of medical services provided by doctors and result in job burnout.^{4,5}

Proponents of positive psychology advocate paying attention to positive emotions, such as happiness, satisfaction and so on, in order to reduce burnout or alleviate its painful effects.⁶ Work engagement emerged as a new perspective in occupational health research. It has been defined as 'a positive, fulfilling, work-related state of mind that is characterised by vigour, dedication and absorption'.⁷ It focuses on the individual's positive attitude towards their own work, along with their feelings of optimism, creativity and engagement. As the opposite of job burnout, the purpose of work engagement research is to help people transition from negative to positive emotions, from burnout to engagement, effectively promote individual self-development, improve job performance and satisfaction, improve the organisational and social atmosphere and adapt to current developments.⁸ Previous

studies have found that work engagement has a significant correlation with work performance and well-being. Low work engagement may lead to low job performance and well-being. Therefore, evaluating, maintaining and promoting work engagement has become an important topic for many organisations.^{9–11} However, existing research on the work engagement of medical staff in China mainly focused on nurses; there is less research on the work engagement of doctors.¹² Therefore, this study has theoretical significance to fill the gap of previous studies. At the same time, our study has practical significance in terms of assessing the status of doctors' work engagement and taking measures to maintain and improve doctors' work engagement in the epidemic context.

Many scholars contend that demand is the basic determinant of human behaviour.¹³ Self-determination theory (SDT) assumes three innate psychological needs: autonomy, competence and relatedness.¹⁴ As a branch of SDT, basic psychological needs theory suggests that satisfying these three basic psychological needs is essential for individual growth.¹⁵ SDT has been successfully applied to work engagement research. For example, the research of Van den Broeck *et al* showed that basic psychological needs satisfaction plays an intermediary role between work demands and work engagement, and that basic psychological needs satisfaction directly affects work engagement.¹⁶ Similarly, Schreurs *et al* found that employees' psychological needs satisfaction was positively correlated with work engagement.¹⁷ Based on the core hypothesis of SDT, that is, the theoretical model of 'environment–basic psychological needs–work motivation–result', combined with the findings of previous studies, it can be suggested that the satisfaction of work-related basic psychological needs will promote employees' work engagement, while a block on work-related basic psychological needs will lead to job burnout. Therefore, the first hypothesis of this study is proposed as work-related basic need satisfaction (W-BNS) positively associates with work engagement.

Motivation at work is defined as the internal force that maintains the content, intensity and duration of work.¹⁸ The distinctive feature of SDT is to identify three types of motivation for people to engage in activities: intrinsic motivation, extrinsic motivation and amotivation. Intrinsic motivation refers to the motivation to engage in activities due to people's own interests and the fun of the activity itself. Extrinsic motivation is a construct that pertains whenever an activity is done in order to attain some separable outcome. Amotivation is the state of lacking an intention to act.¹⁹ Cognitive evaluation theory (CET), another subtheory of SDT, systematically expounds on the relationship between work-related basic psychological needs and intrinsic motivation. It holds that interpersonal events and structures (such as rewards, communication and feedback) that produce feelings related to ability in action can enhance the intrinsic motivation of action because they can meet the basic psychological needs of ability.²⁰ Existing studies have also confirmed the

relationship between W-BNS, work motivation and work engagement. For example, Goodboy *et al*, when studying the relationship between workplace bullying and work engagement, used work-related basic psychological needs satisfaction and intrinsic work motivation as mediating variables. The results showed that basic psychological needs satisfaction and work motivation were continuous mediating variables. Work-related basic psychological needs satisfaction significantly affected intrinsic work motivation, which in turn affected work engagement for employees.²¹ A study on how basic psychological needs and motivation affect pharmacists' vitality and lifelong learning adaptability showed that basic psychological needs are important predictors of outcome variables such as pharmacists' happiness. Basic psychological needs dissatisfaction was positively correlated with unsatisfactory learning motivation and negatively correlated with outcome variables.²² Based on CET and existing research studies, the second hypothesis is proposed as the positive relationship between work-related basic need and work engagement will be mediated by motivation at work.

Job satisfaction is a subjective perception of workers. It is a physiological and psychological response to the work itself and the working environment.²³ Gu *et al* explored the relationship between the job satisfaction and work engagement of doctors in public hospitals in China. The study found that job satisfaction was positively correlated with work engagement.²⁴ When studying the relationship between burnout and job satisfaction of medical staff, Song *et al* used job satisfaction as an intermediary variable. The results showed that job satisfaction had a negative effect on burnout.²⁵ According to the 'cognitive–affective–conative' (CAC) theoretical framework, cognition refers to doctors' perception of the satisfaction of work-related basic psychological needs. Job satisfaction represents the positive emotion generated by the satisfaction of doctors' work-related basic psychological needs. Work engagement is the tendency of doctors to work with a positive attitude, that is, the satisfaction of doctors' work-related basic needs affects their work engagement through job satisfaction.²⁶ Therefore, based on previous studies and the CAC theoretical framework, a third hypothesis is proposed as the positive relationship between W-BNS and work engagement will be mediated by job satisfaction.

In summary, this study aims to examine the association between W-BNS and doctors' work engagement and explore the mediating role of motivation at work and job satisfaction in the relationship between the two factors. The three hypotheses of this study are summarised as follows (table 1).

Based on the following reasons, this study considers motivation at work and job satisfaction as parallel variables. (1) Although motivation at work and job satisfaction belong to individual factors, they differ in scope and focus: motivation at work is a kind of belief, focusing on expectations, while job satisfaction is a kind of attitude, focusing on emotion. (2) Two parallel theoretical

Table 1 Hypotheses of this study

Number	Contents of hypothesis
Hypothesis 1	Work-related basic need satisfaction positively associates with work engagement
Hypothesis 2	The positive relationship between work-related basic need and work engagement will be mediated by motivation at work
Hypothesis 3	The positive relationship between work-related basic need satisfaction and work engagement will be mediated by job satisfaction

perspectives are selected from the study of modelling. Based on the ‘environment–basic psychological needs–work motivation–results’ model of SDT, this study examines the mediating role of motivation at work in the association between W-BNS and work engagement. At the same time, from the perspective of the ‘CAC’ theoretical model, we examine the mediating effect of job satisfaction on the association of W-BNS with work engagement. Based on the above considerations, motivation at work and job satisfaction are more appropriate as parallel intermediary paths in the relationship between W-BNS and work engagement. The proposed model is shown in [figure 1](#).

METHODS

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination of our research.

Data collection

A simple random sampling method was adopted to select four hospitals among the six public grade A tertiary general hospitals in Nanjing, China. The following criteria were set for participation in the study. Entry criteria: having obtained a practitioner qualification certificate, hospital official staff, voluntary participation in this survey. Exclusion criteria: postgraduate students, refresher doctors, do not understand the purpose of the study and have no intention to participate in the research. The data were collected from 8

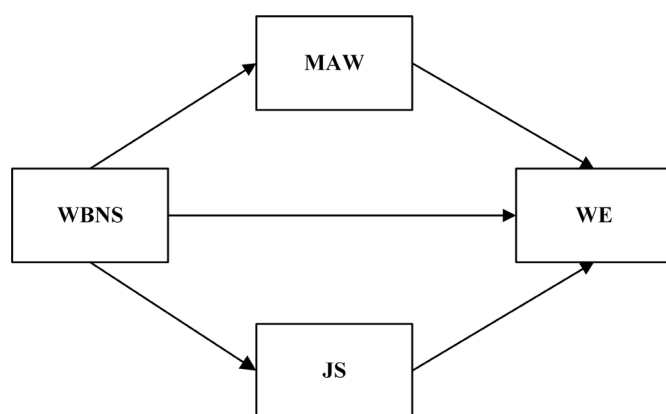


Figure 1 The theoretical model and hypotheses. JS, job satisfaction; MAW, motivation at work; WBNS, work-related basic need satisfaction; WE, work engagement.

September 2021 to 8 November 2021. Due to COVID-19, our research team chose an online and offline questionnaire survey method according to the four hospitals’ epidemic prevention and control policy requirements. The online survey was conducted via the Chinese professional survey website Wenjuanxing (<https://www.wjx.cn/>). After obtaining the agreement of head doctors, our research team sent the link of an online questionnaire to doctors by WeChat. The electronic questionnaire included required items and logical checks to ensure that the questionnaire was filled out effectively. After the electronic questionnaires were completed, two trained investigators checked the data of each questionnaire to ensure that there were no problems with the quality of the questionnaires included in the study. The offline survey was conducted via paper questionnaires. Before the offline questionnaire survey, head doctors informed the doctors in the department in advance of the content and purpose of this survey and obtained their consent. Then, the uniformly trained investigators distributed paper questionnaires face to face to doctors who were interested in participating in this survey. After the doctors completed the questionnaires, the investigators conducted the initial verification. If the investigators found that the questionnaires were incorrectly filled, they immediately gave feedback to the doctor filling in the questionnaire on the spot. After collecting the completed paper questionnaires, a second check was conducted to eliminate invalid questionnaires. The first page of the electronic questionnaire and the paper questionnaire provided information about the study and the informed consent of the participants. The respondents decided whether to voluntarily participate in this study according to their personal conditions.

Measures

The study questionnaire consisted of six main parts: social demographic characteristics (gender, age, education, marital status), work-related characteristics (department, professional ranks and titles, years of work, salary, experience of COVID-19 first-line services), and scales related to W-BNS, work motivation, job satisfaction and work engagement. The duration of a questionnaire was 4–16 min, and the typical duration of this survey was 7 min. The duration of the survey was short, and the respondents’ overall willingness to cooperate was high.

Work-related basic need satisfaction (X)

W-BNS was measured using the W-BNS Scale developed by Broeck.²⁷ The W-BNS is a 16-item self-report scale with three subscales: need for autonomy (eg, 'I feel like I can be myself at my job'), need for competence (eg, 'I really master my tasks at my job') and need for relatedness (eg, 'At work, I feel part of a group'). This scale adopted a 7-point Likert scoring method, ranging from 1 (strongly disagree) to 7 (strongly agree). The higher the score, the higher the satisfaction of work-related basic needs. In this study, the Cronbach α coefficient of this scale was 0.82.

Motivation at work (M1)

The work motivation scale compiled by Gagné *et al* was used.²⁸ The scale has 12 items, such as 'Because I like this job very much'. The subjects were asked to evaluate and judge the reasons for their engagement in their work according to their actual feelings and experiences. This scale adopted a 7-point Likert scoring method, ranging from 1 (strongly disagree) to 7 (strongly agree). Referring to the research of Deci *et al*,²⁹ the scores of this scale were calculated with weights. The formula used was: scale score = 2 × intrinsic motivation + identity motivation - introjected motivation - 2 × extrinsic motivation. In this study, the Cronbach α coefficient of this scale was 0.89.

Job satisfaction (M2)

The job satisfaction scale compiled by Hackman³⁰ and revised by Shu and Liang³¹ was used. The scale consists of three items, such as 'Overall, I am satisfied with my work'. This scale adopted a 5-point Likert scoring method, ranging from 1 (strongly disagree) to 5 (strongly agree). The higher the score, the more satisfied with the work. In this study, the Cronbach α coefficient of the scale was 0.94.

Work engagement (Y)

The 9-item Utrecht Work Engagement Scale developed by Schaufeli *et al* was used.⁷ The scale has nine items, such as 'at work, I feel that I am bursting with energy'. This scale adopted a 7-point Likert scoring method, ranging from 1 (never) to 7 (always). The higher the score, the higher the work engagement. In this study, the Cronbach α coefficient of the scale was 0.96.

Statistical analysis

Descriptive statistical analysis was used to display the demographic and work-related characteristics of the doctors surveyed. One-way analysis of variance (ANOVA) was used to test the differences of the W-BNS Scale, motivation at work scale, job satisfaction scale and work engagement scale scores among different demographic and work-related characteristics. Pearson correlation analysis was used to test the correlation between variables. Mediation analysis was based on model 4 and bootstraps using 95% CIs (5000 bootstrap samples). Bootstrapping was used for mediation analysis because it is a non-parametric resampling technique, involving random and repeated subsampling of data, making data analysis more scientific.

W-BNS was the independent variable (X), motivation at work (M1) and job satisfaction (M2) were the mediating variables, and work engagement was the dependent variable (Y). The macro process was used to calculate and test the significance of the overall, direct and indirect effects. When the 95% CI does not include 0, the effect is considered to be statistically significant. Statistical significance was considered with a two-tailed p value < 0.05. IBM SPSS Statistics (V.25) was adopted to analyse descriptive information, and to conduct the one-way ANOVA and the correlation matrix. A parallel mediation model (model 4) of the PROCESS macro in SPSS was used for the test of study hypotheses.

RESULTS

Demographic characteristics, scores of work-related variables and one-way ANOVA results of doctors

A total of 1000 questionnaires were distributed. The research group effectively recovered 497 online and 352 offline questionnaires, respectively. The valid response rate of the questionnaire was 84.9%. Using descriptive statistics, the frequency and proportion of demographic and work-related characteristics of the sample were analysed. The demographic composition of the sample is close to the natural distribution of the group. In terms of work-related characteristics, the majority of respondents were resident (36.04%), with service years < 5 (32.16%), a monthly income (¥) between 5000 and 10000 (34.98%) and did not have first-line antiepidemic experience (57.13%). The results of the one-way ANOVA showed that age (F=4.81, p<0.001), marital status (F=12.12, p<0.001), professional title (F=7.43, p<0.001), service years (F=5.55, p<0.001) and monthly income (F=8.27, p<0.001) are the five factors that affect W-BNS. Motivation at work is affected by educational status (F=5.61, p<0.001), marital status (F=3.77, p<0.05), professional title (F=5.78, p<0.001) and monthly income (F=8.70, p<0.001). Job satisfaction is affected by professional title (F=4.16, p<0.05) and monthly income (F=3.75, p<0.001). Age (F=4.20, p<0.001), professional title (F=9.20, p<0.001), service years (F=4.41, p<0.001) and monthly income (F=4.55, p<0.001) are four factors affecting work engagement (table 2).

Correlations between work-related variables

The results show that W-BNS, motivation at work, job satisfaction and work engagement are positively correlated. W-BNS is positively correlated with motivation at work (r=0.546, p<0.01), job satisfaction (r=0.612, p<0.01) and work engagement (r=0.546, p<0.01). Motivation at work is positively correlated with job satisfaction (r=0.692, p<0.01) and work engagement (r=0.616, p<0.01). Job satisfaction is positively correlated with work engagement (r=0.690, p<0.01) (table 3).

Parallel mediation model analyses

The parallel mediation model was analysed with W-BNS as the independent variable, motivation at work and job

Table 2 Sample characteristics, scores of work-related variables and one-way ANOVA results

Characteristics	Frequency	Percentage	Scale scores (Mean±SD)			
			WBNS	MAW	JS	WE
Gender						
Male	408	48.06	75.85±11.29	56.60±12.50	10.77±2.50	36.71±11.16
Female	441	51.94	76.22±10.59	56.71±11.45	10.83±2.22	37.25±9.73
F			0.25	0.02	0.15	0.56
P			0.62	0.89	0.70	0.45
Age group						
18–25	37	4.36	74.81±10.07	55.89±11.91	11.00±2.38	36.76±10.31
26–35	432	50.88	74.59±10.76	55.77±12.67	10.69±2.40	35.87±10.41
36–45	256	30.15	77.87±11.18	57.11±11.29	10.75±2.40	37.48±10.17
46–55	104	12.25	77.33±11.02	58.74±10.85	11.10±2.12	39.63±10.60
>55	20	2.36	79.65±7.41	60.55±8.04	12.05±1.39	41.85±10.48
F			4.81	2.05	2.18	4.20
P			0.00	0.09	0.07	0.00
Educational status						
Diploma and lower	9	1.06	76.33±12.87	53.33±18.44	11.00±3.16	33.89±16.18
Bachelor's degree	155	18.26	75.98±10.73	53.63±12.87	10.55±2.44	36.17±10.50
Master's degree	393	46.29	75.35±10.89	56.66±11.78	10.69±2.38	37.27±10.53
Doctor's degree and higher	292	34.39	77.01±10.99	58.36±11.17	11.08±2.23	37.16±10.10
F			1.30	5.61	2.29	0.70
P			0.27	0.00	0.08	0.55
Marital status						
Single	177	20.85	72.53±10.73	54.52±12.92	10.50±2.52	35.81±10.43
Married	653	76.91	77.02±10.78	57.27±11.69	10.89±2.28	37.37±10.42
Divorced	19	2.24	75.37±11.22	55.63±10.11	10.68±3.04	35.21±10.65
Widowed	0	0.00				
F			12.12	3.77	1.88	1.84
P			0.00	0.02	0.15	0.16
Professional title						
Resident	306	36.04	74.03±11.02	55.46±13.00	10.77±2.47	36.30±10.33
Attending	273	32.16	76.37±10.51	55.97±11.57	10.53±2.34	35.36±10.19
Associate chief	169	19.91	77.19±11.16	57.44±11.03	10.91±2.23	38.46±10.02
Chief	101	11.90	79.35±10.27	60.84±10.25	11.48±2.13	41.07±10.87
F			7.43	5.78	4.16	9.20
P			0.00	0.00	0.01	0.00
Service years						
<5	273	32.16	73.85±10.47	56.20±12.49	10.91±2.33	36.20±10.13
5–10	231	27.21	75.78±11.15	56.06±12.69	10.50±2.57	35.60±10.67
11–15	113	13.31	77.93±10.78	56.04±10.19	10.64±2.13	37.23±9.73
16–20	101	11.90	78.14±11.30	57.95±12.69	11.07±2.23	38.36±10.30
>20	131	15.43	77.83±10.53	58.21±10.17	11.04±2.25	39.85±10.82
F			5.55	1.17	1.88	4.41
P			0.00	0.32	0.11	0.00
Monthly income (¥)						
<5000	80	9.42	71.13±11.93	52.50±14.44	10.40±2.76	35.29±11.56

Continued

**Table 2** Continued

Characteristics	Frequency	Percentage	Scale scores (Mean±SD)			
			WBNS	MAW	JS	WE
5000–10000	297	34.98	75.28±10.99	55.04±12.99	10.54±2.66	36.46±11.05
10000–15000	271	31.92	77.03±10.46	57.09±10.95	10.86±2.14	36.33±9.86
15000–20000	127	14.96	76.25±9.61	59.42±9.43	11.21±1.79	38.28±9.30
>20000	74	8.72	80.45±11.19	61.34±9.42	11.39±1.97	41.19±9.51
F			8.27	8.70	3.75	4.55
P			0.00	0.00	0.00	0.00
First-line antiepidemic experience						
Yes	364	42.87	75.60±11.15	55.99±12.79	10.69±2.58	37.19±10.49
No	485	57.13	76.38±10.75	57.16±11.28	10.88±2.17	36.85±10.41
F			1.07	2.01	1.39	0.23
P			0.30	0.16	0.24	0.63

JS, job satisfaction; MAW, motivation at work; WBNS, work-related basic need satisfaction; WE, work engagement.

satisfaction as intermediary variables and work engagement as the dependent variable. The results showed that W-BNS has a significant positive predictive effect on work engagement ($\beta=0.15$, $p<0.001$), while motivation at work and job satisfaction has a significant positive predictive effect on work engagement ($\beta=0.23$, $p<0.001$; $\beta=0.44$, $p<0.001$) (table 4).

The mediating effect of motivation at work and job satisfaction in W-BNS and work engagement was analysed. The results show that the indirect effect of work motivation on work engagement is 0.12, and its Bootstrap 95% CI does not contain 0. This indicates that the mediating effect of motivation at work between W-BNS and work engagement is significant. The indirect effect of job satisfaction on work engagement is 0.26, and its bootstrap 95% CI does not contain 0, indicating that job satisfaction has a significant mediating effect between W-BNS and work engagement. The difference of mediating effect between motivation at work and job satisfaction is -0.14 ; its Bootstrap 95% CI does not include 0, which indicates that the effect of job satisfaction is significantly greater than that of motivation at work in the association between W-BNS and work engagement (table 5 and figure 2).

Table 3 Means, SD and correlations among study variables

Variables	Mean	SD	1	2	3	4
WBNS	76.04	10.92	1			
MAW	56.66	11.96	0.546**	1		
JS	10.80	2.36	0.612**	0.692**	1	
WE	36.99	10.44	0.546**	0.616**	0.690**	1

Note: ** $p<0.01$ (two tailed).

JS, job satisfaction; MAW, motivation at work; WBNS, work-related basic need satisfaction; WE, work engagement.

DISCUSSION

Statement of principal findings

In this study, we used data from questionnaire survey to explore the factors associated with work engagement, W-BNS, work motivation and job satisfaction of doctors who served in public grade A tertiary hospitals. We also explored the mediation role of work motivation and job satisfaction between W-BNS and work engagement. All three hypotheses of this study were supported (table 6). We mainly have the following three findings. First, the work motivation and job satisfaction have significant mediating roles in the association of W-BNS with work engagement, among which job satisfaction has a stronger mediating role. Second, doctors with higher satisfaction of work-related basic needs will demonstrate higher work engagement. Third, we found professional title and monthly income are the common factors positively associated with the four research variables.

Mediation role of motivation at work and job satisfaction between W-BNS and work engagement

The mediating effect of motivation at work in the association between W-BNS and work engagement is significant. For the mediating effect of work motivation, when the work-related basic need is satisfied, doctors will have higher work motivation and thus generate more work engagement. This is consistent with the findings of Van den Broeck *et al* and Vansteenkiste *et al*, where psychological needs satisfaction was found to be essential to promote and maintain intrinsic motivation.^{16 32} Ferraro *et al*'s research further confirms that a high level of intrinsic motivation is related to a higher level of work engagement and reduced job burnout.³³ Based on the above analysis, we suggest that hospitals should master and meet the basic psychological needs of doctors, such as through investigations or interviews, in order to achieve the goal

Table 4 Mediation role of motivation at work and job satisfaction between work-related basic need satisfaction and work engagement

Predictors	Mode 1 (WE)		Mode 2 (MAW)		Mode 3 (JS)		Mode 4 (WE)	
	β	T	β	T	β	T	β	T
WBNS	0.55	18.95***	0.55	18.98***	0.61	22.54***	0.15	4.96***
MAW							0.23	6.80***
JS							0.44	12.35***
R ²	0.3		0.3		0.37		0.53	
F	359.24***		360.34***		508.06***		313.60***	

Note: ***p<0.001 (two tailed).
JS, job satisfaction; MAW, motivation at work; WBNS, work-related basic need satisfaction; WE, work engagement.

of strengthening internal motivation and promoting work engagement.

The research results show that job satisfaction has a significant mediating role in the association between W-BNS and work engagement. For the mediating effect of job satisfaction, when work-related basic psychological needs are satisfied, doctors will have higher job satisfaction, resulting in more work engagement. Previous studies have also confirmed our findings.^{24 34} In addition, compared with motivation at work, this study also finds that job satisfaction plays a stronger mediating role in the relationship between W-BNS and work engagement. Work engagement has three core features: a positive emotional state, an energetic feeling and positive job-oriented behaviour. Employees' positive emotional experience helps them invest more in their work.³⁵ According to the CAC theoretical framework mentioned above, job satisfaction is a positive emotional experience; improvement in job satisfaction is helpful for maintaining and promoting work engagement. However, regarding the China Healthcare Improvement Initiative, a national survey showed that the job satisfaction of hospital medical staff is still at a low level compared with higher patient satisfaction.^{36 37} A possible reason for this is that the mainstream thinking of Chinese hospital managers is still patient-centred, ignoring the satisfaction of medical staff. Therefore, we recommend that hospital managers pay attention to the job satisfaction of medical staff. They

should target the influencing factors of job satisfaction, formulate action plans to effectively improve doctors' job satisfaction, and then achieve the aim of promoting their work engagement.

Association between W-BNS and work engagement

This study found that doctors' W-BNS can significantly positively predict work engagement. The higher the doctors' W-BNS, the higher the doctors' work engagement. This study is consistent with the results of previous studies.^{38 39} SDT holds that when the organisational environment meets people's basic psychological needs (need for autonomy, competence and relationships), they will continue to experience personal growth and happiness.⁴⁰ Therefore, this study suggests the following: (1) Under the institutional norms of clinical diagnosis and treatment guidelines, we should minimise the interference of non-technical factors and truly give doctors the right to work independently to maintain their professional status. (2) To meet the competence need of doctors, hospitals should pay attention to continuing education, regularly carry out training, learning and communication, and continuously improve the professional level of doctors.

Table 5 Bootstrap test results of mediation effect

Category	Effect	Boot SE	Boot 95%CI		Relative effect
			LLCI	ULCI	
Total	0.38	0.03	0.33	0.43	72%
MAW	0.12	0.02	0.08	0.16	23%
JS	0.26	0.03	0.21	0.31	49%
MAW-JS	-0.14	0.04	-0.22	-0.06	

JS, job satisfaction; LLCI, lower limit CI; MAW, motivation at work; ULCI, upper limit CI; WBNS, work-related basic need satisfaction; WE, work engagement.

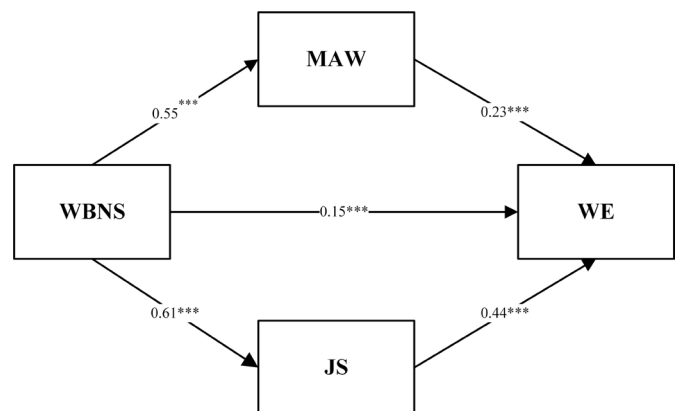


Figure 2 Final model and standardised model paths. Note: *p<0.05, **p<0.01, ***p<0.001 (two tailed). JS, job satisfaction; MAW, motivation at work; WBNS, work-related basic need satisfaction; WE, work engagement.

**Table 6** The results of hypothesis testing

Number	Contents of hypothesis	Results
Hypothesis 1	Work-related basic need satisfaction positively associates with work engagement	Supported
Hypothesis 2	The positive relationship between work-related basic need and work engagement will be mediated by motivation at work	Supported
Hypothesis 3	The positive relationship between work-related basic need satisfaction and work engagement will be mediated by job satisfaction	Supported

(3) To meet the relatedness need of doctors, administrative departments and clinical departments of the hospital should pay attention to the humanistic care of front-line clinicians. The coordination and cooperation mechanism should be strengthened between clinical departments, clinical and medical departments, front-line departments and administrative logistics departments, and a harmonious interpersonal relationship atmosphere should be established in the hospital. Since basic psychological needs satisfaction is dynamic,⁴¹ we suggest that hospitals should continue to pay attention to the basic psychological needs of doctors and carry out regular surveys and evaluations of psychological needs satisfaction. Relevant measures should be taken in a timely manner according to the survey results to continuously meet the basic psychological needs of doctors.

Influence of demographic characteristics on work-related variables

This study found that demographic and work-related characteristics affect doctors' W-BNS, motivation at work, job satisfaction and work engagement. Among them, age, marital status, professional title, service years and monthly income are the five factors that affect W-BNS. Motivation at work is affected by educational status, marital status, professional title and monthly income. Job satisfaction is affected by professional title and monthly income. This is consistent with the findings of a nationwide survey of job satisfaction among medical staff in tertiary public hospitals in China.⁴² Age, professional title, service years and monthly income are the four factors affecting work engagement. The study conducted by Yang *et al* showed that the scores of work engagement in the senior professional title group in Chinese doctors were significantly higher than those in junior and intermediate groups. This study partially supports our findings.⁴³ Professional title and monthly income are the common influencing factors of the four study variables. Doctors with more senior professional titles and higher monthly income show more W-BNS, stronger work motivation, higher job satisfaction and higher work engagement.

First of all, managers need to reasonably increase the income of doctors and provide them with better opportunities for professional development. A study has shown that Chinese doctors have a heavy workload and work more than 40 hours a week, but their salary is at a low level.⁴⁴ Most doctors are not satisfied with their income.⁴⁵ At the same time, doctors in China's public grade A tertiary hospitals face

enormous competitive pressures in terms of promotion.¹ These are possible reasons why income and professional title could have affected the research variables. A study conducted by Kim *et al* on predictors of job satisfaction highlights the importance of health managers in improving doctors' satisfaction and also confirmed that whether doctors are satisfied with their pay is a strong determinant of their job satisfaction.⁴⁶ Second, this study found that the younger the doctor, and the shorter their service years, the lower the degree of W-BNS and work engagement. Therefore, hospital managers should pay attention to the needs of young doctors. We suggest that young doctors' enthusiasm can be better mobilised in the following ways. Hospitals can arrange for senior doctors to help young doctors to improve their professional skills and job competency. Career planning guidance can be implemented to help them develop long-term career planning. Cultural activities can be organised to help them better integrate into the hospital group. Based on the assessment, young doctors can be appropriately empowered to have greater job autonomy. Third, doctors with higher levels of educational have higher scores for motivation at work. Hospitals should encourage doctors to continue to study and improve their academic qualifications. Last but not least, married doctors have higher W-BNS and stronger work motivation. This suggests that hospital managers should be concerned about the marital status of employees; they could provide guidance on love and marriage for doctors through the employee assistance programme.⁴⁷

Limitations

This study has the following limitations. (1) This study was a cross-sectional survey, so we were unable to assess causal relationships between the study variables. However, the mediation effect model proposed in this study was based on the existing solid theory and research. We consider collecting longitudinal data in future studies to confirm the findings of this study. (2) This study was only carried out in Jiangsu province, China; it may be difficult for the sample to represent the situation in China and future research could consider expanding the scope of research. (3) Control variables were not added in the analysis of the mediating effect. At the same time, there may be some other variables, such as job demands, job resources, organisational resources and organisational context, which affect the relationship between W-BNS and work engagement. Future research could consider further exploring the influence mechanism of W-BNS and work engagement in more complex models. (4) The COVID-19 pandemic may have an impact on doctors' subjective experience of practice,

and therefore may affect scale scores. (5) There may be selection bias in this study. We have adopted methods such as formulating and implementing strict inclusion and exclusion criteria; ensuring sufficient questionnaire survey time; and fully conducting informed publicity to minimise the impact of selection bias.

CONCLUSIONS

This study explored the association of W-BNS with work engagement of Chinese doctors in the context of the COVID-19 pandemic. It also explored the mediating role of motivation at work and job satisfaction. The main conclusions are as follows: (1) doctors' W-BNS can significantly predict work engagement; (2) doctors' W-BNS can affect work engagement through motivation at work and job satisfaction, respectively. This study has important value and significance: Based on CET and the theoretical framework of 'CAC', the internal mechanism of doctors' work engagement was investigated. The study is of theoretical value to fill the gaps in existing research. At the same time, this study is conducive to maintaining and promoting doctors' work from different perspectives.

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Competing interests None declared.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants. This study was approved by the academic research ethics committee of the First Affiliated Hospital with Nanjing Medical University (No.2022-SR-030). All procedures were in accordance with the ethical standards of the Helsinki Declaration. Participants gave informed consent to participate in the study before taking part.

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