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Influencing factors of work engagement among ophthalmic specialized nurses in China: a cross-sectional study

Jie Ren[1], Xin Zhang[1] and Yun-xia Gao[2*]

Abstract

Aim This study aims to investigate the current status of work engagement among ophthalmic specialized nurses in China and explore the multifaceted factors influencing work engagement from the physical, psychological, and social perspectives.

Methods This study adopts a cross-sectional survey design, distributed electronic questionnaires through WeChat software, and 261 valid questionnaires were received from ophthalmic specialized nurses. The survey includes demographic information about ophthalmic specialized nurses, as well as work engagement, sleep quality and social support. A generalized linear model was used to investigate the factors influencing the work engagement of ophthalmic specialized nurses.

Results The overall work engagement score among ophthalmic specialized nurses in our study was 143.70 ± 13.66. Multivariate analysis showed that participation in teaching, professional title, sleep quality and perceived social support were the influencing factors of work engagement of ophthalmic specialized nurses.

Discussion The results showed that ophthalmic specialized nurses with the title of "senior nurse", participating in teaching had higher work engagement. According to the Two-Factor Theory, incentive factors can stimulate the work enthusiasm of specialized nurses. The worse the sleep quality of ophthalmic specialized nurses, the lower the work engagement. It is suggested that nursing managers should pay attention to the sleep problems of specialized nurses and reduce work burnout. The nurses who perceived higher levels of social support exhibited higher work engagement. Because social support can mitigate nurses' work burnout and work-related stress.

Conclusion Ophthalmic specialized nurses in China demonstrate a relatively high level of work engagement. Those with the title of senior nurse, involvement in teaching, better sleep quality, and higher perceived social support exhibit higher work engagement.

Keywords Ophthalmic specialized nurses, Work engagement, Influencing factors

*Correspondence:
Yun-xia Gao
4640621@qq.com
[1]Department of Ophthalmology, West China Hospital/ West China School of Nursing, Sichuan University, Chengdu 610041, China
[2]Department of Ophthalmology, West China Hospital, Sichuan University, Chengdu 610041, China

Specialized nurses possess work experience in a specific field and have undergone systematic vocational training in both theoretical and practical aspects, obtaining relevant qualifications (For example, ophthalmic specialized nurse certificate, diabetes specialized nurse certificate, wound specialized nurse certificate, etc.). They can proficiently apply nursing knowledge and skills to provide specialized services to their care recipients [1]. The International Council of Nurses (ICN) explicitly emphasizes that specialized nurses play a pivotal role in enhancing patient health, improving their quality of life, reducing average hospital stays, lowering medical expenses, and enhancing the satisfaction of both patients and nurses [2]. Research has demonstrated that specialized nurses can provide support to doctors in clinical settings and during critical moments [3] (Including the provision of emergency patient care, vigilant monitoring and intervention for critically ill patients). China, as one of the countries with the most severe cases of blindness and visual impairment, requires ophthalmic specialized nurses to provide professional eye care services to its citizens [4]. The training and certification of ophthalmic specialized nurses in China commenced relatively late. In recent years, the importance of ophthalmic specialized nurses has been increasingly recognized, prompting the Chinese Nursing Association and some provincial nursing associations to initiate training and certification programs for them. The role and professional scope of ophthalmic specialized nurses in China include clinical nursing, teaching, scientific research and management [5]. The details are presented in Table 1. More and more trained and certified ophthalmic specialized nurses are making contributions in clinical settings, warranting attention to their work status.

Work engagement refers to a positive and fulfilling emotional and cognitive state related to work, characterized by vigor, dedication, and absorption [6]. It constitutes the core competitiveness of hospitals [7]. High levels of work engagement positively impact nurse job satisfaction, improve the quality of nursing care, and reduce nurse turnover [7–9]. Conversely, low levels of work engagement can lead to a significant decrease in nurse subjective well-being, professional identity, and work efficiency, seriously affecting the quality of nursing care and even patient safety and health outcomes [10, 11].

Table 1 The role and professional scope of ophthalmic specialized nurses in China

Clinical specialty nursing	Perioperative nursing
	Case nursing
	Critical care
	Ophthalmology outpatient treatment and examination
	Ophthalmic operating room nursing
Teaching	Clinical nursing teaching
	Specialist knowledge seminar
	New nursing technology promotion
Research	Research in the field of ophthalmic specialist nursing
	Academic exchange at home and abroad
	Learning and disseminating the latest research results
Management	Formulate the operation standard, work flow and quality standard of specialized nursing
	Nursing quality management

Frederick, an American behavioral scientist, proposed the Two-factor theory [12], also referred to as the motivation-hygiene factor theory. He argues that a person's behavioral motivation is influenced by two factors. One is hygiene factors, such as working conditions, personnel relations, and material welfare facilities. Failure to meet these hygiene factors can lead to dissatisfaction and even confrontational behaviors like passive sabotage or strikes. However, the improvement of these factors can only eliminate the dissatisfaction of employees, but can not make employees become very satisfied, and can not really stimulate the enthusiasm of employees. Because the satisfaction of hygiene factors does not play a more positive role in improving people's morale and stimulating people's behavioral motivation. The other factor is the motivation factors, such as job responsibility, professional development opportunities, sense of accomplishment in work, recognition from society for work achievements, and challenging nature of the work itself. Conversely, improvement and satisfaction in these motivation factors can stimulate employees' enthusiasm and passion - the genuine source of their behavior. Research conducted by Chinese scholar Shan Gao [13] indicates that under China's cultural background and economic development level, the hygiene factor in the Two-factor theory also has an incentivizing effect. In some specific cases, this effect may even surpass that of motivation factors.

According to the Two-factor theory, this study examines the impact of hygiene factors (such as sleep quality and social support) and motivation factors (such as involvement in teaching, scientific research, academic exchange) on work engagement among ophthalmic specialized nurses. This provides a foundation for developing strategies to enhance job engagement among ophthalmic specialized nurses in future steps.

Methods

Participants and methods

This study adopts a cross-sectional survey design, utilizing questionnaires created via WeChat and the Questionnaire star software. The study participants completed the questionnaire through an online link. According to the sample size estimation method of multi-factor analysis proposed by Kendall, the sample size is 5–10 times of the variables. With 22 influencing factors on the analysis

variables in this study, and considering a 20% sample loss and invalid questionnaires, a final required sample size of 132–264 was calculated. A total of 283 questionnaires were received, excluding 22 unqualified questionnaires, resulting in the inclusion of 261 questionnaires for the study, yielding a response rate of 92.23%. Inclusion criteria encompass: (1) Possession of the ophthalmic specialized nurse certificate issued by the Chinese Nursing Association or provincial nursing associations, (2) Current engagement in clinical ophthalmic nursing work, and (3) Willingness to participate voluntarily in this research. Exclusion criteria entail individuals on extended sick leave, maternity leave, or similar leaves lasting over one month. This study was approved by the Biomedical Ethics Committee of West China Hospital of Sichuan University, with ethics lot No. 2024 (554). All participants provided informed consent after they were informed about the study overview.

The ophthalmology department of West China Hospital, Sichuan University, serves as a training base for ophthalmic specialized nurses accredited by the Chinese Nursing Association and the Sichuan Nursing Association. The trained ophthalmic specialized nurses are deployed in 78 hospitals across 20 provinces nationwide. To facilitate communication, the responsible training personnel established WeChat workgroups, which all participating specialized nurses joined. Even after completing their training and obtaining their specialized nurses certificates, these WeChat groups were retained to facilitate ongoing communication on specialized topics. Before conducting the study, the questionnaires were imported into a "questionnaire star" website (https://www.wjx.cn/), and formed a survey link (https://www.wjx.cn/vm/QKtodqD.aspx). At the outset of the study, researchers shared information regarding research objectives, content, data confidentiality measures along with survey link within these WeChat groups. Ophthalmic specialized nurses were invited to voluntarily complete the surveys. If willing, members of these WeChat groups could also share survey links with other ophthalmic specialized nurses in their respective hospitals.

The research questionnaire was designed to be anonymous. When each respondent clicked on "questionnaire star" website's survey link, a blank questionnaire was generated for them to fill out privately. Once completed and submitted, only the researcher who created the questionnaire had access to its contents—ensuring confidentiality throughout the survey process.

Survey content

Questionnaire includes the introduction and survey content of two parts, with 77 items. The introduction provided information on the survey's aims, content and data usage and highlighted voluntary survey participation. The survey content includes demographic information about ophthalmic specialized nurses, as well as work engagement (Specialty Nurse Work Engagement Scale), sleep quality (Pittsburgh Sleep Quality Index), and social support (Perceived Social Support Scale).

Survey instruments

The specialty nurse work engagement scale (SNWES)

The measurement of work engagement among ophthalmic specialized nurses is conducted using the Specialty Nurse Work Engagement Scale (SNWES), developed by Qin Hui [14], utilized the Utrecht Work Engagement Scale as a framework and incorporated literature review, semi-structured interviews, and expert consultations [15]. This scale aligns with the characteristics of the Chinese specialized nursing profession and the psychological traits of specialized nurses. It comprises 32 items distributed across five dimensions: work attitude, work values, work recognition, work initiative, and work enthusiasm and focus. Responses are rated on a 5-point Likert scale (Never=1, Rarely=2, Sometimes=3, Often=4, Always=5), with higher scores indicating higher levels of work engagement. After conducting reliability and validity testing, the scale demonstrated a content validity coefficient of 0.842 and a Cronbach's α coefficient of 0.958.

Pittsburgh sleep quality index (PSQI)

The PSQI, developed by Dr. Buysse and colleagues at the University of Pittsburgh in 1989 [16], assesses the overall sleep quality of participants over the past month. It is suitable for evaluating sleep quality among individuals with sleep disorders, psychiatric conditions, and for researching the relationship between psychological factors and sleep. The PSQI measures sleep quality across seven dimensions: subjective sleep quality, sleep duration, sleep latency, sleep disturbances, sleep efficiency, hypnotic drug use, and daytime dysfunction. Each dimension is scored from 0 to 3 points, resulting in a total score ranging from 0 to 21. A higher total score indicates poorer overall sleep quality. The score ranges are as follows: 0–5 points indicate excellent sleep quality, 6–10 points indicate decent sleep quality, 11–15 points indicate fair sleep quality, and 16–21 points indicate poor sleep quality.

Chinese scholar Liu Xian-chen and colleagues [17] conducted tests on the reliability and validity of the PSQI, revealing high internal consistency and strong empirical validity. The study conducted by Liu Xian-chen revealed that when the critical point is set at 7 points (where PSQI≥7 points indicates poor sleep quality), the scale demonstrates higher sensitivity and specificity (sensitivity: 98.3%, specificity: 90.3%). Moreover, it also possesses a certain auxiliary guiding value for insomnia and

conditions related to sleep quality issues such as depression, anxiety, and neurosis.

The multidimensional scale of perceived social support (MSPSS)

To measure the perceived social support among ophthalmic specialized nurses, we employed the Multidimensional Scale of Perceived Social Support (MSPSS). This scale, adapted from the Multidimensional Scale of Perceived Social Support developed by Zimet [18], was translated into Chinese by Huang Li [19]and colleagues in 1996. It assesses the degree of support individuals perceive from various social support sources (such as family, friends, and others). The total score reflects the overall level of social support perceived by the individual, with higher scores indicating better perceived social support capabilities. The scale comprises three dimensions: family support, friend support, and other support, encompassing a total of 12 items. Responses are rated on a 7-point Likert scale, ranging from "strongly disagree" to "strongly agree," with scores assigned as 1–7 for each item. Each dimension of the scale is scored from 4 to 28 points. Total scores range from 12 to 84. A higher score indicates better perceived support. The Cronbach's α coefficient for the scale is 0.88.

Table 2 Current status of categorical variables

Variable	Frequency	Percentage (%)
Professional Title		
Director of Nurse/Deputy Director Nurse	21	8.05
Supervisor Nurse	147	56.32
Senior Nurse	93	35.63
Nurse	0	0
Level of Education		
Master's degree and above	9	3.45
Bachelor's degree	249	95.40
Below Bachelor's degree	3	1.15
Work Position		
Nursing management position	51	19.54
Head Nurse	75	28.74
Ward nurse	78	29.89
Other	57	21.84
Hospital Nature		
Public General Hospital	231	88.51
Public Specialized Hospital	6	2.30
Private General Hospital	0	0
Private Specialized Hospital	24	9.20
Hospital Grade		
Tertiary Grade A Hospital	210	80.46
Tertiary Grade B Hospital	39	14.94
Secondary Grade A Hospital	9	3.45
Secondary Grade B Hospital	3	1.15

Statistical methods

The study employed SPSS(Statistical Package for the Social Sciences) software for data analysis. For quantitative data, descriptive statistics are presented using means±standard deviations and percentages (constituent ratios) for qualitative data. In single-factor analysis, Pearson correlation coefficients are used to analyze the relationship between continuous variables and the total score of work engagement (as described in the correlation analysis section). For categorical variables, analysis of variance (ANOVA) with a completely random design is employed to assess the relationship between categorical variables and the total score of work engagement. If differences are detected, the Student-Newman-Keuls (SNK) method is applied to test for pairwise differences between groups. In cases where the assumption of homogeneity of variances is not met, a nonparametric test (Mann-Whitney U test) is used. Multiple-factor analysis is conducted using a generalized linear model, incorporating statistically significant variables identified in the single-factor analysis.

Results

Demographic characteristics of ophthalmic specialized nurses

A total of 261 valid questionnaires were collected in the survey. The average age of ophthalmic specialized nurses was 35.03±5.11 years, with an average duration of nursing practice of 13.87±5.68 years. The mean duration of holding the specialized nurse qualification was 1.58±1.05 years. On average, participants had 1.21±1.67 research outputs, attended academic exchange activities 2.00±1.04 times, engaged in various levels of teaching activities 2.16±1.25 times, and worked an average of 2.68±3.30 night shifts per month. Further baseline survey results for the study participants are detailed in Table 2.

Sleep quality among ophthalmic specialized nurses

The score of each dimension of the PSQI is scored from 0 to 3 points, resulting in a total score ranging from 0 to 21. The scores for various dimensions and the total score of the PSQI are described using means±standard deviations. Additionally, the distribution of different levels of sleep quality is presented as frequencies (constituent ratios). The results are summarized in Table 3.

Current status of perceived social support among ophthalmic specialized nurses

Each dimension of the MSPSS scale is scored from 4 to 28 points. A higher score indicates better perceived support. The scores for various dimensions and the total score of perceived social support are described using

Table 3 PSQI scores for different dimensions and overall sleep quality

Characteristics	Index[#]
Sleep Quality	1.07 ± 0.79
Sleep Latency	1.39 ± 0.86
Sleep Duration	1.32 ± 0.75
Sleep Efficiency	0.22 ± 0.58
Sleep Disturbances	1.17 ± 0.38
Hypnotic Medication	0.34 ± 0.77
Daytime Dysfunction	1.51 ± 0.91
PSQI Total Score	**7.02 ± 3.21**
Evaluation Level*	
Excellent Sleep	87(33.33)
Decent Sleep	138(52.87)
Fair Sleep	33(12.64)
Poor Sleep	3(1.15)

*Evaluation Level: PSQI total score 1–5 indicates excellent sleep; PSQI total score 6–10 indicates decent sleep; PSQI total score 11–15 indicates fair sleep; PSQI total score 16–21 indicates poor sleep

[#]Continuous variables are presented as means ± standard deviations, while categorical variables are presented as frequencies (constituent ratios)

Table 4 Scores for various dimensions and total perceived social support

Characteristics	Mean ± Standard Deviation
Family Support	23.93 ± 3.26
Friend Support	23.39 ± 3.69
Other Support	22.93 ± 3.91
Total Support Score	**70.25 ± 10.13**

Table 5 Scores for various dimensions and Total Work Engagement

Characteristics	Mean ± Standard Deviation
Work Attitude	36.91 ± 3.75
Work Values	27.64 ± 3.93
Work Recognition	17.63 ± 2.45
Work Initiative	40.47 ± 4.57
Work Enthusiasm and Focus	21.05 ± 3.00
Total Work Engagement Score	**143.70 ± 13.66**

means ± standard deviations. The results are presented in Table 4.

Current status of work engagement among ophthalmic specialized nurses

The scores for various dimensions and the total score of work engagement among ophthalmic specialized nurses are described using means ± standard deviations. The results are presented in Table 5.

Univariate analysis of continuous variables and work engagement total score among ophthalmic specialized nurses

The results are presented in Table 6. The following continuous variables were found to be related to the total work engagement score: participation in teaching, sleep quality, sleep latency, sleep duration, sleep disturbances, daytime dysfunction, PSQI total score, family support, friend support, other support, and total support score.

Table 6 Univariate analysis of continuous variables and total work engagement score

Variable	Pearson Correlation Coefficient	*P*-value
Age	0.04	0.56
Years in Nursing	0.11	0.08
Years with Specialized Nurse Qualification	0.11	0.07
Research Output	0.11	0.08
Academic Exchanges	0.11	0.08
Participation in Teaching	**0.27****	0.00
Night Shifts (per month)	0.04	0.50
Sleep Quality	**−0.38****	0.00
Sleep Latency	**−0.27****	0.00
Sleep Duration	**−0.28****	0.00
Sleep Efficiency	−0.08	0.20
Sleep Disturbances	**−0.29****	0.00
Hypnotic Medication	−0.01	0.82
Daytime Dysfunction	**−0.46****	0.00
PSQI Total Score	**−0.41****	0.00
Family Support	**0.43****	0.00
Friend Support	**0.35****	0.00
Other Support	**0.42****	0.00
Total Support Score	**0.43****	0.00

*$P < 0.05$;**$P < 0.01$

Univariate analysis of categorical variables and work engagement total score among ophthalmic specialized nurses

The results are shown in Table 7, indicating that there are statistically significant differences in work engagement scores among different job titles, educational levels, and hospital grades. However, no significant differences were found in pairwise comparisons. There is also a statistically significant difference in work engagement scores among different sleep quality levels, with fair sleep quality showing significant differences compared to the other three sleep quality types.

Multivariate analysis in the work involvement of ophthalmic specialist nurses

A multivariate analysis was conducted by incorporating statistically significant variables from the univariate analysis into a generalized linear model. The basic information, including participation in teaching and professional title, was included. Sleep scores were categorized into different models based on seven dimensions, total scores, and rating levels. Similarly, support scores were grouped into different models based on three dimensions and total scores. The results are presented in Table 8. (Due to the small sample sizes in some categories of level of education and hospital grades, their analysis results

Table 7 Work Engagement scores and comparisons for different categorical variables

Variable	Work Engagement Score Mean ± Standard Deviation	Test Statistic	*P*-value
Title			
Director of Nurse/Deputy Director Nurse	146.29 ± 13.15*	F = 4.71	**0.01**
Supervisor Nurse	141.45 ± 14.48*		
Senior Nurse	146.68 ± 11.78*		
Level of Education			
Bachelor's Degree	153.33 ± 10.00*	H = 6.82#	**0.03**
Below Bachelor's Degree	143.30 ± 13.74*		
Master's Degree and Above	148.00 ± 0.00*		
Work Position		F = 1.66	0.18
Nursing management position	147.18 ± 12.00		
Head nurse	142.20 ± 12.94		
Ward nurse	142.46 ± 15.06		
Other	144.26 ± 13.66		
Hospital Nature		F = 0.62	0.54
Public General Hospital	143.95 ± 13.87		
Public Specialized Hospital	138.00 ± 14.24		
Private Specialized Hospital	142.75 ± 11.52		
Hospital Grade		H = 9.77#	**0.02**
Tertiary Grade A Hospital	144.63 ± 13.92*		
Tertiary Grade B Hospital	139.69 ± 13.54*		
Secondary Grade A Hospital	139.00 ± 3.00*		
Secondary Grade B Hospital	145.00 ± 0.00*		
Sleep Quality Level		F = 14.43	**0.00**
Excellent Sleep	148.69 ± 11.61*		
Decent Sleep	143.39 ± 12.85*		
Fair Sleep	131.64 ± 15.14&		
Poor Sleep	146.00 ± 0.00*		

*& symbol indicates that there are significant differences in pairwise comparisons ($P<0.05$), while the # symbol signifies that the variable did not meet the homogeneity of variance assumption and, therefore, the Kruskal-Wallis H rank sum test was employed

Table 8 Multiple Linear regression analysis of Work Engagement scores for Specialized nurses ($n=261$)

Variables	Model One		Model Two	
	β(95%CI)	*P*	β(95%CI)	*P*
Intercept	95.40(83.87, 106.93)	**0.00**	117.89(106.79, 128.98)	**0.00**
Participation in Teaching	2.22(1.04, 3.41)	**0.00**	2.48(1.34, 3.62)	**0.00**
Title (with Senior Nurse as reference)				
Director of Nurse/Deputy Director Nurse	-3.91(-9.39, 1.58)	0.16	-3.79 (-9.25,1.67)	0.17
Supervisor Nurse	-3.31(-6.42, -0.20)	**0.04**	-3.96(-6.96, -0.96)	**0.01**
Sleep Quality	-	-	-	-
Sleep Latency	-	-	-	-
Sleep Duration	-	-	-	-
Sleep Efficiency	-	-	-	-
Sleep Disturbances	-	-	-	-
Hypnotic Medication	-	-	-	-
Daytime Dysfunction	-	-	-	-
PSQI Total Score	-	-	-1.25(-1.69, -0.81)	**0.00**
PSQI Score Level (with Fair Sleep as reference)				
Excellent Sleep	12.29(7.54, 17.03)	**0.00**	-	-
Decent Sleep	9.87(5.41, 14.34)	**0.00**	-	-
Poor Sleep	9.88(-4.11, 23.86)	0.17	-	-
Family Support	0.93(0.18, 1.68)	**0.02**	-	-
Friend Support	-0.39(-1.22, 0.44)	0.36	-	-
Other Support	1.01(0.32, 1.69)	**0.00**	-	-
Total Support Score	-	-	0.45(0.31, 0.59)	**0.00**

Model One: Participation in Teaching, Title, PSQI Score Level, Support Scores across three dimensions ($F=15.278$, $P<0.001$, $R=0.595$)

Model Two: Participation in Teaching, Title, PSQI Total Score, Support Total Score ($F=27.213$, $P<0.001$, $R=0.590$)

may be biased; hence, the level of education and hospital grades were excluded from the analysis.) In the multivariate analysis, the average work engagement of ophthalmic specialist nurses who participated in teaching were 2.22 points(Model One)or 2.48 points (Model Two) higher than those who did not participate in teaching. Supervisor nurse reported an average of 3.31 points (Model One) or 3.96 points (Model Two) lower work engagement than senior nurse. For every 1 point increase in PSQI total score, the work engagement of ophthalmic specialist nurses decreased by 1.25 points on average. Compared with fair sleep, the work engagement of nurses with excellent sleep was 12.29 points higher on average, and that of nurses with decent sleep was 9.87 points higher on average. When the total score of perceived social support increased by 1 point, the ophthalmic specialist nurses ' work engagement increased by 0.45 points on average. For every 1-point increase in family support, nurses' work engagement increased by an average of 0.93 points, and for every 1-point increase in other support, nurses' work engagement increased by an average of 1.01 points.

Discussion

Impact of demographic factors on work engagement of ophthalmic specialist nurses

In recent years, the training and certification of ophthalmic specialist nurses in China have gained prominence.

Large tertiary comprehensive hospitals have shown increased emphasis on nurturing specialized nursing talents. Our study surveyed 261 ophthalmic specialist nurses nationwide, with over 80% of them originating from top-tier tertiary hospitals. Due to the prerequisites for specialized nursing, nearly 98.85% of these nurses hold at least a bachelor's degree, and 64.37% possess the title of supervisor nurse or higher. Their average nursing experience spans 13.87±5.68 years. Hospitals select exceptional nurses for specialized training, and this score surpasses previous findings that a majority of these nurses have engaged in research activities, participated in various academic exchanges, and contributed to nursing education. The training of specialized nurses in China is in the stage of exploration and development, and the number of specialized nurses is relatively small. Registered nurses who want to be specialized nurses need several years of working experience and completion of the specialized nurse training courses [20]. Specialized nurse training requires 3–5 months of full-time study, and the training costs are usually borne by the hospital. Due to human and economic reasons, each hospital can only select a small number of nurses to participate in full-time study each year. Therefore, the hospital will select exceptional nurses to participate in specialized nurse training first. These exceptional nurses include those who have performed well in specialized clinical work, those who have undertaken clinical teaching, and those who have a higher level of education (such as master's degree) and have undertaken nursing research and academic exchange. And performing specialized clinical nursing, teaching, research, and management are all expected of specialized nurses, and related content is also included in the curriculum of specialized nurse training. Compared to general nurses in China, specialized nurses focus on specific areas with more in-depth professional knowledge and skills, and mainly play a role in teaching, management, scientific research, discussion of challenging medical cases, outpatient clinics, consultations, and so on [21]. The overall work engagement score among the nurses in our study was 143.70±13.66. This score surpasses findings from prior research by Qin Hui [22], who investigated work engagement among specialist nurses in Jiangsu Province, and Liang Ruichen [23], who examined specialist nurses in operating rooms in Sichuan Province. These results indicate that ophthalmic specialist nurses in China exhibit a relatively high level of work engagement. It serves as an affirmation of China's efforts in the training of ophthalmic specialist nurses.

In our multivariate analysis, it was observed that higher work engagement was demonstrated by ophthalmic specialist nurses with the professional title of " senior nurse" (as opposed to " supervisor nurse " or other higher titles). This contrasts with the findings of Liang Ruichen [23], whose study focused on specialist nurses in Sichuan Province operating rooms. The disparity can be attributed to the fact that Liang Ruichen's research included registered nurses working in operating rooms, whereas our study focused specifically on ophthalmic specialist nurses who had undergone hospital selection, specialized training, and certification to become ophthalmic specialist nurses. A high level of expertise is demanded in ophthalmic nursing, and the selection process for nurse specialists indicates that those with the title of " senior nurse " have excelled in clinical practice, displaying high levels of motivation. In China, the professional title of nurses is divided into five levels. To obtain a nurse's license is to be a nurse. After obtaining the title of nurse, with a certain educational and work experience requirements, they can pass the exam to obtain the senior nurse. After obtaining the title of senior nurse, with certain educational and work experience requirements, they can pass the exam to obtain the qualification of supervisor nurse. In order to obtain the qualification of director of nurse or deputy director nurse, in addition to the work experience and passing the exam, there is also a need to have certain scientific research achievements. Therefore, senior nurse is a relatively preliminary stage in the career of nurses, they often hope to be promoted, thereby leading to higher work engagement [24]. Additionally, this score indicates that higher work engagement was observed in ophthalmic specialist nurses who were actively engaged in teaching. Hospitals require teaching faculty not only to possess solid subject knowledge but also to have effective communication and coordination skills [25]. The involvement in teaching motivates nurses to enhance their understanding of educational theories and methods, ultimately improving their teaching abilities [26]. Participation in teaching also serves as an effective means to enhance the quality of nursing care and technical competence [27]. According to the Two-Factor Theory [28], the engagement of specialist nurses in teaching not only signifies organizational recognition of their capabilities but also ignites their work enthusiasm, increasing their proactivity and commitment to their responsibilities, thus fostering higher work engagement. This is also in line with Maslow's Hierarchy of Needs theory. Organizational recognition of nurses' ability to work is a Self-actualization needs and the highest level of the hierarchy of needs.

Impact of sleep quality on work engagement of ophthalmic specialist nurses

Our investigation revealed that the PSQI total score for ophthalmic specialist nurses was 7.02±3.21 points. PSQI≥7 indicates poor sleep quality [15], indicating that overall sleep quality among them is suboptimal. Nurses working night shift must function counter to circadian

rhythms and be awake at night when they are physiologically primed for sleep. This conflict, known as circadian misalignment, can lead to health impairments and performance issues associated with night shift work [29]. Circadian misalignment can seriously affect sleep quality. For example, the hormone melatonin, which is enhanced by darkness and inhibited by light, plays an essential role in rhythms of sleep and alertness and other biobehavioral processes (e.g., hormone secretion, metabolism). Melatonin secretion begins shortly after sunset, peaks in the middle of the night, and then gradually decreases with daylight in adult. Circadian misalignment affects melatonin secretion [30]. In our study, ophthalmic specialist nurses reported an average of 2.68±3.30 night shifts per month, which may contribute to their poor sleep quality. Nursing managers should prioritize addressing the sleep quality concerns of ophthalmic specialist nurses and implement effective interventions to enhance their sleep quality, for example advocate for policies such as staffing, scheduling, and work breaks. A holistic approach to improving sleep health should include supporting healthy nutrition, healthy weight and adequate physical activity [31]. In China, most ophthalmic surgeries require hospitalization. Although an increasing number of ophthalmic surgeries are carried out on a model of day surgery. Day surgery in China requires patients to stay in the hospital for 24 h, so ophthalmic nurses also have night shifts. It is gratifying that in recent years, some hospitals have carried out ophthalmic surgery in the mode of same-day surgery, that is, patients complete the whole process of admission, operation and discharge within one day, and do not stay overnight in the hospital. This model not only improves the efficiency of the use of medical resources but also saves medical manpower, which will be the development direction of ophthalmic surgery in the future.

Our multivariate analysis revealed that ophthalmic specialist nurses with higher PSQI total scores exhibited lower work engagement. Significant differences in work engagement were observed among ophthalmic specialist nurses across different sleep quality levels, indicating a marked decrease in work engagement with each decline in sleep quality level. Nursing is a profession that demands both mental and physical exertion. Reduced sleep quality can lead to fatigue and professional burnout among nurses [32], resulting in decreased work efficiency [33], feelings of inadequacy, and reduced work engagement. The findings of several studies indicate a negative correlation between work engagement and work burnout [34, 35]. Therefore, hospitals and nursing managers should address sleep quality issues among nurses to reduce fatigue and professional burnout, ultimately enhancing the work engagement of specialist nurses. Tomasz [36] and others have suggested that hospitals should improve their management mechanisms, implement flexible scheduling based on individual needs, and enhance nurses' fatigue management and sleep quality.

Impact of social support on work engagement of ophthalmic specialist nurses

In our study, the perceived total score for social support among ophthalmic specialist nurses was 70.25±10.13, which is higher than the results of Ren Zheng [37] in a survey of nurses from top-tier hospitals (67.74±10.49). This suggests that ophthalmic specialist nurses in China have a relatively high level of perceived social support.

Multivariate analysis revealed that ophthalmic specialist nurses with higher scores on the Multidimensional Scale of Perceived Social Support (MSPSS), particularly in the dimensions of family support and other support, exhibited higher work engagement. Social support involves building interdependencies through social interactions with others or groups, which not only influences an individual's perception and evaluation of stressful events but also affects their ability to adapt and cope with stress [38]. Nursing is characterized by irregular working hours, heavy daily workloads, and the requirement for nurses to maintain focus and precision, leading to significant work stress. Previous research has indicated that social support can mitigate nurses' professional burnout and work-related stress[39]. Furthermore, there is a negative correlation between professional burnout, work-related stress, and work engagement among nurses [34]. In our study, nurses who perceived higher levels of family support exhibited higher work engagement. Strong family support can enhance nurses' subjective well-being [37], effectively reducing work stress and increasing work engagement. The mean age of ophthalmic specialized nurses was 35.03±5.11 years, and we speculate that many individuals in this age group are likely to be taking care of children or elderly parents in society. Therefore, the social support they receive can help alleviate caregiving burdens and consequently enhance their work engagement. The survey indicates that nurses who perceived higher levels of other support exhibited higher work engagement. Research by Zhou Xi [40] and others suggests that support received by nurses from within the organization can influence their professional identity and subsequently impact their level of work engagement. Therefore, nursing managers should pay attention to the perceived social support among specialist nurses, encourage them to seek support and give them plenty of recognition and encouragement in their work. This will enable specialist nurses to receive help and recognition from others, enhance their sense of belonging, stimulate their work enthusiasm, and consequently boost their work engagement.

Conclusion

Ophthalmic specialist nurses in China demonstrate a relatively high level of work engagement. Those with the title of senior nurse, involvement in teaching, better sleep quality, and higher perceived social support exhibit higher work engagement. This underscores the importance for managers to implement practical measures to improve the sleep quality of ophthalmic specialist nurses and enhance their perceived social support, ultimately leading to increased work engagement.

Limitations

Our study had several limitations. First, it was a cross-sectional design and was inherently limited in its inability to confirm the cause-and-effect relationship between individual variable and work engagement of ophthalmic specialized nurses. Longitudinal studies are required to further clarify these relationships. Second, influencing factors were self-reported by volunteers, which might have induced recall bias. Nevertheless, this can be considered as an inherent limitation of any survey-based study. Moreover, the sample size included in this study was small because of the short history of ophthalmic specialized nurses training in China.

All the abbreviations in the article show in Table 9.

Table 9 A list of abbreviations

ICN	International Council of Nurses
SNWES	The Specialty Nurse Work Engagement Scale
PSQI	Pittsburgh Sleep Quality Index
MSPSS	The Multidimensional Scale of Perceived Social Support
SPSS	Statistical Package for the Social Sciences

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Author contributions
Jie Ren wrote the main manuscript text, Xin Zhang collated the data and Yun-Xia Gao did the statistical analysis. All authors reviewed the manuscript.

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Data availability
The data sets are available with the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was approved by the Biomedical Ethics Committee of West China Hospital of Sichuan University, with ethics lot No. 2024 (554). All participants provided informed consent after they were informed about the study overview.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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