



Research article

A cross-sectional study of the relationship between premenstrual syndrome and missed nursing care among female nursing staff

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ABSTRACT

Purpose: Premenstrual syndrome (PMS) is a cyclical psychosomatic disorder prevalent among women of reproductive age. However, research on the potential impact of PMS on routine nursing schedules and activities is limited. This study aims to identify the prevalence of PMS among female nursing staff and to examine the relationship between PMS and missed nursing care (MNC). **Method:** Between November 1, 2022, and April 30, 2023, this study was conducted among female nursing staff working in nine inpatient departments at Sun Yat-sen University Cancer Center. This study used a cross-sectional design. The participants were recruited through convenience sampling. Data were collected using the standardized Menstrual Distress Questionnaire, the Oncology Missed Nursing Care self-rating scale, and a sociodemographic questionnaire. One-way analysis of variance, Fisher's least significant difference test for post-hoc comparisons, and Spearman's correlation coefficient were utilized for data analysis. A trend test was also performed to explore patterns in the severity of PMS and MNC over time.

Results: We collected a total of 224 questionnaires, with 154 (68.7%) female nursing staff reporting PMS. The most common symptoms were low back pain (91.1%), abdominal discomfort (90.6%), cold hands and feet (87.1%), and lethargy (87.1%). Moreover, 91.5% of the 224 female nursing staff reported at least one MNC activity. The nursing activities most frequently missed or left incomplete were liquid intake and output monitoring as ordered (43.3%), medication administration within 30 min before or after the scheduled time (43.3%), and electrocardiogram monitoring as ordered (42.9%). "Abdominal discomfort" from the Menstrual Distress Questionnaire was significantly correlated with the majority of MNC activities ($p < 0.001$).

Conclusions: This study provides evidence for a strong association between PMS and MNC among female nursing staff, suggesting that administrators should take the premenstrual conditions of female nursing staff into consideration. It is necessary to provide appropriate understanding and support to mitigate the impact on patient care and safety.

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1. Introduction

Premenstrual syndrome (PMS) is a condition that affects some women of childbearing age. It comprises somatic and emotional symptoms that are unrelated to any organic disease, occurring during the late luteal phase of the menstrual cycle (5–7 days before menstruation) and the early follicular phase (2–4 days after the onset of bleeding). These symptoms include pain, decreased concentration, autonomic reactions, water retention, and negative affect [1,2]. Epidemiological data indicates that PMS is a prevalent issue that affects women's health globally. Approximately 80% of women experience varying degrees of physical and emotional symptoms during the premenstrual phase, and about 20%–31% experience moderate to severe symptoms [3,4].

Studies have indicated that stress is a significant predisposing factor in the development of PMS. It is widely acknowledged that nurses frequently experience high levels of occupational stress [5]. Notably, nurses are predominantly female, especially in Asian countries. Consequently, emotions, attitudes, and behaviours related to pre-menstruation are more likely to affect this predominantly female group. A study conducted in Japan revealed that premenstrual tension was the most common PMS symptom reported by female nursing staff, with 47% experiencing it occasionally and another 42% constantly. This was followed by breast tenderness (49.2%) and stomach pain (47.3%). In another study involving 335 female nursing staff in China, 47% presented with PMS. The most commonly reported symptoms were fatigue (24.30%), lethargy (21.18%), anger (21.18%), and emotional instability (19%) [6–8].

Nurses play an essential role in healthcare teams. Over the past two decades, patient safety has been the primary goal of service delivery in the modern National Health Service [9]. As a global health challenge, patient safety remains a central concern in healthcare, however, the complexity of these systems presents a significant hurdle in ensuring safety. The quality of nursing care is integral to ensuring patient safety. Improvements in living standards and an increased focus on healthcare have resulted in demands for higher patient safety standards and enhanced quality of nursing care [10].

However, patient safety and quality of nursing care can be compromised by missed nursing care (MNC). A substantial body of research suggests that MNC is closely related to patient safety and nursing care quality [11]. The concept of MNC, also known as 'nursing care left undone', 'nursing defects', 'rationing of nursing', 'unfinished nursing care', and 'unmet nursing care needs', refers to the delay, partial completion, or non-completion of nursing services [12]. Internationally, MNC is prevalent among nursing staff in acute care hospitals, with incidence rates ranging from 55% to 98% [13]. A concept analysis study by Kalish et al. identified various contributing factors, including decision-making processes, beliefs, and habits [14].

Interestingly, a study by Ansong et al. found that women tend to exhibit behaviour changes such as reduced productivity, inattention, and aberrant behaviour 7–14 days before menstruation, which can lead to increased decision-making errors and work-related mistakes [15]. The burden of PMS can reduce workplace productivity and lead to higher absenteeism rates [16].

PMS and its associated symptoms pose a global health challenge for female nursing staff [7]. In recent years, growing evidence has suggested that PMS, which is potentially influenced by nurses' self-perceived occupational stress, may impact decision-making processes and nursing practices [17,18]. Despite this growing evidence, a significant gap remains. Specifically, there is a lack of direct studies examining how PMS disrupts routine nursing schedules and activities and its direct correlation with MNC. Consequently, the existing literature fails to provide definitive evidence on the direct relationship between PMS and MNC, underscoring the necessity for further investigation in this particular area. Accordingly, this study aims to identify the prevalence of PMS among female nursing staff and to examine the relationship between PMS and MNC. Examining this relationship will inform evidence-based interventions aimed at supporting nurses in managing challenges related to PMS and optimising the delivery of patient care.

2. Materials and methods

2.1. Objectives

This study aims to identify the prevalence of PMS among female nursing staff and to examine the relationship between PMS and MNC.

2.2. Study design and setting

This study used a cross-sectional study design. The study was conducted among female nursing staff working in nine inpatient departments at Sun Yat-sen University Cancer Center. Ethical approval was obtained from the Institutional Review Board of Sun Yat-sen University Cancer Center (G2021-068-01).

2.3. Participants

Participants were recruited through convenience sampling. The inclusion criteria were individuals who: 1) were aged over 18 years old; 2) possessed at least one year of relevant work experience; 3) served as frontline female nursing staff, including registered nurses and certified nursing assistants; 4) voluntarily participated in this study. Exclusion criteria encompassed non-clinical nursing personnel, such as head nurses or nurse managers. Study information was provided on the questionnaire website and participants volunteered to take part in this study.

2.4. Data collection

The study was conducted from November 1, 2022, to April 30, 2023. Data were gathered using a three-part questionnaire comprising [1]: Sociodemographic details [2]; The Menstrual Distress Questionnaire (MDQ) – a standardized tool used to assess PMS symptoms during the premenstrual cycle [3]; The Oncology Missed Nursing Care self-rating Scale – a validated survey designed to measure MNC and assess patient care quality among nursing staff caring for cancer patients. Complete versions of both the original Chinese and translated English versions of each questionnaire are included in the supplementary material.

2.5. Sociodemographic questionnaire

The sociodemographic questionnaire collected data on participants' age, height, weight, education, marital status, years of working, the number of night shifts worked per month, history of alcohol consumption, medical history, and menstrual issues including the use of medicine for dysmenorrhea or menstrual disorders. This questionnaire was developed in alignment with this study's objectives and was validated using the content-validity method by the faculty members of the nursing school at Sun Yat-sen University.

2.6. The menstrual distress questionnaire

The MDQ, developed by, was adapted for this study into a Chinese version translated and validated by Liu et al. [19]. The Chinese MDQ is a 30-item questionnaire assessing PMS, encompassing five pain scales, two decreased concentration scales, seven autonomic reaction scales, two water retention scales, eight behaviour change scales, and six negative affect scales. The items are rated on a 5-point Likert scale (1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Frequently, 5 = Always), measuring the frequency of PMS symptoms impacting daily activities. MDQ scores range from 30 to 150, with higher scores indicating more severe premenstrual physical and psychological symptoms. The severity of PMS was categorized as normal (0–60), mild (61–90), moderate (91–120), moderate to severe (121–140), and severe (141–150). The Cronbach's α coefficient of the total scale was 0.937 ($P < 0.001$), and the Cronbach's α coefficient of each item ranged from 0.652 to 0.862.

2.7. The Oncology Missed Nursing Care self-rating scale

Drawing from the MNC model, Zhang et al. developed the Chinese version of the Oncology MNC self-rating Scale [20]. This scale, used to measure MNC and assess the quality of nursing care, comprises four dimensions with 33 items, including nursing evaluation (6 items), nursing plan (6 items), basic nursing (8 items), and nursing intervention (13 items). Each item is scored on a 5-point Likert scale (total score range of 33–165), where "1" = Never, "2" = Rarely, "3" = Occasionally, "4" = Frequently, and "5" = Always. The content validity index was 0.786, the test-retest reliability was 0.833, the Cronbach's α coefficient of the total scale was 0.948, and the Cronbach's α coefficient for each item ranged from 0.796 to 0.961. Higher scores on the scale denote a higher degree of MNC.

2.8. Survey method

The participants were recruited utilizing the Questionnaire Star platform (Changsha Ranxing Information Technology Co., Ltd., Changsha, P.R.C.) through an online survey methodology employed during the formal investigation. Distribution and collection of questionnaires were facilitated via this platform. QR codes containing a concise overview of the study (comprising background, significance, and methodology) were printed and disseminated across various departments and posted on hospital bulletin boards. Nurses who chose to participate voluntarily scanned the QR code using WeChat to access the questionnaire login page and provided anonymous responses with no time constraints. Each account was restricted to the submission of a single questionnaire. Furthermore, the Questionnaire Star platform was programmed to prevent the submission of uniform responses, thereby ensuring thorough completion by participants before submission.

2.9. Sample size

The most important indicator in this study is the correlation coefficient between The Oncology MNC self-rating scale and the Menstrual Distress Questionnaire. The sample size was estimated using G*Power version 3.1 software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). The expected correlation coefficient r is at least 0.2, with a type I error (alpha) of 0.05 and a power of 0.80, a two-tailed test. The calculation results indicated that a minimum of 193 participants were required.

2.10. Statistical analysis

IBM SPSS Statistics 26.0 (IBM SPSS Statistics for Windows, IBM Corp., Armonk, NY, United States) was used for statistical analysis. Continuous variables are expressed as mean \pm standard deviation (SDs), and categorical variables as a number (percentage). One-way analysis of variance (ANOVA) and Fisher's least significant difference test post-hoc comparison were used to investigate differences among groups. Descriptive statistics were used to analyse sociodemographic variables. Spearman's correlation coefficient was employed to assess the relationship between PMS and MNC. Additionally, a trend test was performed to investigate whether the

severity of PMS and incidences of MNC demonstrated a discernible pattern over time. Statistical significance was defined as $p < 0.05$.

3. Results

A total of 224 complete and valid questionnaires were collected, with no incomplete or invalid questionnaires. As shown in Table 1, the participants' ages ranged from 21 to 56 years (mean = 34.00, SD = 6.05). Their heights varied between 150.00 and 176.00 cm (mean = 160.10, SD = 4.72), and their weights were between 40.00 and 89.00 kg (mean = 55.24, SD = 7.35). Regarding the educational levels of the female nursing staff, 90.2% had an undergraduate degree, 4.9% held a master's degree or higher, and 4.9% had an associate degree or less. In terms of marital status and childbearing, 18.7% of the participants were unmarried without sexual experience, 7.6% were unmarried with sexual experience, 9.4% were married and nulliparous, and the remaining 64.3% were married with children. Approximately half (50.9%) of the female nursing staff had over 10 years of professional experience, and the majority (86.1%) were scheduled for night shifts fewer than four times per month. Health histories showed that 35.2% of participants had a history of benign breast disease, 9.4% were diagnosed with thyroid dysfunction, 28.6% had irregular menstruation, and 67.8% had other medical histories in the last decade. Most participants reported no history of alcohol use or medication use for dysmenorrhea or menstrual disorders.

Table 2 presents the total scores for nurses' PMS as determined by the MDQ. The mean score was 68.74 (SD = 19.09), with a range of 30.00–128.00 out of 150. PMS was present in 154 out of 224 female nursing staff, indicating a prevalence of 68.7%. Within this group, 130 individuals (58.0%) had mild PMS, 22 (9.8%) had moderate PMS, and two (0.9%) exhibited moderate-to-severe PMS. The distribution of each PMS symptom is presented in Table 3. Of the 30 symptoms, the most commonly reported were low back pain (91.1%), abdominal discomfort (90.6%), cold hands and feet (87.1%), and lethargy (87.1%).

Table 4 demonstrates that 96.0% of the 224 female nursing staff reported at least one MNC activity. The nursing activities most often reported as always missed or incomplete included monitoring of liquid intake and output as ordered (43.3%), medication administration within 30 min before or after the scheduled time (43.3%), and electrocardiogram monitoring as ordered (42.9%). The nursing activities most frequently missed encompassed assisting patients with rehabilitation exercises (22.3%), patient bathing/skincare (21.0%), and rehabilitation or exercise planning as required (20.5%). In contrast, the activities least commonly missed were monitoring liquid intake and output as ordered (8.9%), electrocardiogram monitoring as ordered (9.4%), drainage tube care maintenance (9.8%), and bedside glucose monitoring as ordered (9.8%), according to hospital policy.

Spearman's correlation coefficient was used to investigate the relationship between the total score or each scale score of the MDQ and the total score or each scale score of the Oncology MNC self-rating Scale (please refer to Supplementary Table 1 for more details).

Table 1

Nurses' sociodemographic characteristics (n = 224), in November 2022–April 2023 in China.

Variable	Mean, SD, (min-max)	Number (%)
Age (yrs)	34.00, 6.05, (21.00–56.00)	
Height (cm)	160.10, 4.72, (150.00–176.00)	
Weight (kg)	55.24, 7.35, (40.00–89.00)	
Education		
Junior college or less		11 (4.9%)
Undergraduate		202 (90.2%)
Master or above		11 (4.9%)
Marital status		
Unmarried and not sexually active		42 (18.7%)
Unmarried and sexually active		17 (7.6%)
Married and childless		21 (9.4%)
Married and childbearing		144 (64.3%)
Working experience (yrs)		
1-5		35 (15.6%)
5-10		75 (33.5%)
>10		114 (50.9%)
Number of night shifts per month		
≤4		193 (86.1%)
5-9		23 (10.3%)
≥10		8 (3.6%)
History of alcohol consumption		
No		213 (95.1%)
Yes		11 (4.9%)
History of disease		
Benign breast disease		79 (35.2%)
Thyroid dysfunction		21 (9.4%)
Irregular menstruation		64 (28.6%)
Other		152 (67.8%)
The use of medicine for dysmenorrhea or menstrual disorders		
No		136 (60.7%)
Yes		88 (39.3%)

Note: SD = standard deviation; min = minimal; Max = Maximum; yrs = years; cm = centimetre; kg = kilogram.

Table 2

The total score of nurses' premenstrual syndrome based on the menstrual distress questionnaire, in November 2022–April 2023 in China.

Premenstrual syndrome	Mean, SD, (min-max)	Severity (n = 224) [n (%)]				
		Normal	Mild	Moderate	Moderate to severe	Severe
Total score ^a	68.74, 19.09, (30.00–128.00)	70 (31.3%)	130 (58.0%)	22 (9.8%)	2 (0.9%)	0(0)
Total score ^b	78.92, 12.38, (61.00–128.00)	–	130 (84.4%)	22 (14.3%)	2 (1.3%)	0 (0)

Note: SD = standard deviation; min = minimal; Max = Maximum.

Total score.

^a The calculation includes all 224 participants; Total score.^b The calculation includes 154 participants who suffered from premenstrual syndrome (severe level from mild to severe).**Table 3**

Nurses' premenstrual syndrome based on the menstrual distress questionnaire, in November 2022–April 2023 in China.

Item	Mean, SD	Nurses' premenstrual syndrome (n = 224) [n (%)]				
		Never	Rarely	Occasionally	Frequently	Always
Pain scales						
"Abdominal discomfort"	2.71, 0.90	21 (9.4%)	64 (28.6%)	104 (46.4%)	29 (12.9%)	6 (2.7%)
"Low back pain"	2.83, 0.90	20 (8.9%)	47 (21.0%)	116 (51.8%)	34 (15.2%)	7 (3.1%)
"Headache"	2.21, 0.92	53 (23.7%)	91 (40.6%)	63 (28.1%)	14 (6.3%)	3 (1.3%)
"Muscle stiffness"	1.99, 0.88	71 (31.7%)	100 (44.6%)	40 (17.9%)	11 (4.9%)	2 (0.9%)
"Generalized pain"	2.19, 0.85	50 (22.3%)	94 (42.0%)	70 (31.3%)	8 (3.6%)	2 (0.9%)
Subtotal	11.92, 3.50	17.6%	32.5%	32.2%	7.9%	1.6%
Decreased concentration scales						
"Hard to concentrate"	2.43, 0.87	36 (16.1%)	74 (33.0%)	98 (43.8%)	14 (6.3%)	2 (0.9%)
"Easy to make little mistakes"	1.84, 0.67	71 (31.7%)	118 (52.7%)	35 (15.6%)	0 (0)	0 (0)
Subtotal	4.27, 1.36	21.9%	39.3%	27.3%	2.9%	0.4%
Behaviour change scales						
"Hard to fall asleep in pain"	2.11, 0.90	59 (26.3%)	100 (44.6%)	50 (22.3%)	12 (5.4%)	3 (1.3%)
"Rather be alone"	2.43, 0.97	39 (17.4%)	80 (35.7%)	84 (37.5%)	12 (5.4%)	9 (4.0%)
"Rather be silent and not talk"	2.53, 0.97	36 (16.1%)	66 (29.5%)	96 (42.9%)	19 (8.5%)	7 (3.1%)
"Dysmenorrhea interferes with work"	2.22, 0.89	45 (20.1%)	104 (46.4%)	59 (26.3%)	12 (5.4%)	4 (1.8%)
"Dysmenorrhea interferes with sports"	2.49, 0.98	36 (16.1%)	76 (33.9%)	86 (38.4%)	18 (8.0%)	8 (3.6%)
"Lateness, early departure, absenteeism due to Dysmenorrhea"	1.45, 0.53	127 (56.7%)	94 (42.0%)	3 (1.3%)	0 (0)	0 (0)
"Cold sweats"	1.86, 0.79	80 (35.7%)	102 (45.5%)	36 (16.1%)	5 (2.2%)	1 (0.4%)
"Decreased appetite"	2.15, 0.87	54 (24.1%)	95 (42.4%)	64 (28.6%)	9 (4.0%)	2 (0.9%)
Subtotal	17.24, 5.43	24.4%	36.7%	24.5%	4.5%	1.7%
Autonomic reaction scales						
"Nausea or vomiting"	1.69, 0.71	98 (43.8%)	101 (45.1%)	21 (9.4%)	4 (1.8%)	0 (0)
"Dizziness"	1.85, 0.75	77 (34.4%)	107 (47.8%)	36 (16.1%)	4 (1.8%)	0 (0)
"Diarrhoea or constipation"	2.39, 0.94	44 (19.6%)	73 (32.6%)	87 (38.8%)	16 (7.1%)	4 (1.8%)
"Urinary frequency"	2.06, 0.89	64 (28.6%)	97 (43.3%)	50 (22.3%)	11 (4.9%)	2 (0.9%)
"Fatigue"	2.58, 0.92	33 (14.7%)	58 (25.9%)	109 (48.7%)	19 (8.5%)	5 (2.2%)
"Cold hands and feet"	2.74, 1.01	29 (12.9%)	53 (23.7%)	100 (44.6%)	32 (14.3%)	10 (4.5%)
"Sensitive"	2.40, 0.96	43 (19.2%)	77 (34.4%)	78 (34.8%)	23 (10.3%)	3 (1.3%)
Subtotal	15.71, 4.72	22.7%	33.1%	28.2%	6.4%	1.4%
Water retention scales						
"Breast tenderness"	2.66, 0.95	27 (12.1%)	64 (28.6%)	99 (44.2%)	27 (12.1%)	7 (3.1%)
"Oedema"	2.01, 0.87	68 (30.4%)	99 (44.2%)	46 (20.5%)	9 (4.0%)	2 (0.9%)
Subtotal	4.67, 1.58	19.5%	33.4%	29.7%	7.4%	1.8%
Negative affect scales						
"Stressed"	2.23, 0.92	52 (23.2%)	89 (39.7%)	65 (29.0%)	16 (7.1%)	2 (0.9%)
"Anger"	2.60, 0.94	31 (13.8%)	65 (29.0%)	93 (41.5%)	32 (14.3%)	3 (1.3%)
"Tension"	2.34, 0.95	47 (21.0%)	78 (34.8%)	77 (34.4%)	19 (8.5%)	3 (1.3%)
"Lethargy"	2.70, 0.93	29 (12.9%)	50 (22.3%)	109 (48.7%)	32 (14.3%)	4 (1.8%)
"Vague"	2.50, 0.94	36 (16.1%)	71 (31.7%)	87 (38.8%)	28 (12.5%)	2 (0.9%)
"Emotional instability"	2.56, 0.97	34 (15.2%)	70 (31.3%)	86 (38.4%)	29 (12.9%)	5 (2.2%)
Subtotal	14.93, 5.04	15.6%	28.9%	35.3%	10.7%	1.3%

Note: SD = standard deviation.

Interestingly, there was no statistically significant correlation found between the total MDQ and MNC scores (Spearman's $\rho = 0.011$, $p = 0.865$). Furthermore, the correlations between each scale score of MDQ and each scale score of the Oncology MNC self-rating Scale were not statistically significant, with Spearman's correlation coefficient (ρ) ranging from -0.027 to 0.108 . An additional analysis was conducted to inspect the relationship between the severity of nurses' premenstrual syndrome, based on the MDQ, and MNC, based on the Oncology MNC self-rating Scale. This was accomplished using a trend test, and the results are presented in [Supplementary Table 2](#).

Table 4

Missed nursing care based on the Chinese version of the Oncology Missed Nursing Care self-rating Scale, in November 2022–April 2023 in China.

Item	Missed nursing care (n = 224) [n (%)]				
	Always	Frequently	Occasionally	Rarely	Never
<i>Nursing evaluation scales</i>					
“Illness assessments performed each shift”	79 (35.3%)	33 (14.7%)	22 (9.8%)	49 (21.9%)	41 (18.3%)
“Physiological assessments performed each shift”	60 (26.8%)	34 (15.2%)	46 (20.5%)	58 (25.9%)	26 (11.6%)
“Psychosocial assessments performed each shift”	46 (20.5%)	37 (16.5%)	68 (30.4%)	49 (21.9%)	24 (10.7%)
“Intravenous assessments of chemotherapy”	80 (35.7%)	35 (15.6%)	12 (5.4%)	44 (19.6%)	53 (23.7%)
“Focused reassessments according to patient condition”	74 (33.0%)	44 (19.6%)	14 (6.3%)	50 (22.3%)	42 (18.8%)
“Effectiveness and adverse effects assessments of antitumor therapy”	65 (29.0%)	44 (19.6%)	22 (9.8%)	54 (24.1%)	39 (17.4%)
<i>Nursing plan scales</i>					
“The prevention planning for antitumor therapy complications as needed”	55 (24.6%)	45 (20.1%)	38 (17.0%)	57 (25.4%)	29 (12.9%)
“The nutrition support planning as needed”	50 (22.3%)	43 (19.2%)	49 (21.9%)	56 (25.0%)	26 (11.6%)
“The rehabilitation or exercise planning as needed”	43 (19.2%)	46 (20.5%)	50 (22.3%)	62 (27.7%)	23 (10.3%)
“Patient discharge planning and teaching”	48 (21.4%)	44 (19.6%)	44 (19.6%)	61 (27.2%)	27 (12.1%)
“Full documentation of all necessary data”	86 (38.4%)	30 (13.4%)	13 (5.8%)	51 (22.8%)	44 (19.6%)
“Morning and evening bedside care”	67 (29.9%)	35 (15.6%)	33 (14.7%)	54 (24.1%)	35 (15.6%)
<i>Basic nursing scales</i>					
“Mouth care”	32 (14.3%)	34 (15.2%)	56 (25.0%)	67 (29.9%)	35 (15.6%)
“Patient bathing/skin care”	44 (19.6%)	47 (21.0%)	37 (16.5%)	57 (25.4%)	39 (17.4%)
“Turning the patient every 2 h”	45 (20.1%)	45 (20.1%)	38 (17.0%)	62 (27.7%)	34 (15.2%)
“Assisting patients with rehabilitation exercises”	41 (18.3%)	50 (22.3%)	40 (17.9%)	67 (29.9%)	26 (11.6%)
“Feeding patient when the food is still warm”	41 (18.3%)	29 (12.9%)	38 (17.0%)	67 (29.9%)	49 (21.9%)
“Vital signs assessed as ordered”	94 (42.0%)	22 (9.8%)	9 (4.0%)	40 (17.9%)	59 (26.3%)
“Hand washing”	89 (39.7%)	29 (12.9%)	7 (3.1%)	37 (16.5%)	62 (27.7%)
“Inhaling oxygen as ordered”	91 (40.6%)	24 (10.7%)	10 (4.5%)	30 (13.4%)	69 (30.8%)
<i>Nursing intervention scales</i>					
“Atomization inhalation as ordered”	93 (41.5%)	25 (11.2%)	6 (2.7%)	32 (14.3%)	68 (30.4%)
“Bedside glucose monitoring as ordered”	95 (42.4%)	22 (9.8%)	9 (4.0%)	31 (13.8%)	67 (29.9%)
“Liquid intake and output monitoring as ordered”	97 (43.3%)	20 (8.9%)	7 (3.1%)	28 (12.5%)	72 (32.1%)
“ECG monitoring as ordered”	96 (42.9%)	21 (9.4%)	7 (3.1%)	28 (12.5%)	72 (32.1%)
“Central intravenous catheter maintenance”	95 (42.4%)	24 (10.7%)	5 (2.2%)	29 (12.9%)	71 (31.7%)
“Drainage tube care maintenance”	93 (41.5%)	22 (9.8%)	7 (3.1%)	30 (13.4%)	72 (32.1%)
“Pain care”	85 (37.9%)	35 (15.6%)	12 (5.4%)	34 (15.2%)	61 (27.2%)
“Airway management”	73 (32.6%)	27 (12.1%)	17 (7.6%)	43 (19.2%)	64 (28.6%)
“Medications administered within 30 min before or after scheduled time”	97 (43.3%)	26 (11.6%)	10 (4.5%)	26 (11.6%)	69 (30.8%)
“Response to call light is initiated within 5 min”	90 (40.2%)	29 (12.9%)	11 (4.9%)	34 (15.2%)	60 (26.8%)
“PRN medication requests acted on within 15 min”	86 (38.4%)	31 (13.8%)	11 (4.9%)	33 (14.7%)	63 (28.1%)
“Emotional support to patient and/or family”	63 (28.1%)	33 (14.7%)	48 (21.4%)	45 (20.1%)	35 (15.6%)
“Patient and/or family teaching about illness, tests, and diagnostic studies”	84 (37.5%)	34 (15.2%)	17 (7.6%)	47 (21.0%)	42 (18.8%)

Note: ECG = electrocardiogram; PRN = Pro re nata (from Latin, meaning “as needed”).

Supplementary Table 3 presents Spearman’s correlation results of the items from the MDQ and their associations with selected item scores from the Oncology MNC self-rating scale in the oncology department. As indicated, The symptom “abdominal discomfort” from the MDQ was found to have significant correlations with several tasks from the Oncology MNC self-rating Scale. Specifically, it correlated with: “illness assessments performed each shift” (Spearman’s rho = 0.148, $p = 0.027$), “physiological assessments performed each shift” (Spearman’s rho = 0.148, $p = 0.027$), “intravenous assessments of chemotherapy” (Spearman’s rho = 0.145, $p = 0.030$), “the prevention planning for antitumor therapy complications as needed” (Spearman’s rho = 0.141, $p = 0.035$), “morning and evening bedside care” (Spearman’s rho = 0.134, $p = 0.045$), “airway management” (Spearman’s rho = 0.132, $p = 0.048$), and “PRN medication requests acted on within 15 min” (Spearman’s rho = 0.132, $p = 0.045$). Additionally, several symptoms from the MDQ were significantly correlated with the task of “feeding the patient when the food is still warm” from the Oncology MNC self-rating Scale, including: “abdominal discomfort” (Spearman’s rho = 0.143, $p = 0.032$), “low back pain” (Spearman’s rho = 0.170, $p = 0.011$), “headache” (Spearman’s rho = 0.134, $p = 0.046$), “easy to make little mistakes” (Spearman’s rho = 0.155, $p = 0.020$), “decreased appetite” (Spearman’s rho = 0.143, $p = 0.033$), “diarrhoea or constipation” (Spearman’s rho = 0.152, $p = 0.023$), and “fatigue and

Table 5

Comparing the total score of missed nursing care by the severity grade of nurses’ premenstrual syndrome.

MNS severity grade	n	Mean	SD	F	p
Normal	70	93.07	51.54	0.61	0.609
Mild	130	96.42	46.71		
Moderate	22	84.32	42.44		
Moderate to severe	2	68.50	14.85		

No significance was found in all post-hoc comparisons.

The lower the score, the more missed nursing care incidents there are.

weakness" (Spearman's $\rho = 0.148$, $p = 0.026$).

The highest correlations were observed for the unfinished or missed "feeding patient when the food is still warm" in participants with muscle stiffness (Spearman's $\rho = 0.176$, $p = 0.008$), generalized pain (Spearman's $\rho = 0.194$, $p = 0.004$), and hard-to-concentrate syndrome (Spearman's $\rho = 0.187$, $p = 0.005$), while correlations with the unfinished or missed "turning the patient every 2 h" in participants with generalized pain (Spearman's $\rho = 0.133$, $p = 0.046$), and the unfinished or missed "mouth care" in patients with the hard-to-concentrate syndrome (Spearman's $\rho = 0.148$, $p = 0.027$) were lower yet still statistically significant.

Table 5 shows the total score of MNC by the severity grade of nurses' premenstrual syndrome. In addition, Supplementary Table 4 further analyses the differences for 33 MNC items by the severity grades of nurses' premenstrual syndrome. In the overall ANOVA test or paired-group comparisons, no significance was found (all $p > 0.05$). The inability to demonstrate statistical significance may be due to the large variation (SD) in the scores among participants. However, the descriptive means of the total score still provide potentially useful observations. As indicated, there was a small difference between normal and mild severity groups; Among the 154 participants with PMS, the average MNC scores decreased (worsened) as the severity of PMS increased.

4. Discussion

This study investigated the current situation of female nursing staff's PMS and the delay in, partial completion, or non-completion of nursing care, and probed into the relationship between PMS and MNC. PMS is not only one of the most common health problems in women and one of the most prevalent cyclical groups of emotional and physical symptoms worldwide [21]. To our knowledge, the prevalence of PMS is unrelated to age, educational achievement, or employment status [22]. Among the 224 female nursing staff in this study, the incidence of PMS was 68.7%, which was relatively lower than that of a prospective-longitudinal community survey of 1488 women conducted in Germany that estimated that 80% of women experience at least one physical or psychiatric symptom during the luteal phase of their menstrual cycle [23]. These differences may be caused by ethnic/cultural differences in PMS reporting, differences in sample size, as well as differences in the study setting (hospital versus community).

Furthermore, a small number of female nursing staff participating in the present study reported moderate or moderate to severe PMS, accounting for 10.8%. This result is consistent with the findings of Potter et al. who reported a 12.2% incidence of moderate-to-severe PMS among 2863 reproductive-age women in the French population [24]. However, the result disagreed with some previous studies, which indicated that at least 20% of adolescents experience moderate-to-severe PMS associated with functional impairment, and differences in method, follow-up time, and sample size may be responsible for the discrepancy [3,4]. In addition, the most frequent PMS symptoms in the present study were low back pain, abdominal discomfort, cold hands and feet, and lethargy. Studies reported that the most common PMS are stress, abdominal discomfort, emotional instability, tension, lethargy, fatigue, anger, breast tenderness, headache, and low back pain [7,25]. Racial/ethnic disparities and methodological differences may contribute to these differences.

We found that 96.0% of female nursing staff missed or failed to complete at least one nursing activity, indicating that MNC was common among the oncological nurses in this study. Our finding on MNC prevalence is in accordance with that reported by Bassi [26]. The nursing activities that female nursing staff commonly missed or unfinished were rehabilitation or exercise planning as needed, psychosocial assessments performed each shift, physiological assessments performed each shift, nutrition support planning as needed, and assisting patients with rehabilitation exercises. The three items with the lowest incidence of MNC were: liquid intake and output monitoring, electrocardiogram monitoring, and drainage tube care maintenance. The results of our study differed from those of previous studies [10,27]. The differences in findings could be attributed to the differences in participants' characteristics, sample size, and study setting. To the best of our knowledge, the onset and development of tumours in the oncology department are characterised by rapid changes, complicated illness states, and difficult treatment options. When caring for patients with tumours, nurses are required to implement various nursing interventions to manage symptoms, maintain function, and improve health, thus nurses pay more attention to and prioritize nursing interventions, resulting in less delay in or non-completion of nursing care of those nursing activities. Female nursing staff frequently missed or left incomplete tasks such as nursing evaluation and nursing planning. This may be attributed to the perception that these activities were time-consuming and non-urgent. and if delayed or missed, would not have serious consequences for patient safety. As a result, these tasks were not prioritized resulting in a high incidence of delay, partial completion, or non-completion.

Contrary to our expectations, no correlation was observed between each scale score or the total score of MDQ and each scale score or the total score of the Oncology MNC self-rating Scale. However, there was a statistically significant association between PMS abdominal discomfort associated with PMS and the majority of MNC activities. The more severe the abdominal discomfort, the more MNC activities reported, and the more MNC activities, the more pronounced the perception of some premenstrual symptoms during the late luteal phase and early follicular phase of the menstrual cycle. This finding was consistent with those of the previous studies. Borenstein and Ansong found that premenstrual somatic symptoms including abdominal bloating were related to work productivity, so the less severe the premenstrual symptoms, the more work effectiveness increased [14,28]. Another study in Iran found that PMS had a negative effect on work activities - women with PMS perceive higher levels of work pressure, less autonomy in their job, and less variety in their workplace than those without symptoms [29]. However, they did not find a relationship between the symptoms experienced by nurses before menstruation and their accuracy and timeliness in completing nursing care.

It may be that, in China, the association between some premenstrual symptoms and MNC exists because female nursing staff with PMS at work attempt to use 'self-regulation' as a strategy to cope with premenstrual distress, including the avoidance of relational demands and responsibilities, to allow time for self-care. A study conducted in England revealed that avoidance in the work environment is frequently accompanied by negative self-perceptions (e.g. reduced confidence in their ability to work), which could further increase caregiving deficits [30]. Moreover, the severity of some PMS symptoms and their impact on nurses' performance may be

influenced by nurses' over-compensatory behaviours. Nurses' attempts to cope with or live through their premenstrual symptoms may highlight potentially damaging work patterns. Over-compensatory behaviours could result in an increase in work intensity, suggesting that nurses may experience a poor work-life balance. Poor work-life balance has been proven to lead to poor working performance and outcomes. The current results, which indicate a direct relationship between some PMS and the MNC, verified the findings of other studies.

The study reveals a significant association between PMS symptoms and MNC among female nursing staff, highlighting the necessity for targeted nursing policy adjustments to uphold patient care standards. Emphasizing the development of supportive policies that address PMS-related challenges can cultivate a healthier workplace environment and improve patient outcomes. Nursing policies could be customized to provide flexible scheduling options or workload modifications for nurses experiencing severe PMS symptoms. This may involve initiatives such as allowing affected nurses to adapt their tasks or take additional breaks to alleviate discomfort or fatigue during their menstrual cycle. Additionally, integrating educational programs into policies can enhance awareness among nursing staff regarding the potential impact of PMS on their performance and patient care quality. Incorporating the findings from this study into nursing policy frameworks enables healthcare institutions to establish more conducive work environments for female nursing staff, ultimately enhancing the overall safety and quality of patient care delivery.

This is the first study to investigate the influence of premenstrual symptoms suffered by female nursing staff influences MNC activities. However, there are still several limitations. The sample size was relatively small and did not include nurses in various centres distributed throughout the national territory. The second limitation of this study was that nurses, especially junior registered nurses, may be reluctant to report an incident in which there was a negative outcome for the patient, which may have led to reporting bias. Further studies are ongoing to address these issues. Additionally, as a cross-sectional study, causal associations cannot be assessed, which deserves further in-depth exploration. Moreover, the study was constrained by its inability to differentiate between the effects of PMS and workload on MNC. This lack of differentiation complicates the accurate interpretation of results and introduces potential ambiguity in the findings.

5. Conclusion

This study indicated a clear relationship between some PMS symptoms and MNC among female nursing staff; the more severe some premenstrual symptoms are, the greater the forgetfulness or absence of nursing care occurrences. To ensure the delivery of high-quality, safe, and effective nursing services, this study provides compelling reasons for administrators to consider and prioritize nursing staff's premenstrual conditions. Understanding and support from administrators should be provided for nurses with severe PMS.

Data availability statement

The data associated with our study has not been deposited into a publicly available repository. Data will be made available on request.

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Ethics statement

This study was reviewed and approved by the Institutional Review Board of Sun Yat-sen University Cancer Center, with the approval number: G2021-068-01. All participants/patients (or their proxies/legal guardians) provided informed consent to participate in the study. All participants provided informed consent for the publication of their anonymized case details and images. Informed consent was obtained from the patient(s) (or relative/guardian) for the publication of all images, clinical data and other data.

CRediT authorship contribution statement

Xiaoxue Chen: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Juan Yu:** Resources, Investigation, Data curation. **Jianwen Chen:** Resources, Investigation, Conceptualization. **Shuxiao He:** Investigation, Data curation. **Huihua Tao:** Investigation. **Yuqing Lin:** Visualization, Resources, Investigation. **Li Zhang:** Supervision, Resources, Project administration. **Huaqiang Zhou:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Software, Project administration. **Yalan Wang:** Writing – review & editing, Supervision, Project administration.

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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e27609>.

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