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The influencing factors of dysmenorrhea among hospital nurses: A questionnaire survey in Taiwan

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ABSTRACT

Objectives: Nurses are at a high risk for dysmenorrhea while working intensely and focusing on their patients. The purposes of the current study were to (1) describe the basic demographic data, dysmenorrheal knowledge, and menstrual attitudes of dysmenorrheal and non-dysmenorrheal hospital nurses; (2) analyze these nurse populations to identify significant differences; and (3) examine their risk factors.

Methods: This cross-sectional survey employed a structured questionnaire. Two hospitals in southern Taiwan were recruited. The participants included (1) full-time hospital nurses (2) at least 18 years of age (3) who agreed to participate. All participants were recruited through random sampling. The questionnaire contained demographic data, the Dysmenorrheic Knowledge Scale, and the Menstrual Attitude Scale (MAS).

Results: A total of 420 nurses completed all questionnaires. Among them, 297 (70.7%) had experienced dysmenorrhea in the past six months, while 123 (29.3%) had not. Significant differences in age, marital status, childbearing status, age of menarche,

and rotating three-shift ratio were identified between the dysmenorrhea and non-dysmenorrhea groups. Analysis of the MAS results revealed significant differences between the groups regarding consideration of menstruation as a debilitating or a bothersome event, anticipation and prediction of menstruation onset, and denial of any effects from menstruation. The results of multiple logistic regression showed that the predictive factors included age less than 40 years, working three-shift rotations, marital status, acknowledging menstruation as a debilitating event, anticipation and prediction of the onset of menstruation, and denial of any effects from menstruation.

Conclusions: The risk factors of dysmenorrhea are age, working three-shift rotations, marital status, acknowledging menstruation as a debilitating event, anticipation and prediction of the onset of menstruation, and denial of any effects from menstruation are predictive. These results will help managers design health-promoting menstrual self-care programs for hospital nurses.

Keywords: dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

STRENGTHS AND LIMITATIONS

- This study explored the risk factors for dysmenorrhea among nurses.
- The prevalence rate of dysmenorrhea in women is high and negatively affects their daily activity.
- The risk factors of dysmenorrhea are complex; thus, we used multiple logistic regression analysis to identify these factors.
- The study was limited in analyzing the effects of lifestyle choices such as smoking and drinking because few nurses reported those behaviors.
- The findings of the present study can improve health-promoting self-care and friendly environments for hospital nurses.

INTRODUCTION

More than 50% of women experience dysmenorrhea, defined as pain that accompanies menstruation. The majority (75.1%) of women believe dysmenorrhea to be a normal part of their lives and that the symptoms will continue to affect their daily lives until they near menopause[1] Dysmenorrhea occurs during the first one to three years after menarche and is commonly accompanied by sweating, lack of appetite, headache, distraction, nausea, vomiting, dizziness [2], and depression [3]. Dysmenorrhea arises during menstrual bleeding due to lower abdominal pain brought on by menses, with no relevant diagnoses from other gynecological examinations [4]. The prevalence rates of dysmenorrhea differ between age groups; however, over half of women in all age groups experience dysmenorrhea. The prevalence rate of dysmenorrhea is between 50.9% and 87.4% worldwide [5-7] Parker et al found that 21% of Australian adolescents experienced severe dysmenorrhea, with 26% having school absences due to dysmenorrhea.[8]

In Taiwan, adolescent vocational nursing students 16–18 years of age had a dysmenorrhea prevalence rate of 73.3%, and another study reported a rate of 90.2% among the general population of women.[10] A study on hospital nurses in Taiwan reported a prevalence rate of 90.7% .[11] Despite the high prevalence rate, nurses often neglect their own health while working and caring for patients. [12]

Dysmenorrhea can be cyclical or chronic. It can be possibly a result of pain catastrophizing, and is sensitive to anxiety[13]. It not only causes physical pain but also affects mental well-being and quality of life, leading to work or school absenteeism and significant health burdens [14]. This problem not only affects performance but also the daily lives of adolescent students in Taiwan [9] and may cause women to take days off, which may affect their work[15]. A study in Malaysia reported poor concentration, absenteeism, and poor grades to be common factors of dysmenorrhea that affect daily life. Despite its high prevalence rate and effect on daily life, 76.1% of women still believe that dysmenorrhea is a natural part of a women's menstrual cycle, and only 14.8% believe that treatment is necessary. In terms of dysmenorrhea information, 62.3% of adolescent girls claimed that they learned about the condition from their mothers, while 52.9% said that they had obtained their knowledge from peers [16]. Besides influencing daily learning, dysmenorrhea also causes tiredness, depression, difficulty concentrating, etc. In addition, dysmenorrhea is negatively correlated with self-awareness of one's own health; in other words, individuals with dysmenorrhea have poorer self-awareness regarding their own health [6]. Another study of Malaysian college students found that social activities, responsibilities, time spent resting, class absenteeism, and daily life were affected in individuals with dysmenorrheal individuals [17].

In Taiwan, a study of 417 fifth- and sixth-grade students reported that dysmenorrhea affected the emotions, daily lives, school activities, and social activities of 74.8%, 73.1%, 61.6%, and 50.1% of students, respectively [8]. Another study of 165 15- to 19-year-old students found that 82.4% experienced disruptions in daily activities because of dysmenorrhea and 12.7% reported school absences due to dysmenorrhea [18]. A study of 297 nurses (average age: 30.3 years) found that 8.4% had taken menstrual leave, 11.8% had booked a leave of absence for dysmenorrhea, and 28.6% saw their doctors due to the condition. [15]. Furthermore, 20.8% of adolescent girls from vocational schools in the same region had seen doctors for dysmenorrhea [9]. Menstrual leave is currently available in Japan, Indonesia, South Korea, and Taiwan. Focus groups studies in Taiwan showed that most interviewed women had menstrual discomfort and that they understood the implementation and regulation of menstrual leave in different companies. Yet in reality, the application rate is low due to factors including "the regulations are too rigid," "no one else has taken menstrual leave," "other kinds of leaves are available," "no one will take my shift," or "there has to be a doctor's note"[19].

Previous studies showed that the physical and mental health of nurses are significantly correlated with job satisfaction, tiredness, and comfort [19 20]. The Gender Equality in Employment Act of Taiwan, approved in 2002, clearly defines regulations

regarding menstrual leave in which a female employee who has trouble working due to discomfort during menstruation should take one day of menstrual leave every month [21]. However, because of the particularity of nursing, temporary leave affects the allocation of nurses. Cheng [10]found that the long-term use of medicine to maintain a ready-to-work status is a common experience among women; nurses, who have frequent contact with drugs, use them extensively to overcome menstrual discomfort at work [21], including the use of sumatriptan–naproxen sodium to reduce the effect of dysmenorrhea during work and leisure[22].

Several risk factors affect dysmenorrhea, such as the following criteria. (a) Age: older women are generally less likely to have dysmenorrhea, although the relationship to marital status or birth condition remains unclear. (b) Age of menarche: age of menarche is significantly related to the occurrence of dysmenorrhea, with women with an earlier age of menarche more likely to experience more severe dysmenorrhea [7 17] (c) Duration of menstrual cycle: a Nigerian study noted that longer menstrual flows are an important predictive factor of dysmenorrhea. [7] (d) Regularity of menstrual cycle: women with irregular menstrual cycles are more likely to have dysmenorrhea [9]. In terms of lifestyle factors, the results of several studies indicated that smoking and alcohol consumption are risk factors for primary dysmenorrhea and that women with smoking or drinking habits are more likely to have dysmenorrhea [23]

[24] With regard to work, several studies found that women who work rotations, especially nurses who have to work "sometimes day shifts, sometimes night shifts," have relatively more serious menstrual discomfort [21]. Nurses who work night shifts are more likely to have dysmenorrheal symptoms during their menstrual cycles compared to those who work regular shifts [15].

Furthermore, the attitudes of adolescent students toward menstruation correlate with the occurrence of dysmenorrheal [25]. Those who tend to agree that menstruation is a debilitating experience and those who anticipate and predict the onset of menstruation are more likely to have dysmenorrhea [26]. The effect of dysmenorrhea on women varies based on the degree and frequency of their pain.

Previous studies have revealed that women have inadequate knowledge about menstruation and that educational information about menstrual health care contains contradictory messages, including the idea that menstruation is a normal and natural event, but should be hidden [27]. Cheng [28] observed that some female students knew about menstruation taboos; while they had doubts about those taboos, they still had negative attitudes about menstruation. Medical expenses due to dysmenorrhea increase with age, besides the topic of women menstrual health and their emotional problems, should also be taken seriously [29]. Nevertheless, since dysmenorrhea is so common, and women consider it a normal phenomenon and rarely seek medical

treatment due to their cultural and religious attitudes [15] or due to the feeling that they can tolerate the pain [23].

In Taiwan, 98.8% of hospital nurses are women. There is a high prevalence rate of dysmenorrhea in women; due to the nature of nursing work, nurses are at a high-risk for dysmenorrhea. However, previous studies on nurses did not discuss the influencing factors. The purposes of this study were to (1) describe the basic demographic data as well as menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitude of dysmenorrheal and non-dysmenorrheal clinical nurses; (2) analyze the demographic data as well as menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitude of dysmenorrheal and non-dysmenorrheal clinical nurses, and identify significant differences between these groups; and (3) examine the risk factors of dysmenorrhea in clinical nurses.

METHODS

Study design and participants

This study used a cross-sectional questionnaire survey based on structured questionnaires for data collection. The participants were recruited from two medical institutions in southern Taiwan. One institution was a medical center with 1,300 beds;

the other was a regional hospital with 650 beds. The participants included 2,000 clinical nurses. The inclusion criteria for this study included (1) full-time nurses at the study hospitals (2) at least 18 years of age who (3) agreed to participate in this study after reading an informed consent document. The sample size was estimated using JMP 7.0 with an effect size of 0.3, α of 0.05, power of 0.80, resulting in a required sample size of 350 individuals. With a predicted questionnaire recovery rate of 80%, the sample size was estimated to be 438. We randomly sampled 450 nurses and recovered 420 valid questionnaires (93.3%). Among the 420 nurses, 297 (70.7%) had experienced dysmenorrhea in the past six months and were categorized in the dysmenorrhea group, while the 123 (29.3%) nurses who had not experienced dysmenorrhea were classified as the non-dysmenorrhea group.

Random sampling was conducted after this study received approval from the Institutional Review Board (IRBD No. CLH0088) using lists of nurses from the two hospitals. The questionnaires were delivered to the nurses by a trained research assistant. The participants provided written consent and answered the questionnaires independently. The written consent form indicated that participation in this study was not compulsory and the questionnaire was anonymous. Anyone who was not willing to participate in this study could simply choose not to return the questionnaire. No individual rights or interests were compromised during this process. Those who

completed the questionnaire received a gift. The questionnaires were collected two weeks after being issued, upon which the written consents and questionnaires were filed separately and placed in locations chosen by the participants to protect their personal privacy.

Measurements

This study was conducted in May 2010. The study instruments included the Demographic Inventory (DI), Dysmenorrheal Knowledge Scale (DKS), and Menstrual Attitude Scale (MAS). The DI was designed based on related studies [9 30] and included age, age of menarche, marital and childbirth status, discussion of menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea, working conditions, self-care health education experience regarding menstruation, dysmenorrhea influences, and work coping. The DKS was designed using both the researchers' clinical experiences and previous studies.[30] The scale included 20 questions with yes/no answers. Correct answers received a score of 1, while incorrect answers received a score of 0. The total summed scores ranged from 0 to 20, with higher scores representing a better knowledge of dysmenorrhea. The Kuder-Richardson reliability coefficient was 0.63 in a previous study[30], and 0.72 in this study. The MAS was developed by Brooks-Gunn and Ruble (1980) and modified

by Lee (1994). It includes 32 items with five dimensions, including menstruation as a debilitating event, menstruation as a bothersome event, menstruation as a natural event, anticipation and prediction of the onset of menstruation, and denial of the effects of menstruation. Each item was scored on a 7-point Likert scale from 1 (disagree strongly) to 7 (agree strongly). The total summed scores ranged from 32 to 224, with higher scores representing a more positive attitude toward menstruation. Cronbach's α was 0.58 in the original scale [31], 0.61 and 0.75 in Morrison's study [32], and 0.57 in the present study.

Data Analysis

The data in this study were stored using Microsoft Excel. JMP 7.0 (a business unit of SAS) for statistical analysis. Based on the study's variables and purposes, percentage, mean, and standard deviation were used to describe the demographics and menstruation characteristics as well as the DKS and MAS distributions in the dysmenorrhea and the non-dysmenorrhea groups. T- and chi-square tests were used to detect differences in demographics, menstruation characteristics, DKS, and MAS between the two groups. Finally, multiple logistic regression analysis was used to examine the relationships between each variable and the occurrence of dysmenorrhea.

RESULTS

A total of 420 participants completed the questionnaire. Among them, 297 (70.7%) had experienced dysmenorrhea in the past six months, while 123 (29.3%) had not. Compared to the non-dysmenorrhea group, the dysmenorrhea group was significantly younger, had higher percentage of unmarried status, had no childbearing experience, had a higher percentage of age of menarche of less than 12 years, and higher percentage of those who worked a three-shift rotation (Table 1).

Table 1. Comparison of demographic and menstruation characteristics between the dysmenorrhea and non-dysmenorrhea groups

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t or χ^2	p-value
	n	%	n	%		
Age (years) M± SD	30.33± 3.61		32.04±4.47		-3.78	<0.001
Marital status					20.03	<0.001
Unmarried	231	77.78	69	56.10		
Married	66	22.22	54	43.90		
Childbearing					19.38	<0.001
No	247	83.16	78	63.41		
Yes	50	16.84	45	36.59		
Age of menarche					4.70	0.030
＜12	46	15.49	11	8.94		
≧12	251	84.51	112	91.06		
Regularity of menstrual cycle					0.10	0.755
Yes	193	64.98	85	69.11		
No	104	35.02	38	30.89		
Duration of menstrual cycle					1.99	0.575
≦4 days	110	37.04	43	34.96		
5-6 days	157	52.86	70	56.91		
≧7 days	30	10.10	10	8.13		
Prior health education on dysmenorrhea					0.99	0.321
No	163	54.88	74	60.16		
Yes	134	45.12	49	39.84		
Three-shift rotation					6.06	0.014
Yes	271	91.25	102	82.93		
No	26	8.75	21	17.07		

Table 1. Comparison of Demographic and Menstruation Characteristics Between Dysmenorrheal and Non-Dysmenorrheal Groups (continue)

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t or χ^2	p-value
	n	%	n	%		
Whether to know it is allowed to ask for menstrual leave					2.03	.154
Yes	242	81.48	107	86.99		
No	55	18.52	16	13.01		
Whether to consider menstrual leave necessary					1.68	.195
Yes	288	96.97	115	93.50		
No	9	3.03	8	6.50		
Have ever asked for menstrual leave					0.14	.707
No	272	91.58	114	92.68		
Yes	25	8.42	9	7.32		
Have ever asked for more leaves for dysmenorrhea?					3.59	.058
No	262	88.22	116	94.31		
Yes	35	11.78	7	5.69		

In terms of dysmenorrheal knowledge and menstrual attitudes, the dysmenorrhea group showed a significantly higher degree of acknowledgment than that of the non-dysmenorrhea group in considering menstruation a debilitating event, considering menstruation a bothersome event, and anticipation and prediction of menstruation onset. In terms of denial of the effects of menstruation, the dysmenorrhea group was significantly lower than that of the non-dysmenorrhea group. No significant differences were observed between groups in terms of considering menstruation a natural event (Table 2).

Table 2. Comparison of dysmenorrheic knowledge and menstrual attitude between the dysmenorrhea and non-dysmenorrhea groups

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t-value	p-value
	M	SD	M	SD		
Dysmenorrheic knowledge scale	14.12	2.19	13.40	2.40	1.18	0.238
Menstrual attitude scale	148.64	12.74	146.85	12.69	1.31	0.192
Menstruation as a debilitating event	56.44	8.52	52.55	7.65	4.58	<.001
Menstruation as a bothersome event	29.05	5.01	27.54	6.64	2.27	0.024
Menstruation as a natural event	19.98	5.19	20.98	4.92	-1.87	0.062
Anticipation and prediction of the onset of menstruation	20.04	3.01	18.98	3.55	2.93	0.004
Denial of any effect of menstruation	23.12	6.75	26.80	5.70	5.70	<.001

Age less than 40 years, working three-shift rotations, and marital status were the predictive factors for the occurrence of dysmenorrhea. In terms of menstrual attitudes using mean as the contact point, the tendency to acknowledge menstruation as a debilitating event, and the tendency to deny the effects of menstruation were also predictive factors for dysmenorrhea occurrence. After controlling for working three-shift rotations, marital status, the tendency to acknowledge menstruation as a debilitating event, and the tendency to acknowledge the effects of menstruation, the rate of occurrence of dysmenorrhea in those younger than 40 years was 4.46 times

higher than that in those over 40 years of age. After controlling for age, marital status, the tendency to acknowledge menstruation as a debilitating event, and the tendency to acknowledge the effects of menstruation, the dysmenorrhea occurrence rate for those who worked three-shift rotations was 2.07 times higher than that in those who did not. After controlling for age, working three-shift rotations, marital status, and the tendency to acknowledge the effects of menstruation, those who acknowledged that menstruation was a debilitating event had a dysmenorrhea occurrence rate that was 2.72 times higher than that of those who did not. After controlling for age, working three-shift rotations, marital status, and the tendency to acknowledge menstruation as a debilitating event, those who acknowledged the effects of menstruation had a dysmenorrhea occurrence rate that was 2.59 times higher than that in those who did not (Table 3).

Table 3: Risk factors of dysmenorrhea

		Crude OR	95% CI	P-Value	Adjusted OR	95% CI	P-Value
Age	Age＜40	4.06	(1.33 , 13.7)	＜0.05	4.46	(1.24 , 17.23)	＜0.05
	Age≧40	1.00	(- , -)		1.00	(- , -)	
Three-shift rotationRotating 3-shift	Yes	2.15	(1.15 , 3.98)	＜0.05	2.07	(1.01 , 4.21)	＜0.05
	No	1.00	(- , -)		1.00	(- , -)	

Married	No	2.74	(	1.75	,	4.30	)	<0.001	2.59	(1.57 , 4.28)	<0.001
	Yes	1.00	(	-	,	-	)		1.00	(- , -)	
Menstruation as a debilitating event	Higher	2.53	(	1.63	,	3.95	)	<0.001	2.72	(1.67 , 4.52)	<0.001
	Lower	1.00	(	-	,	-	)		1.00	(- , -)	
Denial of any effect of menstruation	Lower	2.83	(	1.83	,	4.46	)	<0.001	2.59	(1.61 , 4.23)	<0.001
	Higher	1.00	(	-	,	-	)		1.00	(- , -)	

Reference group: Age ≧40 years, no three-shift rotation, unmarried, reduced menstruation as a debilitating event, and increased denial of any effect on menstruation

CI, confidence interval; OR, odds ratio; SE, standard error.

DISCUSSION

Although the average age of the dysmenorrhea group was significantly lower than that of the non-dysmenorrhea group, when age was the only variable being compared, the dysmenorrhea occurrence rate of nurses younger than 40 years was 4.06 times higher than that of those over 40 years. After controlling for three-shift rotations, marital status, the tendency to acknowledge menstruation as a debilitating event, and the tendency to deny the effects of menstruation, the occurrence rate of dysmenorrhea in those under 40 years was 4.46 times higher than that in those over 40 years. Therefore, age was a risk factor for dysmenorrhea. To our knowledge, no other studies have directly discussed the correlation between age and dysmenorrhea. However, previous studies reported that dysmenorrhea occurrence rates were over 76%

in adolescent girls or students [5 6 16], compared to a rate of 55.9% in a study with 15- to 45-year-old women [33], with a decrease in the occurrence rate with increasing participants' age. Since dysmenorrhea is part of being a woman, periodic dysmenorrhea comes with the menstrual cycle. With age, women's dysmenorrhea and coping experience also increase; therefore, dysmenorrheal women are "female specialists with embodied knowledge," meaning that their experiences may affect their subjective perceptions and tolerance of dysmenorrhea, which in turn affect the occurrence of dysmenorrheal [34].

In terms of marital and childbirth status, both the marital status ratio and childbirth ratio in the dysmenorrhea group were significantly lower than those in the non-dysmenorrhea group, indicating a high dysmenorrhea occurrence rate among unmarried, non-childbearing women. After adjusting for age, working three-shift rotations, marital status, the tendency to acknowledge menstruation as a debilitating event, and the tendency to deny the effects of menstruation, the dysmenorrhea occurrence rate in unmarried women was 2.59 times higher than that in married women. This result is consistent with the results of Chung [35] (average age = 27 years), which reported a higher dysmenorrhea occurrence rate in single than in married and divorced nurses [35]. Many women are by their doctors that their dysmenorrhea will

improve after getting married and giving birth, which may improve menstrual blood discharge. Furthermore, women may perform positive self-care behaviors for menstruation after getting married due to childbearing needs, which may also be a factor that indirectly relieves dysmenorrhea [11] In terms of menstruation history, the dysmenorrhea occurrence rate in women who had their menarche after 12 years of age was significantly lower in the dysmenorrhea group than that in the non-dysmenorrhea group, indicating that those who had menarche at a younger age were more likely to have dysmenorrhea; however, after performing further logistic regression analysis, this variable was not significant. Therefore, after adjusting, age of menarche was not an important influencing factor for dysmenorrhea. Previous studies of dysmenorrhea in adolescent girls or students found early menarche to be a risk factor for dysmenorrhea [7 17 36]. With age and dysmenorrhea experience, women develop coping abilities; together with marital and childbearing status, these factors could weaken the effect of age of menarche on dysmenorrhea occurrence.

In terms of work, the dysmenorrhea occurrence rate among those who worked three-shift rotations was significantly higher in the dysmenorrhea group than that in the non-dysmenorrhea group. After controlling for age, marital status, the tendency to acknowledge menstruation as a debilitating event, and the tendency to deny the

effects of menstruation, the dysmenorrhea occurrence rate in those who worked three-shift rotations was 2.07 times higher than the rate in those who did not. This indicates that work type (e.g., rotating nightshift) is a risk factor for dysmenorrhea occurrence in nurses. However, Chung [35] found that rotating work shifts were not significantly related to dysmenorrhea occurrence in nurses. Furthermore, one study on Japanese junior high school students also found that nightshift work was not significantly associated with dysmenorrhea [37]. However, an interview of focus groups conducted by Chang found that working rotating shifts was highly associated with menstrual discomfort [19]. Due to the nature of nursing work, most nurses need to work rotating night shifts, and the graveyard shift can easily cause uncomfortable menstrual cycles or obvious irregularities [25]. Coupling nurses' day/night activities and sleep patterns with the increased pressure from working night shifts, menstrual discomfort may be more common in those with frequent rotation changes.

In terms of menstrual attitude, the dysmenorrhea group was significantly higher than the non-dysmenorrhea group in considering menstruation to be a debilitating event, considering menstruation to be a bothersome event, and anticipating and predicting the onset of menstruation, while significantly lower than the non-dysmenorrhea group in denying the effects of menstruation. There was no

significant difference between the two groups with regard to considering menstruation to be a natural event. In multiple logistic regressions, the tendency to acknowledge menstruation as a debilitating event and the tendency to deny the effects of menstruation were influencing factors for the occurrence of dysmenorrhea. In this study, menstrual attitude was related to dysmenorrhea occurrence, particularly considering menstruation to be a debilitating event and denying the effects of menstruation. Firat found no significant correlation between menstrual discomfort and menstrual attitude [38]. In vocational nursing students, "menstruation is a debilitating event" and "anticipation and prediction of the onset of menstruation" in the dysmenorrhea group scored significantly higher than those in the non-dysmenorrhea group. In terms of "menstruation is a bothersome event" and "menstruation is a natural event," the non-dysmenorrhea group was significantly higher than the dysmenorrhea group; and no significant differences were observed between the two groups in terms of "denial of any effect of menstruation" [26]. These results are different from those of the present study. The most obvious difference between the two studies is the tendency to deny the effect of menstruation. The scores in the dysmenorrhea and non-dysmenorrhea groups in the present study were 23.1 and 26.8, respectively, compared to 26.6 and 28.0 in adolescent nursing students. In other words, compared to adolescent nursing students, nurses in the present study did not deny the effects

caused by menstruation and recognized that they were affected by menstruation. When a nurse experiences dysmenorrhea, her work may be affected. If she asks for menstrual leave, temporary work arrangements and patient care may be affected. Since dysmenorrhea is a periodic phenomenon, frequently asking for menstrual leave may affect working relationships; therefore, nurses usually choose to work even when they experience dysmenorrhea.

In this study, age under 40 years, working three-shift rotations, marital status, using mean as the contact point, the tendency to acknowledge menstruation as a debilitating event, and the tendency to deny the effects of menstruation were predictive factors for dysmenorrhea occurrence. Chiou's [30] study of adolescent nursing students found that menstrual regularity and health education were predictive factors for dysmenorrhea. Those who had irregular menstruations and had not received dysmenorrhea-related health education had higher dysmenorrhea occurrence rates [9]; however, these two factors were not predictive factors in the present study. Our participants were nurses from a wide range of age groups rather than adolescents; therefore, they had more dysmenorrhea and self-care experience. In addition, menstrual health is a part of nursing education; therefore, although nurses are not directly involved in health education, education is a part of their professional training.

Thus, health education was not an important predictive factor in this study.

This study mainly evaluated the predictive factors for dysmenorrhea in hospital nurses and aimed to build a friendly work environment for high-risk women. The participants were randomly selected nurses from only two hospitals in southern Taiwan; therefore, the results might be limited. In future studies, inclusion research settings can be extended to examine any differences between different living areas. In addition, rotating night shifts are required in many other occupations besides nursing. Considering different professional backgrounds and life experiences, future studies should also study women from different occupations with rotating shifts to evaluate differences in the influence of their knowledge and attitudes on dysmenorrhea occurrence. The variables assessed in this study included demographic characteristics, menstruation history, dysmenorrheal knowledge, menstrual attitudes, etc.; however, lifestyle choices such as smoking, drinking, and exercising were not included. Future studies are necessary to analyze the effects of these lifestyle choices on dysmenorrhea.

CONCLUSIONS

Nursing is a female-dominated occupation in Taiwan. The high prevalence rate of dysmenorrhea severely affects nurses such that they may not be able to focus on

their work, thereby affecting the quality of patient care. Nurses may need to take menstrual leave, which can cause a shortage of nursing resources. The predictive factors for dysmenorrhea occurrence were assessed with the hope to produce interventions for high-risk groups and improve workplace comfort for nurses. In this study, age less than 40 years, working three-shift rotations, marital status, using mean as the contact point, the tendency to acknowledge menstruation as a debilitating event, and the tendency to deny the effects of menstruation were predictive factors for the occurrence of dysmenorrhea. This finding could help nursing managers to offer appropriate assistance for high-risk groups and build a health-promoting self-care and friendly environment for hospital nurses.

In terms of clinical practices, if the majority of nurses are under 40 years of age and unmarried, establishing a menstruation-supporting environment should be considered. Since women with dysmenorrhea do not necessarily need to take a full day off, if a supportive environment can be created that allows them to take a break from work, then their comfort will be improved. Work environments, particularly hospitals, can provide measures such as flexibility with menstrual leave or scheduling menstrual leave, integrating menstrual self-care measures into annual occupational safety and health training, and providing spaces at work for short breaks together with

thermotherapy, aromatherapy massage, etc. These measures will enable nurses to care for themselves at work, thus improving their workplace comfort and increasing their work satisfaction.

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Competing interests

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Contributors

Min-Hui Chiu and Hsiu-Hung Wang designed the study, analyzed and interpreted the data, and drafted the manuscript. Min-Hui Chiu contributed to the study design, analysis, and interpretation of the data. All authors had full access to all data in the study and take responsibility for its integrity.

Data sharing statement

No additional data are available.

REFERENCES

1. Chen CX, Kwekkeboom KL, Ward SE. Beliefs About Dysmenorrhea and Their Relationship to Self-Management. *Res Nurs Health* 2016;39(4):263-76.
2. Eryilmaz G, Ozdemir F. Evaluation of menstrual pain management approaches by Northeastern Anatolian adolescents. *Pain management nursing : official journal of the American Society of Pain Management Nurses* 2009;10(1):40-7.
3. Kato T. Effects of Flexibility in Coping with Menstrual Pain on Depressive Symptoms. *Pain practice : the official journal of World Institute of Pain* 2017;17(1):70-77.
4. Zhu X, Wong F, Bensoussan A, Lo SK, Zhou C, Yu J. Are there any cross-ethnic differences in menstrual profiles? A pilot comparative study on Australian and Chinese women with primary dysmenorrhea. *The journal of obstetrics and gynaecology research* 2010;36(5):1093-101.
5. Abdul-Razzak KK, Ayoub NM, Abu-Taleb AA, Obeidat BA. Influence of dietary intake of dairy products on dysmenorrhea. *The journal of obstetrics and gynaecology research* 2010;36(2):377-83.
6. Agarwal AK, Agarwal A. A study of dysmenorrhea during menstruation in adolescent girls. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine* 2010;35(1):159-64.
7. Loto OM, Adewumi TA, Adewuya AO. Prevalence and correlates of dysmenorrhea among Nigerian college women. *The Australian & New Zealand journal of obstetrics & gynaecology* 2008;48(4):442-4.
8. Chang YT, Chen YC. Menstrual Health Care Behavior and Associated Factors Among Female Elementary Students in the Hualien Region. *Journal of Nursing Research* 2008;16(1):9.
9. Chiou MH, Wang HH. Predictors of Dysmenorrhea and Self-Care Behavior Among Vocational Nursing School Female Students. *Journal of Nursing Research* 2008;16(1):17-25.
10. Cheng HF, Lin YH. Selection and efficacy of self-management strategies for dysmenorrhea in young Taiwanese women. *Journal of clinical nursing* 2011;20(7-8):1018-25.
11. Palmer D. "To Help a Million Sick, You Must Kill a Few Nurses": Nurses' Occupational Health, 1890–1914. *Nursing History Review* 2012;20(1):14-45.
12. Laschinger HK, Grau AL. The influence of personal dispositional factors and organizational resources on workplace violence, burnout, and health outcomes in new graduate nurses: a cross-sectional study. *International journal of nursing studies* 2012;49(3):282-91.

13. Payne LA, Rapkin AJ, Lung KC, Seidman LC, Zeltzer LK, Tsao JC. Pain Catastrophizing Predicts Menstrual Pain Ratings in Adolescent Girls with Chronic Pain. *Pain Med* 2016;17(1):16-24.
14. Berkley KJ, McAllister SL. Don't dismiss dysmenorrhea! *Pain* 2011;152(9):1940-1.
15. Chiu MH, Wang HH, Hsu SC, Liu IP. Dysmenorrhoea and self-care behaviours among hospital nurses: a questionnaire survey. *Journal of clinical nursing* 2013;22(21-22):3130-40.
16. Wong LP. Attitudes towards dysmenorrhoea, impact and treatment seeking among adolescent girls: a rural school-based survey. *The Australian journal of rural health* 2011;19(4):218-23.
17. Zukr SM, Naing L, Hamzah TNT, Hussain NHN. Primary Dysmenorrhea among Medical and Dental University Students in Kelantan: Prevalence and Associated Factors. *International Medical Journal* 2009;16(2):93-99.
18. Lu I-C. Dysmenorrhea and related factors in Taiwanese adolescent girls. *University of Texas at Austin* 2010.
19. Chang C, Chen FL, Chang CH, Hsu CH. A preliminary study on menstrual health and menstrual leave in the workplace in Taiwan. *Taiwan J Public Health* 2011;30(5):436-50.
20. Schluter PJ, Turner C, Huntington AD, Bain CJ, McClure RJ. Work/life balance and health: the Nurses and Midwives e-cohort study. *International Nursing Review* 2011(58):28-36.
21. Cady RK, Diamond ML, Diamond MP, Ballard JE, Lener ME, Dorner DP, et al. Sumatriptan-naproxen sodium for menstrual migraine and dysmenorrhea: satisfaction, productivity, and functional disability outcomes. *Headache* 2011;51(5):664-73.
22. Bettendorf B, Shay S, Tu F. Dysmenorrhea: contemporary perspectives. *Obstetrical and Gynecological Survey* 2008;63(9):597-603.
23. Perry M. Treatment options for dysmenorrhoea. *Practice Nursing* 2012;23(4):4.
24. Ju H, Jones M, Mishra GD. Smoking and trajectories of dysmenorrhoea among young Australian women. *Tobacco control* 2016;25(2):195-202.
25. Chiou MH, Wang HH. The Relationship Between Dysmenorrhea and Menstrual Attitudes Among Female Students in Vocational Nursing Schools. *The Journal of Nursing* 2004;51(4):45-52.
26. Parker MA, Sneddon AE, Arbon P. The menstrual disorder of teenagers (MDOT) study: determining typical menstrual patterns and menstrual disturbance in a large population-based study of Australian teenagers. *BJOG : an international journal of obstetrics and gynaecology* 2010;117(2):185-92.

27. Stubbs ML. Cultural perceptions and practices around menarche and adolescent menstruation in the United States. *Annals of the New York Academy of Sciences* 2008;1135:58-66.
28. Cheng CY, Yang K, Liou SR. Taiwanese adolescents? gender differences in knowledge and attitudes towards menstruation. *Nursing & Health Sciences* 2007;9(2):127-34.
29. H LY. The Medical Utilization of Chinese and Western Medicine in Females with Dysmenorrhea. Kaohsiung Medical University, 2012.
30. Chiou M-H, Wang H-H, Yang Y-H. Effect of Systematic Menstrual Health Education on Dysmenorrheic Female Adolescents' Knowledge, Attitudes, and Self-care Behavior. *Kaohsiung J Med Sci* 2007;23(4):183-90.
31. S L. Prevalence and Associated Factors of Premenstrual Syndrome Among Nurses in Taiwan. In: Ministry of Science and Technology, R. O. C., editor, 1994.
32. Morrison LA, Larkspur L, Calibuso MJ, Brown S. Women's Attitudes About Menstruation and Associated Health and Behavioral Characteristics. *American Journal of Health Behavior* 2010;34(1):90-100.
33. Brooks-Gunn J, Ruble D. The menstrual attitude questionnaire. *Psychosomatic medicine* 1980;42:503-11.
34. Lin YX. *When "Experts" Meet the Medical Professionals: The Women with Menstrual Pain Encountering Western Medicine*. Kaohsiung Medical University, Taiwan, 2006.
35. Chung F, Yao C, Wan G. The associations between menstrual function and life style/working conditions among nurses in Taiwan. *Journal of occupational health* 2005;47(2):149-56.
36. Nagata C, Hirokawa K, Shimizu N, Shimizu H. Associations of menstrual pain with intakes of soy, fat and dietary fiber in Japanese women. *European journal of clinical nutrition* 2005;59(1):88-92.
37. Takeuchi H, Oishi T, Harada T. Morningness-eveningness preference, and mental and physical symptoms during the menstrual cycle of Japanese junior high school students. *Sleep and Biological Rhythms* 2003(1):245-47.
38. Firat MZ, Kulakac O, Oncel S, Akcan A. Menstrual Attitude Questionnaire: confirmatory and exploratory factor analysis with Turkish samples. *Journal of advanced nursing* 2009;65(3):652-62.

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Running head

Dysmenorrhea and influencing factors

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Influencing factors of dysmenorrhea among hospital nurses: A questionnaire survey in Taiwan

ABSTRACT

Objectives: Nurses are at high risk for dysmenorrhea while working closely with patients. The study objectives were to: (1) describe basic demographic data and menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitudes of dysmenorrheal and non-dysmenorrheal hospital nurses; (2) analyze the demographic data and menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitudes of the both groups, and identify significant differences between the groups; and (3) examine influencing factors of dysmenorrhea among them.

Methods: This cross-sectional survey used a structured questionnaire, administered at two hospitals in southern Taiwan. Participants included full-time hospital nurses at least 18 years of age and agreed to participate. All participants were recruited through random sampling. The questionnaire included demographic data, the Dysmenorrhea Knowledge Scale, and Menstrual Attitude Scale (MAS).

Results: A total 420 nurses completed the questionnaire. Among them, 297 (70.7%)

had experienced dysmenorrhea in the past 6 months; 123 (29.3%) had not. Significant differences in age ($p < 0.001$), marital status ($p < 0.001$), childbearing status ($p < 0.001$), age of menarche ($p < 0.05$), and rotating three-shift ratio ($p < 0.05$) were identified between the dysmenorrhea and non-dysmenorrhea groups. Analysis of MAS results revealed significant differences between the groups regarding consideration of menstruation as a debilitating ($p < 0.001$) or bothersome event ($p < 0.05$), anticipation and prediction of menstruation onset ($p < 0.01$), and denial of any effects from menstruation ($p < 0.001$). Results of multiple logistic regression showed that predictive factors included age less than 40 years (4.46 vs. 1.00), working three-shift rotations (2.07 vs. 1.00), marital status (2.59 vs. 1.00), acknowledging menstruation as a debilitating event (2.72 vs. 1.00), and denial of effects from menstruation (2.59 vs. 1.00).

Conclusions: These findings could help nursing managers to create a caring climate and friendly work environment for hospital nurses at risk of dysmenorrhea.

Keywords: Dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

STRENGTHS AND LIMITATIONS

- The influencing factors of dysmenorrhea are complex; in this study, multiple logistic regression analysis was used to control for confounding variables and to identify these influencing factors.
- The findings of this study can improve health-promoting self-care and create friendly environments for hospital nurses.
- Participants in this study were aged 22–48 years; therefore. the results have limited application to hospital nurses aged under 22 years and more than 48 years.
- This study was limited in analyzing the effects of lifestyle choices, such as smoking and drinking, because few nurses reported those behaviors.

INTRODUCTION

More than 50% of women experience dysmenorrhea, defined as pain that accompanies menstruation. The majority (75.1%) of women believe dysmenorrhea to be a normal part of their lives and that the symptoms will continue to affect their daily life until they near menopause.[1] Dysmenorrhea occurs during the first 1 to 3 years after menarche and is commonly accompanied by sweating, lack of appetite, headache, distraction, nausea, vomiting, dizziness,[2] and depression.[3] Dysmenorrhea arises during menstrual bleeding owing to lower abdominal pain brought on by menses, with no relevant diagnoses of other gynecological disorders.[4] The prevalence rates of dysmenorrhea differ by age; however, over half of women in all age groups experience dysmenorrhea. The prevalence rate of dysmenorrhea worldwide is between 50.9% and 87.4%.[5-7] Parker et al. found that 21% of Australian adolescents experienced severe dysmenorrhea, with 26% having school absences due to dysmenorrhea.[8]

In Taiwan, adolescent vocational nursing students 16–18 years of age had a reported dysmenorrhea prevalence rate of 73.3%;[9] another study reported a rate of 90.2% among the general population of women in Taiwan.[10] A study on hospital nurses in Taiwan reported a prevalence rate of 90.7%.[11] Despite the high prevalence of dysmenorrhea, nurses often neglect their own health while working and caring for

patients.[12]

Dysmenorrhea can be cyclical or chronic; in some cases, it can be a possible result of pain catastrophizing and anxiety sensitivity.[13] Dysmenorrhea not only causes physical pain, it also affects mental well-being and quality of life, leading to work or school absenteeism and significant health burdens.[14-18] Despite its high prevalence rate and effect on daily life, 76.1% of women still believe that dysmenorrhea is a natural part of a women's menstrual cycle, and only 14.8% believe that treatment is necessary.[16] In terms of dysmenorrhea information, 62.3% of adolescent girls claim that they learned about the condition from their mothers, and 52.9% state that they obtained their knowledge from peers.[16] In addition, dysmenorrhea is negatively correlated with self-awareness of one's own health; in other words, individuals with dysmenorrhea have poorer self-awareness regarding their own health.[6]

A study of 297 nurses (average age 30.3 years) found that 8.4% had taken menstrual leave, 11.8% had taken a leave of absence for dysmenorrhea, and 28.6% saw their doctors owing to the condition.[15] Furthermore, 20.8% of adolescent girls from vocational schools in the same region had seen doctors for dysmenorrhea.[9] Menstrual leave is currently available in Japan, Indonesia, South Korea, and Taiwan. Focus group studies in Taiwan have showed that most women had menstrual discomfort and they understood the implementation and regulation of menstrual leave

in different companies. However, in reality, the application rate is low because of factors expressed as follows: “the regulations are too rigid”, “no one else has taken menstrual leave”, “other kinds of leave are available”, “no one will take my shift”, or “there has to be a doctor’s note”.[19]

Previous studies have showed that the physical and mental health of nurses are significantly correlated with job satisfaction, tiredness, and comfort.[19, 20] The Gender Equality in Employment Act of Taiwan, approved in 2002, clearly defines the regulations regarding menstrual leave, in which a female employee who has trouble working due to discomfort during menstruation should take 1 day of menstrual leave every month.[21] However, because of the particularities of nursing, temporary leave affects the allocation of nurses. Cheng found that the long-term use of medication to maintain a ready-to-work status is common among women. Nurses, who have frequent contact with drugs, use them extensively to overcome menstrual discomfort at work,[10] including the use of sumatriptan–naproxen sodium to reduce the effects of dysmenorrhea during work and leisure.[21, 22]

Several risk factors affect dysmenorrhea, as follows. (a) Age: older women are generally less likely to have dysmenorrhea, although the relationships with marital status or childbirth history remain unclear. (b) Age of menarche: age of menarche is significantly related to the occurrence of dysmenorrhea, with women who have an

earlier age of menarche more likely to experience more severe dysmenorrhea.[7, 17] (c) Duration of menstrual cycle: a Nigerian study noted that longer menstrual flow is an important predictive factor of dysmenorrhea.[7] (d) Regularity of menstrual cycle: women with irregular menstrual cycles are more likely to have dysmenorrhea.[9] In terms of lifestyle factors, the results of several studies indicate that smoking and alcohol consumption are risk factors for primary dysmenorrhea and that women who habitually smoke or drink alcohol are more likely to have dysmenorrhea.[23, 24] With regard to work, several studies have found that women who work rotations, especially nurses who have to alternate between day and night shifts, have relatively more serious menstrual discomfort.[21] Nurses who work night shifts are more likely to have dysmenorrheal symptoms during their menstrual cycles compared with those who work regular shifts.[15]

Furthermore, the attitudes of adolescent students toward menstruation correlate with the occurrence of dysmenorrhea.[25] Adolescent girls who tend to feel that menstruation is a debilitating experience and those who anticipate and predict the onset of menstruation are more likely to experience dysmenorrhea.[26] The effect of dysmenorrhea on women varies based on the degree and frequency of their pain.

Previous studies have revealed that women have inadequate knowledge about menstruation and that educational information about menstrual health care contains

contradictory messages, including the idea that menstruation is a normal and natural event but should be "invisible".[27] Cheng observed that some female students knew about menstruation taboos; while they had doubts about those taboos, they still had negative attitudes about menstruation.[28] Medical expenses due to dysmenorrhea increase with age; therefore, the topic of women's menstrual health and accompanying emotional challenges should be taken seriously.[29] Nevertheless, because dysmenorrhea is so common, many women consider it a normal phenomenon and rarely seek medical treatment owing to their cultural and religious attitudes [15] or because they feel that they can tolerate the pain.[23]

In this study, we define dysmenorrhea as lower abdominal pain brought on by menses at any time during the last 6 months.[11] In Taiwan, 98.8% of hospital nurses are women. There is a high prevalence rate of dysmenorrhea among women; owing to the nature of nursing work, nurses are at high risk for dysmenorrhea. However, previous studies on nurses have not discussed the influencing factors. The objectives of this study were to: (1) describe the basic demographic data as well as menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitudes of dysmenorrheal and non-dysmenorrheal clinical nurses; (2) analyze the demographic data as well as menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitudes of dysmenorrheal and non-dysmenorrheal clinical nurses, and

identify significant differences between these groups; and (3) examine the risk factors of dysmenorrhea among clinical nurses.

METHODS

Study design and participants

This study used a cross-sectional questionnaire survey based on structured questionnaires for data collection. Participants were recruited at two medical institutions in southern Taiwan; one institution was a medical center with 1,300 beds, the other was a regional hospital with 650 beds. The two institutions were at different hospital levels within the same health care system. All 2,000 nurses at the two institutions were potential participants. The inclusion criteria for this study were full-time nurses at the study hospitals who were at least 18 years of age and agreed to participate in the study after reading an informed consent document. The sample size was estimated using JMP 7.0 (SAS Institute, Cary, NC, USA) with an effect size of 0.3, α of 0.05, and a power of 0.80, resulting in a required sample size of 350 individuals. With a predicted questionnaire recovery rate of 80%, the sample size was estimated to be 438. We used simple random sampling to recruit the estimated number of study participants. Each participant was chosen randomly and entirely by chance. In total, 450 nurses were chosen for inclusion in the study. Among these 450 nurses,

finally 420 valid questionnaires were returned, with a response rate of 93.3%. Among these 420 nurses, 297 (70.7%) had experienced dysmenorrhea in the past 6 months and were categorized in the dysmenorrhea group; 123 (29.3%) nurses who had not experienced dysmenorrhea were classified as the non-dysmenorrhea group.

Random sampling was conducted after the study received approval from the Institutional Review Boards (IRBD No. CLH0088) of the two hospitals. The questionnaires were administered to the nurses by a trained research assistant. All participants provided their written consent and answered the questionnaires independently. The written consent form indicated that participation in this study was not compulsory and the questionnaire was anonymous. Anyone who was not willing to participate in the study could simply choose not to return the questionnaire. No individual rights or interests were compromised during this process. Those who completed the questionnaire received a small gift. The questionnaires were collected 2 weeks after being issued, upon which the written consent forms and questionnaires were filed separately and placed in locations chosen by participants, to protect their personal privacy.

Measurements

This study was conducted in May 2010. The study instruments included the

Demographic Inventory (DI), Dysmenorrheal Knowledge Scale (DKS), and Menstrual Attitude Scale (MAS). The DI was designed based on related studies [9, 30] and included age, age of menarche, marital and childbirth status, discussion of menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea, working conditions, self-care health education experience regarding menstruation, dysmenorrhea influences, and work coping methods. The DKS was designed using both the researchers' clinical experiences and previous studies.[30] The scale included 20 questions with yes/no answers, for example, "Women with dysmenorrhea are at high risk for sterility" and "Applying hot compresses to the lower abdomen can ease menstrual cramps". Correct answers received a score of 1, and incorrect answers received a score of 0. The total summed scores ranged from 0 to 20, with higher scores representing a better knowledge of dysmenorrhea. The Kuder-Richardson reliability coefficient was 0.63 in a previous study[30] and 0.72 in this study. The MAS was developed by Brooks-Gunn and Ruble (1980)[31] and modified by Lee (1994). Lee translated this scale into a Chinese version and deleted one items owing to cultural differences.[32] The Chinese version of MAS includes 32 items with five dimensions, including consideration of menstruation as a debilitating event, menstruation as a bothersome event, menstruation as a natural event, anticipation and prediction of the onset of menstruation, and denial of the effects of menstruation. Each item is scored

on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The total summed scores range from 32 to 224, with higher scores representing a more positive attitude toward menstruation. Cronbach's α was 0.58 in the original scale[31] and 0.61 in Morrison's study.[33] Lo and Lin (1998) suggested that an acceptable Cronbach's α was from 0.3 to 0.7.[34] As we were concerned about comparability with other studies, we decided to use this scale with a Cronbach's α of 0.57 in the present study.

Data analysis

The data in this study were entered using Microsoft Excel. JMP 7.0 was used for statistical analysis. Based on the study variables and objectives, percentage, mean, and standard deviation were used to describe participant demographics and menstruation characteristics as well as DKS and MAS distributions in the dysmenorrhea and non-dysmenorrhea groups. We used *t*-tests and chi-square tests to detect differences in demographics, menstruation characteristics, DKS, and MAS between the two groups. Finally, multiple logistic regression analysis was used to examine influencing factors (independent variables) of the occurrence of dysmenorrhea (dependent variable). Independent variables with significant differences were included in the multiple logistic regression analysis.

RESULTS

A total of 420 participants completed the questionnaire. Among them, 297 (70.7%) had experienced dysmenorrhea in the past 6 months, and 123 (29.3%) had not. Compared with the non-dysmenorrhea group, participants with dysmenorrhea were significantly younger ($t = -3.78$, $p < 0.001$), had a higher percentage of unmarried status (77.78%, $\chi^2 = 20.03$, $p < 0.001$), had no childbirth experience (83.16%, $\chi^2 = 19.38$, $p < 0.001$), had a higher percentage of age of menarche less than 12 years (15.49%, $\chi^2 = 4.70$, $p = 0.03$), and a higher percentage worked a three-shift rotation (91.25%, $\chi^2 = 6.06$, $p = 0.014$). The other variables showed no significant difference between the two groups (Table 1).

Table 1. Comparison of demographic and menstruation characteristics between the dysmenorrhea and non-dysmenorrhea groups

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t or χ^2	p-value
	n	%	n	%		
Age (years) M± SD	30.33± 3.61		32.04±4.47		-3.78	<0.001
Age＜40	292	98.32	115	93.50	6.74	<0.01
Age≧40	5	1.68	8	6.50		
Marital status					20.03	<0.001
Unmarried	231	77.78	69	56.10		
Married	66	22.22	54	43.90		
Childbearing					19.38	<0.001
No	247	83.16	78	63.41		
Yes	50	16.84	45	36.59		
Age of menarche					4.70	0.030
＜12	46	15.49	11	8.94		
≧12	251	84.51	112	91.06		
Regularity of menstrual cycle					0.10	0.755
Yes	193	64.98	85	69.11		
No	104	35.02	38	30.89		
Duration of menstrual cycle					1.99	0.575
≦4 days	110	37.04	43	34.96		
5-6 days	157	52.86	70	56.91		
≧7 days	30	10.10	10	8.13		
Prior health education on dysmenorrhea					0.99	0.321
No	163	54.88	74	60.16		
Yes	134	45.12	49	39.84		
Three-shift rotation					6.06	0.014
Yes	271	91.25	102	82.93		
No	26	8.75	21	17.07		

Table 1. Comparison of Demographic and Menstruation Characteristics Between Dysmenorrheal and Non-Dysmenorrheal Groups (continue)

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t or χ^2	p-value
	n	%	n	%		
Whether to know it is allowed to ask for menstrual leave					2.03	0.154
Yes	242	81.48	107	86.99		
No	55	18.52	16	13.01		
Whether to consider menstrual leave necessary					1.68	0.195
Yes	288	96.97	115	93.50		
No	9	3.03	8	6.50		
Have ever asked for menstrual leave					0.14	0.707
No	272	91.58	114	92.68		
Yes	25	8.42	9	7.32		
Have ever asked for more leaves for dysmenorrhea?					3.59	0.058
No	262	88.22	116	94.31		
Yes	35	11.78	7	5.69		
Secondary dysmenorrhea					0.02	0.886
No	267	89.90	110	89.43		
Yes	30	10.10	13	10.57		

Note: Regularity of periods means that the duration between consecutive first-day menses is similar.

With respect to knowledge about dysmenorrhea, there was a non-significant difference between the two groups (p = 0.238). The highest scoring items among both groups were “applying hot compresses”, “adopting a knee-to-chest position”, and “drinking hot beverages including warm water or milk or ginger soup to ease cramps.” The lowest scoring items were “normal bleeding amount every cycle”, “dysmenorrhea

is a disease of the reproductive system", and "women with dysmenorrhea are at high risk for sterility." Regarding menstrual attitudes, after standardizing, the highest scoring dimension among the dysmenorrhea group was "considering menstruation a debilitating event" (73.30) and "considering menstruation a natural event" (74.93) in the non-dysmenorrhea group. The lowest scoring dimension in both groups was "denial of any effect of menstruation" (47.18 in the dysmenorrhea group and 54.69 in the dysmenorrhea group). Women with dysmenorrhea had significantly higher scores than women in the non-dysmenorrhea group with respect to the following: considering menstruation a debilitating event ($p < 0.001$), considering menstruation a bothersome event ($p = 0.024$), and anticipation and prediction of menstruation onset ($p = 0.004$). In terms of denying the effects of menstruation, scores for the dysmenorrhea group were significantly lower than those of the non-dysmenorrhea group ($p < 0.001$). No significant differences were observed between the groups in terms of considering menstruation a natural event (Table 2).

Table 2. Comparison of dysmenorrheic knowledge and menstrual attitude between the dysmenorrhea and non-dysmenorrhea groups

Variables		Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t-value	p-value
		M	SD	M	SD		
Dysmenorrheic	knowledge	14.12	2.19	13.40	2.40	1.18	0.238

scale						
Menstrual attitude scale	148.64	12.74	146.85	12.69	1.31	0.192
Menstruation as a debilitating event	56.44	8.52	52.55	7.65	4.58	<0.001
Menstruation as a bothersome event	29.05	5.01	27.54	6.64	2.27	0.024
Menstruation as a natural event	19.98	5.19	20.98	4.92	-1.87	0.062
Anticipation and prediction of the onset of menstruation	20.04	3.01	18.98	3.55	2.93	0.004
Denial of any effect of menstruation	23.12	6.75	26.80	5.70	5.70	<0.001

We conducted a multiple logistic regression analysis using dysmenorrhea and non-dysmenorrhea as dependent variables and significant differences between the variables of demographics, menstruation characteristics, DKS, and MAS as predictors. The results of the analysis showed that crucial predictive factors for the occurrence of dysmenorrhea among hospital nurses include age less than 40 years, working three-shift rotations, and marital status. In terms of menstrual attitudes, using the mean as the contact point, the tendency to consider menstruation to be a debilitating event and the tendency to deny the effects of menstruation were also predictive factors for dysmenorrhea occurrence. The adjusted odd ratios are shown in Table 3.

After controlling for working three-shift rotations, marital status, the tendency to consider menstruation a debilitating event, and the tendency to deny the effects of menstruation, the rate of occurrence of dysmenorrhea in women younger than 40

years was 4.46 times higher than that in women over 40 years of age. After controlling for age, marital status, the tendency to consider menstruation a debilitating event, and tendency to deny the effects of menstruation, the dysmenorrhea occurrence rate for nurses who worked three-shift rotations was 2.07 times higher than that in nurses who did not. After controlling for age, working three-shift rotations, marital status, and the tendency to deny the effects of menstruation, participants who felt that menstruation was a debilitating event had a dysmenorrhea occurrence rate that was 2.72 times higher than that of participants who did not. After controlling for age, working three-shift rotations, marital status, and the tendency to think of menstruation as a debilitating event, women who did not acknowledge the effects of menstruation had a dysmenorrhea occurrence rate that was 2.59 times higher than that in women who did not deny these effects.

Table 3: Risk factors of dysmenorrhea

		Crude OR	95% CI	P-Value	Adjusted OR	95% CI	P-Value
Age	Age＜40	4.06	(1.33 , 13.7)	＜0.05	4.46	(1.24 , 17.23)	＜0.05
	Age≧40	1.00	(- , -)		1.00	(- , -)	
Three-shift rotationt	Yes	2.15	(1.15 , 3.98)	＜0.05	2.07	(1.01 , 4.21)	＜0.05
	No	1.00	(- , -)		1.00	(- , -)	
Married	No	2.74	(1.75 , 4.30)	<0.001	2.59	(1.57 , 4.28)	<0.001

	Yes	1.00	(- , -)		1.00	(- , -)	
Menstruation as a debilitating event	Higher	2.53	(1.63 , 3.95)	<0.001	2.72	(1.67 , 4.52)	<0.001
	Lower	1.00	(- , -)		1.00	(- , -)	
Denial of any effect of menstruation	Lower	2.83	(1.83 , 4.46)	<0.001	2.59	(1.61 , 4.23)	<0.001
	Higher	1.00	(- , -)		1.00	(- , -)	

Reference group: Age ≧40 years, no three-shift rotation, unmarried, reduced menstruation as a debilitating event, and increased denial of any effect on menstruation

CI, confidence interval; OR, odds ratio; SE, standard error.

DISCUSSION

Although the average age of participants in the dysmenorrhea group was significantly lower than that of women in the non-dysmenorrhea group, when age was the only variable being compared, the dysmenorrhea occurrence rate of nurses younger than 40 years was 4.06 times higher than that of nurses over age 40 years; after controlling for confounding variables, the rate of dysmenorrhea in younger women was 4.46 times higher than that in women over 40 years old. Therefore, age was a risk factor for dysmenorrhea. To our knowledge, no other studies have directly discussed the correlation between age and dysmenorrhea. However, previous studies have reported dysmenorrhea occurrence rates over 76% in adolescent girls or students,[5, 6, 16] compared with a rate of 55.9% in a study among women aged 15–45-years,[31] with a

decrease in the occurrence with increasing age. As dysmenorrhea is very common, periodic dysmenorrhea comes naturally with the menstrual cycle. With age, experiences of dysmenorrhea and coping among women also increase; therefore, women with dysmenorrhea can be thought of as "female specialists with embodied knowledge," meaning that their experiences may affect their subjective perception and tolerance of dysmenorrhea, which can in turn affect the occurrence of dysmenorrhea.[35] Nursing is a female-dominated occupation in Taiwan. In this study, 97% of participants were younger than 40 years old. The high prevalence rate of dysmenorrhea severely affects nurses such that they may not be able to focus on their work, thereby affecting the quality of patient care. Nurses may need to take menstrual leave, which can cause a shortage of nursing resources.

In terms of marital status, the unmarried ratio in the dysmenorrhea group was 2.74 times that of the non-dysmenorrhea group, indicating a high dysmenorrhea occurrence rate among unmarried women; after adjusting for confounding variables, it was 2.59 times higher than that among married women. This result is consistent with those of Chung (average study participant age 27 years), which reported a higher dysmenorrhea occurrence rate in single nurses than in married and divorced ones.[36] Many women are told by their doctors that their dysmenorrhea will improve after getting married and giving birth, which may improve menstrual blood discharge.

Furthermore, women may engage in positive self-care for menstruation after getting married for childbearing reasons, which may also be a factor that indirectly relieves dysmenorrhea.[11] In terms of work, the dysmenorrhea occurrence rate among nurses in the dysmenorrhea group who worked three-shift rotations was 2.15 times that of nurses in the non-dysmenorrhea group; after adjusting for confounding variables, it was 2.07 times higher than among nurses who did not work three-shift rotations. This indicates that work type (e.g., rotating nightshifts) is a risk factor for dysmenorrhea in nurses. However, Chung found that rotating work shifts were not significantly related to dysmenorrhea occurrence in nurses.[36] Furthermore, one study among Japanese junior high school students also found that nightshift work was not significantly associated with dysmenorrhea.[37] However, an interview of focus groups conducted by Chang found that working rotating shifts was highly associated with menstrual discomfort.[19] Owing to the nature of nursing work, most nurses need to work rotating night shifts, and the graveyard shift can easily cause uncomfortable menstrual cycles or obvious irregularities.[25] Coupling nurses' day/night activities and sleep patterns with the increased pressure of working night shifts, menstrual discomfort may be more common in those with frequent rotation changes.

In terms of menstrual attitude, the dysmenorrhea group had significantly higher scores than the non-dysmenorrhea group in considering menstruation to be a

debilitating event and significantly lower scores than the non-dysmenorrhea group in denying the effects of menstruation. In multiple logistic regression for menstrual attitude, the tendency to consider menstruation as a debilitating event in the dysmenorrhea group was 2.53 times higher than that of the non-dysmenorrhea group; after adjusting for confounding variables, women with dysmenorrhea had a 2.72 times higher tendency to think of menstruation as a debilitating event than women who did not consider menstruation to be debilitating. The tendency to deny the effects of menstruation in the dysmenorrhea group was 2.83 times higher than the non-dysmenorrhea group; after adjusting for confounding variables, women with dysmenorrhea had a 2.59 times higher tendency to deny the effects of menstruation. In this study, menstrual attitude was related to dysmenorrhea occurrence. Firat found no significant correlation between menstrual discomfort and menstrual attitude.[38] In that study among vocational nursing students with dysmenorrhea, "menstruation is a debilitating event" and "anticipation and prediction of the onset of menstruation" scored significantly higher than in those who did not have dysmenorrhea. In terms of "menstruation is a bothersome event" and "menstruation is a natural event," the non-dysmenorrhea group scored significantly higher than the dysmenorrhea group; no significant differences were observed between the two groups in terms of "denial of any effect of menstruation".[26] These results are different from those of the present

study. The most obvious difference between the two studies is the tendency to deny the effects of menstruation. Scores in the dysmenorrhea and non-dysmenorrhea groups in the present study were 23.1 and 26.8, respectively, compared with 26.6 and 28.0 among adolescent nursing students in Firat's study. In other words, compared with adolescent nursing students, nurses in the present study did not deny the effects caused by menstruation and recognized that they were affected by menstruation. When a nurse experiences dysmenorrhea, her work may be affected. If she requests menstrual leave, temporary work arrangements must be made and patient care may be affected. Because dysmenorrhea is a periodic phenomenon, taking frequent menstrual leave may affect working relationships; therefore, nurses usually choose to work even when they experience dysmenorrhea.

In summary, influencing factors for dysmenorrhea occurrence included age under 40 years, working three-shift rotations, marital status, and using mean as the contact point, the tendency to consider menstruation to be a debilitating event and tendency to deny the effects of menstruation. Chiou's study of adolescent nursing students found that menstrual regularity and health education were predictive factors for dysmenorrhea.[30] Women who had irregular menstrual cycles and had not received dysmenorrhea-related health education had higher dysmenorrhea occurrence rates;[9] however, these two factors were not predictive factors in the present study. Our

participants were nurses from a wide range of age groups rather than only adolescents; therefore, they had more experience with dysmenorrhea and self-care. In addition, menstrual health is a part of nursing education; therefore, although nurses are not directly involved in health education, education is a part of their professional training. Thus, health education was not an important predictive factor in this study. This study mainly evaluated the influencing factors for dysmenorrhea in hospital nurses with the aim of helping to build a caring climate and friendly work environment for high-risk nurses. The participants were randomly selected nurses from only two hospitals in southern Taiwan; therefore, the results might have limited generalizability to nurses in other parts of the country. In future studies, inclusion criteria should be extended to examine any differences between different areas of Taiwan. In addition, rotating night shifts are required in many other occupations besides nursing. Considering different professional backgrounds and life experiences, future studies should also include women from different occupations who work rotating shifts, to evaluate differences in the influence of their knowledge and attitudes on dysmenorrhea occurrence. The variables assessed in this study included demographic characteristics, menstruation history, dysmenorrhea knowledge, and menstrual attitudes, among others; however, lifestyle choices such as smoking, drinking, and exercising were not included. Future studies are necessary to analyze the effects of these lifestyle choices on dysmenorrhea.

CONCLUSIONS

We assessed various influencing factors for dysmenorrhea occurrence with the aim of helping nursing managers to offer appropriate assistance for high-risk groups and build a caring climate and friendly environment for at-risk hospital nurses. One example of this is hospital nursing managers can assist nurses who are at risk for dysmenorrhea by setting up a more accommodating system of working hours that is based on nurses' menstrual cycle. Because women with dysmenorrhea do not necessarily need to take an entire day off of work, if a supportive environment can be created that allows them to take a break from work to apply hot compresses or drink hot beverages, their comfort will be improved. Work environments, particularly hospitals, can provide measures such as flexible menstrual leave or scheduling menstrual leave, thereby integrating menstrual self-care into annual occupational safety and health training. In addition, spaces can be provided at work for women to take short breaks and supportive measures can be offered, such as thermotherapy, aromatherapy massage, and others. Such measures will enable nurses to care for themselves at work, thus improving their workplace comfort and increasing their work satisfaction and performance.

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Competing interests

None.

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Contributors

Min-Hui Chiu and Hsiu-Hung Wang designed the study, analyzed and interpreted the data, and drafted the manuscript. Yi-Hsin Yang assisted in defining the statistical analysis. Min-Hui Chiu and Su-Chen Hsu contributed to the data collection and analysis. Hsiu-Fen Hsieh and Huei-Mein Chen assisted to draft the manuscript. All authors had full access to all data in the study and take responsibility for its integrity.

Data sharing statement

No additional data are available.

REFERENCES

1. Chen CX, Kwekkeboom KL, Ward SE. Beliefs about dysmenorrhea and their relationship to self-management. *Res Nurs Health* 2016;39(4):263-76.
2. Eryilmaz G, Ozdemir F. Evaluation of menstrual pain management approaches by northeastern Anatolian adolescents. *Pain management nursing: official journal of the American Society of Pain Management Nurses* 2009;10(1):40-7.
3. Kato T. Effects of flexibility in coping with menstrual pain on depressive symptoms. *Pain practice: the official journal of World Institute of Pain* 2017;17(1):70-77.
4. Zhu X, Wong F, Bensoussan A, Lo SK, Zhou C, Yu J. Are there any cross-ethnic differences in menstrual profiles? A pilot comparative study on Australian and Chinese women with primary dysmenorrhea. *The journal of obstetrics and gynaecology research* 2010;36(5):1093-101.
5. Abdul-Razzak KK, Ayoub NM, Abu-Taleb AA, Obeidat BA. Influence of dietary intake of dairy products on dysmenorrhea. *The journal of obstetrics and gynaecology research* 2010;36(2):377-83.
6. Agarwal AK, Agarwal A. A study of dysmenorrhea during menstruation in adolescent girls. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine* 2010;35(1):159-64.
7. Loto OM, Adewumi TA, Adewuya AO. Prevalence and correlates of dysmenorrhea among Nigerian college women. *The Australian & New Zealand journal of obstetrics & gynaecology* 2008;48(4):442-4.
8. Chang YT, Chen YC. Menstrual health care behavior and associated factors among female elementary students in the Hualien region. *Journal of Nursing Research* 2008;16(1):11-6.
9. Chiou MH, Wang HH. Predictors of dysmenorrhea and self-care behavior among vocational nursing school female students. *Journal of Nursing Research* 2008;16(1):17-25.
10. Cheng HF, Lin YH. Selection and efficacy of self-management strategies for dysmenorrhea in young Taiwanese women. *Journal of clinical nursing* 2011;20:1018-25.
11. Palmer D. "To help a million sick, you must kill a few nurses": Nurses' occupational health, 1890–1914. *Nursing History Review* 2012;20(1):14-45.
12. Laschinger HK, Grau AL. The influence of personal dispositional factors and organizational resources on workplace violence, burnout, and health outcomes in new graduate nurses: a cross-sectional study. *International journal of nursing studies* 2012;49(3):282-91.
13. Payne LA, Rapkin AJ, Lung KC, Seidman LC, Zeltzer LK, Tsao JC. Pain catastrophizing predicts menstrual pain ratings in adolescent girls with chronic pain. *Pain Med* 2016;17(1):16-24.

14. Berkley KJ, McAllister SL. Don't dismiss dysmenorrhea! *Pain* 2011;152(9):1940-1.
15. Chiu MH, Wang HH, Hsu SC, Liu IP. Dysmenorrhoea and self-care behaviours among hospital nurses: a questionnaire survey. *Journal of clinical nursing* 2013;22(22):3130-40.
16. Wong LP. Attitudes towards dysmenorrhoea, impact and treatment seeking among adolescent girls: a rural school-based survey. *The Australian journal of rural health* 2011;19(4):218-23.
17. Zukr SM, Naing L, Hamzah TNT, Hussain NHN. Primary dysmenorrhea among medical and dental university students in Kelantan: Prevalence and associated factors. *International Medical Journal* 2009;16(2):93-99.
18. Lu I-C. Dysmenorrhea and related factors in Taiwanese adolescent girls. *University of Texas at Austin* 2010.
19. Chang C, Chen FL, Chang CH, Hsu CH. A preliminary study on menstrual health and menstrual leave in the workplace in Taiwan. *Taiwan J Public Health* 2011;30(5):436-50.
20. Schluter PJ, Turner C, Huntington AD, Bain CJ, McClure RJ. Work/life balance and health: the nurses and midwives e-cohort study. *International Nursing Review* 2011(58):28-36.
21. Cady RK, Diamond ML, Diamond MP, Ballard JE, Lener ME, Dorner DP, et al. Sumatriptan-naproxen sodium for menstrual migraine and dysmenorrhea: satisfaction, productivity, and functional disability outcomes. *Headache* 2011;51(5):664-73.
22. Bettendorf B, Shay S, Tu F. Dysmenorrhea: contemporary perspectives. *Obstetrical and Gynecological Survey* 2008;63(9):597-603.
23. Perry M. Treatment options for dysmenorrhoea. *Practice Nursing* 2012;23(4):4.
24. Ju H, Jones M, Mishra GD. Smoking and trajectories of dysmenorrhoea among young Australian women. *Tobacco control* 2016;25(2):195-202.
25. Chiou MH, Wang HH. The relationship between dysmenorrhea and menstrual attitudes among female students in vocational nursing schools. *The Journal of Nursing* 2004;51(4):45-52.
26. Parker MA, Sneddon AE, Arbon P. The menstrual disorder of teenagers (MDOT) study: determining typical menstrual patterns and menstrual disturbance in a large population-based study of Australian teenagers. *BJOG : an international journal of obstetrics and gynaecology* 2010;117(2):185-92.
27. Stubbs ML. Cultural perceptions and practices around menarche and adolescent menstruation in the United States. *Annals of the New York Academy of Sciences* 2008;1135:58-66.

28. Cheng CY, Yang K, Liou SR. Taiwanese adolescents? Gender differences in knowledge and attitudes towards menstruation. *Nursing & Health Sciences* 2007;9(2):127-34.
29. H LY. The medical utilization of chinese and western medicine in females with dysmenorrhea. Kaohsiung Medical University, 2012.
30. Chiou M-H, Wang H-H, Yang Y-H. Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior. *Kaohsiung J Med Sci* 2007;23(4):183-90.
31. Brooks-Gunn J, Ruble D. The menstrual attitude questionnaire. *Psychosomatic medicine* 1980;42:503-11.
32. S L. Prevalence and associated factors of premenstrual syndrome among nurses in Taiwan. In: Ministry of Science and Technology, R. O. C., editor, 1994.
33. Morrison LA, Larkspur L, Calibuso MJ, Brown S. Women's attitudes about menstruation and associated health and behavioral characteristics. *American Journal of Health Behavior* 2010;34(1):90-100.
34. Lo Sing-Kai, Lin Ching-Fen. On the use and interpretation of Cronbach's alpha. *The Journal of Nursing Research* 1998;6:82-9.
35. Lin YX. *When "Experts" meet the medical professionals: The women with menstrual pain encountering western medicine.* Kaohsiung Medical University, Taiwan, 2006.
36. Chung F, Yao C, Wan G. The associations between menstrual function and life style/working conditions among nurses in Taiwan. *Journal of occupational health* 2005;47(2):149-56.
37. Takeuchi H, Oishi T, Harada T. Morningness-eveningness preference, and mental and physical symptoms during the menstrual cycle of Japanese junior high school students. *Sleep and Biological Rhythms* 2003(1):245-47.
38. Firat MZ, Kulakac O, Oncel S, Akcan A. Menstrual attitude questionnaire: confirmatory and exploratory factor analysis with Turkish samples. *Journal of advanced nursing* 2009;65(3):652-62.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Page No	Recommendation
Title and abstract	1	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		2	(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
		Introduction	
Background/rationale	2	4-8	Explain the scientific background and rationale for the investigation being reported
Objectives	3	4	State specific objectives, including any prespecified hypotheses
		Methods	
Study design	4	9	Present key elements of study design early in the paper
Setting	5	9	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	9	*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	10-12	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	10-12	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	3	Describe any efforts to address potential sources of bias
Study size	10	9	Explain how the study size was arrived at
Quantitative variables	11	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	12	(*a*) Describe all statistical methods, including those used to control for confounding
			(*b*) Describe any methods used to examine subgroups and interactions
			(*c*) Explain how missing data were addressed
			(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
			(*e*) Describe any sensitivity analyses

Continued on next page

		Results	
Participants	13*	9	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
			(b) Give reasons for non-participation at each stage
Descriptive data	14*	13	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	13	*Cross-sectional study*—Report numbers of outcome events or summary measures
Main results	16	13	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
			(*b*) Report category boundaries when continuous variables were categorized
			(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	-	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
		Discussion	
Key results	18	19-24	Summarise key results with reference to study objectives
Limitations	19	3	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	19-24	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	19-24	Discuss the generalisability (external validity) of the study results
		Other information	
Funding	22	26	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Influencing factors of dysmenorrhea among hospital nurses: A questionnaire survey in Taiwan

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Title Page

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Influencing factors of dysmenorrhea among hospital nurses: A questionnaire survey in Taiwan

Running head

Dysmenorrhea and influencing factors

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keywords

Dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

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Influencing factors of dysmenorrhea among hospital nurses: A questionnaire survey in Taiwan

ABSTRACT

Objectives: Nurses are at high risk for dysmenorrhea while working with patients. The study objectives were to: (1) describe demographic and menstruation characteristics, knowledge about dysmenorrhea, and menstrual attitudes towards menstruation among dysmenorrheal and non-dysmenorrheal hospital nurses; (2) identify significant differences between the groups; and (3) examine the factors influencing dysmenorrhea.

Methods: This cross-sectional survey used a structured questionnaire, administered at two hospitals in southern Taiwan. Participants included hospital nurses at least 18 years of age who agreed to participate. All participants were recruited through random sampling. The questionnaire included demographic data, the Dysmenorrhea Knowledge Scale, and Menstrual Attitude Scale (MAS).

Results: A total of 420 nurses completed the questionnaire. Among them, 297 (70.7%) had experienced dysmenorrhea in the past 6 months and 123 (29.3%) had not. Significant differences in age ($p < 0.001$), marital status ($p < 0.001$), childbearing status ($p < 0.001$), age at menarche ($p < 0.05$), and rotating three-shift ratio ($p < 0.05$) were identified between the dysmenorrhea and non-dysmenorrhea groups. Analysis of the MAS results revealed significant differences between the groups regarding consideration of menstruation as a debilitating ($p < 0.001$) or bothersome event ($p < 0.05$), anticipation and prediction of menstruation onset ($p < 0.01$), and denial of any effects from menstruation ($p < 0.001$). Results of the multiple logistic regression

showed that predictive factors included age less than 40 years (4.46 vs. 1.00), working three-shift rotations (2.07 vs. 1.00), marital status (2.59 vs. 1.00), acknowledging menstruation as a debilitating event (2.72 vs. 1.00), and denial of effects from menstruation (2.59 vs. 1.00).

Conclusions: These findings could help nursing managers to create a caring climate and friendly work environment for hospital nurses at risk for dysmenorrhea.

Keywords: Dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

Strengths and limitations of this study

- The factors influencing dysmenorrhea are complex; in this study, multiple logistic regression analysis was used to control for confounding variables and to identify these factors.
- Participants in this study were aged 22–48 years; therefore, the results have limited application to hospital nurses aged under 22 years and above 48 years.
- This study was limited in terms of analyzing the effects of lifestyle choices, such as smoking and alcohol consumption, because only a few nurses reported those behaviors.

INTRODUCTION

More than 50% of women experience dysmenorrhea, defined as pain that accompanies menstruation. The majority (75.1%) of women believe dysmenorrhea to be a normal part of their lives and that the symptoms will continue to affect their daily life until they near menopause.[1] Dysmenorrhea occurs during the first 1 to 3 years after menarche and is commonly accompanied by sweating, lack of appetite, headache, distraction, nausea, vomiting, dizziness,[2] and depression.[3] Dysmenorrhea arises during menstrual bleeding owing to lower abdominal pain brought on by menses, and is not any other gynecological disorders.[4] The prevalence rates of dysmenorrhea differ by age; however, over 50% of women in all age groups experience dysmenorrhea. The prevalence rate of dysmenorrhea worldwide is between 50.9% and 87.4%.[5-7] Parker et al. found that 21% of Australian adolescents experienced severe dysmenorrhea, with 26% requiring absence from school due to dysmenorrhea.[8]

In Taiwan, the reported prevalence rate of dysmenorrhea among adolescent vocational nursing students aged 16–18 years was 73.3%;[9] another study reported a prevalence rate of 90.2% among the general population of women in Taiwan.[10] A study on hospital nurses in Taiwan reported a prevalence rate of 90.7%.[11] Despite the high prevalence of dysmenorrhea, nurses often neglect their own health while working and caring for patients.[12]

Dysmenorrhea can be cyclical or chronic; in some cases, it can be a possible result of pain catastrophizing and anxiety sensitivity.[13] Dysmenorrhea not only causes physical pain, it also affects mental well-being and quality of life, leading to work or school absenteeism and significant health burdens.[14-18] Despite its high prevalence rate and effect on daily life, 76.1% of women still believe that dysmenorrhea is a natural part of a women's menstrual cycle, and only 14.8% believe that treatment is

necessary.[16] In terms of dysmenorrhea information, 62.3% of adolescent girls claim that they learned about the condition from their mothers, and 52.9% state that they obtained their knowledge from peers.[16] In addition, dysmenorrhea is negatively correlated with self-awareness of one's own health; in other words, individuals with dysmenorrhea have poorer self-awareness regarding their own health.[6]

A study of 297 nurses (average age 30.3 years) revealed that 8.4% had taken menstrual leave, 11.8% had taken a leave of absence for dysmenorrhea, and 28.6% saw their doctors owing to the condition.[15] Furthermore, 20.8% of adolescent girls from vocational schools in the same region had visited doctors for consultation regarding dysmenorrhea.[9] Menstrual leave is currently available in Japan, Indonesia, South Korea, and Taiwan. Focus group studies in Taiwan have shown that most women have experienced menstrual discomfort and that they understand the implementation and regulation of menstrual leave in different companies. However, in reality, menstrual leave is rarely availed of owing to the following factors: "the regulations are too rigid," "no one else has taken menstrual leave," "other kinds of leave are available," "no one will take my shift," or "there has to be a doctor's note."[19]

Previous studies have shown that the physical and mental health of nurses is significantly correlated with job satisfaction, tiredness, and comfort.[19, 20] The Gender Equality in Employment Act of Taiwan, approved in 2002, clearly defines the regulations regarding menstrual leave, in which a female employee who has trouble working due to discomfort during menstruation should take 1 day of menstrual leave every month.[21] However, because of the particularities of nursing, temporary leave affects the allocation of nurses. Cheng found that the long-term use of medication to maintain a ready-to-work status is common among women. Nurses, who have frequent contact with drugs, use them extensively to overcome menstrual discomfort

at work,[10] including the use of sumatriptan–naproxen sodium to reduce the effects of dysmenorrhea during work and leisure.[21, 22]

Several risk factors affect dysmenorrhea. (a) Age: older women are generally less likely to experience dysmenorrhea, although the relationships with marital status or childbirth history remain unclear. (b) Age at menarche: age at menarche is significantly related to the occurrence of dysmenorrhea, and women who demonstrate an earlier age at menarche are more likely to experience more severe dysmenorrhea.[7, 17] (c) Duration of menstrual cycle: a Nigerian study noted that longer menstrual flow duration is an important predictive factor of dysmenorrhea.[7] (d) Regularity of menstrual cycle: women with irregular menstrual cycles are more likely to have dysmenorrhea.[9] In terms of lifestyle factors, the results of several studies indicate that smoking and alcohol consumption are risk factors for primary dysmenorrhea and that women who habitually smoke or drink alcohol are more likely to have dysmenorrhea.[23, 24] With regards to work, several studies have found that women who work rotations, especially nurses who have to alternate between day and night shifts, experience relatively more serious menstrual discomfort.[21] Nurses who work night shifts are more likely to experience dysmenorrheal symptoms during their menstrual cycles than those who work regular shifts.[15]

Furthermore, the attitudes of adolescent students toward menstruation correlate with the occurrence of dysmenorrhea.[25] Adolescent girls who tend to feel that menstruation is a debilitating experience and those who anticipate and predict the onset of menstruation are more likely to experience dysmenorrhea.[26] The effect of dysmenorrhea on women varies based on the degree and frequency of their pain.

Previous studies have revealed that women have inadequate knowledge about menstruation and that educational information about menstrual health care contains

contradictory messages, including the idea that menstruation is a normal and natural event but should be "invisible."[27] Cheng observed that some female students knew about menstruation taboos; although they did have doubts about those taboos, they still had negative attitudes towards menstruation.[28] Medical expenses due to dysmenorrhea increase with age; therefore, the topic of women's menstrual health and accompanying emotional challenges should be taken seriously.[29] Nevertheless, because dysmenorrhea is so common, many women consider it a natural phenomenon and rarely seek medical treatment owing to their cultural and religious attitudes [15] or because they feel that they can tolerate the pain.[23]

Herein, we defined dysmenorrhea as lower abdominal pain brought on by menses at any time during the past 6 months.[11] In Taiwan, 98.8% of hospital nurses are women. There is a high prevalence rate of dysmenorrhea among women; owing to the nature of nursing work, nurses are at high risk for dysmenorrhea. However, previous relevant studies on nurses have not discussed the factors influencing dysmenorrhea. The objectives of this study were to: (1) describe the basic demographic data as well as menstruation characteristics, knowledge about dysmenorrhea, and attitudes towards menstruation among dysmenorrheal and non-dysmenorrheal clinical nurses; (2) analyze the demographic data as well as menstruation characteristics, knowledge about dysmenorrhea, and attitudes towards menstruation among dysmenorrheal and non-dysmenorrheal clinical nurses, and identify significant differences between these groups; and (3) examine the risk factors for dysmenorrhea among clinical nurses.

METHODS

Study design and participants

This study used a cross-sectional survey based on structured questionnaires for data collection. Participants were recruited from two medical institutions in southern Taiwan; one institution was a medical center with 1,300 beds, the other was a regional hospital with 650 beds. The two institutions were at different hospital levels within the same health care system. All 2,000 nurses at the two institutions were potential participants. The inclusion criteria for this study were full-time nurses employed at the study hospitals who were at least 18 years of age and agreed to participate in the study after providing informed consent. The sample size was estimated using JMP 7.0 (SAS Institute, Cary, NC, USA) with an effect size of 0.3, α of 0.05, and a power of 0.80, resulting in a required sample size of 350 individuals. With a predicted questionnaire recovery rate of 80%, the sample size was estimated to be 438. After obtaining a list of the names of the potential participants, serial numbers were assigned to each participant. The estimated number of study participants were randomly selected using the sampling function of Microsoft Excel 2007. In total, 450 nurses were chosen for inclusion in the study, and finally, 420 valid questionnaires were returned, yielding a response rate of 93.3%. Among these 420 nurses, 297 (70.7%) had experienced dysmenorrhea in the past 6 months and were classified as the dysmenorrhea group; 123 (29.3%) nurses who had not experienced dysmenorrhea were classified as the non-dysmenorrhea group.

The random sampling was conducted after the study received approval from the Institutional Review Boards (IRBD No. CLH0088) of the two hospitals. The questionnaires were administered to the nurses by a trained research assistant. All participants provided their written consent and answered the questionnaires independently. The written consent form indicated that participation in this study was not compulsory and the questionnaire was anonymous. Anyone who was not willing

to participate in the study could simply choose not to return the questionnaire. No individual rights or interests were compromised during this process. Those who completed the questionnaire received a small gift. The questionnaires were collected 2 weeks after being issued, upon which the written consent forms and questionnaires were filed separately and placed in locations chosen by participants, to protect their personal privacy.

Measurements

This study was conducted in May 2010. The study instruments included the Demographic Inventory (DI), Dysmenorrheal Knowledge Scale (DKS), and Menstrual Attitude Scale (MAS). The DI was designed based on related studies [9, 30] and included age, age at menarche, marital and childbirth status, discussion of menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea, working conditions, self-care health education regarding menstruation, factors affecting dysmenorrhea, and work coping methods. The DKS was designed using both the researchers' clinical experiences and previous studies.[30] The scale included 20 questions with yes/no answers, for example, "Women with dysmenorrhea are at high risk for sterility" and "Applying hot compresses to the lower abdomen can ease menstrual cramps". Correct answers received a score of 1, and incorrect answers received a score of 0. The total summed scores ranged from 0 to 20, with higher scores representing better knowledge of dysmenorrhea. The Kuder-Richardson reliability coefficient was 0.63, according to a previous study[30] and 0.72 in this study. The MAS was developed by Brooks-Gunn and Ruble (1980)[31] and modified by Lee (1994). Lee translated this scale into a Chinese version and deleted one item owing to cultural differences.[32] The Chinese version of the MAS includes 32 items with five

dimensions, including consideration of menstruation as a debilitating event, menstruation as a bothersome event, menstruation as a natural event, anticipation and prediction of the onset of menstruation, and denial of the effects of menstruation. Each item is scored on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The total summed scores range from 32 to 224, with higher scores representing a more positive attitude toward menstruation. Cronbach's α was 0.58 in the original scale[31] and 0.61 in Morrison's study.[33] Lo and Lin (1998) suggested that an acceptable Cronbach's α ranged from 0.3 to 0.7.[34] Because we were concerned about the comparability of our study with other studies, we decided to use this scale with a Cronbach's α of 0.57 in the present study.

Data analysis

The data in this study were entered using Microsoft Excel. JMP 7.0 was used for the statistical analysis. Based on the study variables and objectives, percentage, mean, and standard deviation were used to describe participant demographics and menstruation characteristics as well as DKS and MAS score distributions in the dysmenorrhea and non-dysmenorrhea groups. We used *t*-tests and chi-square tests to detect differences in demographics, menstruation characteristics, DKS score, and MAS score between the two groups. Finally, multiple logistic regression analysis was used to examine factors (independent variables) influencing the occurrence of dysmenorrhea (dependent variable). Independent variables with significant differences were included in the multiple logistic regression analysis.

RESULTS

A total of 420 participants completed the questionnaire. Among them, 297

(70.7%) had experienced dysmenorrhea in the past 6 months, and 123 (29.3%) had not. Compared with the non-dysmenorrhea group, participants with dysmenorrhea were significantly younger ($t = -3.78$, $p < 0.001$), were more frequently unmarried (77.78%, $\chi^2 = 20.03$, $p < 0.001$) and without a history of childbirth (83.16%, $\chi^2 = 19.38$, $p < 0.001$), and more often demonstrated an age at menarche of less than 12 years (15.49%, $\chi^2 = 4.70$, $p = 0.03$); moreover, a higher percentage of participants with dysmenorrhea worked a three-shift rotation (91.25%, $\chi^2 = 6.06$, $p = 0.014$). The other variables showed no significant differences between the two groups (Table 1).

Table 1. Comparison of demographic and menstruation characteristics between the dysmenorrhea and non-dysmenorrhea groups

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t or χ^2	p-value
	n	%	n	%		
Age (years) M± SD	30.33± 3.61		32.04±4.47		-3.78	<0.001
Age＜40	292	98.32	115	93.50	6.74	<0.01
Age≧40	5	1.68	8	6.50		
Marital status					20.03	<0.001
Unmarried	231	77.78	69	56.10		
Married	66	22.22	54	43.90		
Childbearing					19.38	<0.001
No	247	83.16	78	63.41		
Yes	50	16.84	45	36.59		
Age of menarche					4.70	0.030
＜12	46	15.49	11	8.94		
≧12	251	84.51	112	91.06		
Regularity of menstrual cycle					0.10	0.755
Yes	193	64.98	85	69.11		
No	104	35.02	38	30.89		
Duration of menstrual cycle					1.99	0.575
≦4 days	110	37.04	43	34.96		
5-6 days	157	52.86	70	56.91		
≧7 days	30	10.10	10	8.13		
Prior health education on dysmenorrhea					0.99	0.321
No	163	54.88	74	60.16		
Yes	134	45.12	49	39.84		
Three-shift rotation					6.06	0.014
Yes	271	91.25	102	82.93		
No	26	8.75	21	17.07		

Table 1. Comparison of demographic and menstruation characteristics between dysmenorrheal and non-dysmenorrheal groups (continued)

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t or χ^2	p-value
	n	%	n	%		
Whether to know it is allowed to ask for menstrual leave					2.03	0.154
Yes	242	81.48	107	86.99		
No	55	18.52	16	13.01		
Whether to consider menstrual leave necessary					1.68	0.195
Yes	288	96.97	115	93.50		
No	9	3.03	8	6.50		
Have ever asked for menstrual leave					0.14	0.707
No	272	91.58	114	92.68		
Yes	25	8.42	9	7.32		
Have ever asked for more leaves for dysmenorrhea?					3.59	0.058
No	262	88.22	116	94.31		
Yes	35	11.78	7	5.69		
Secondary dysmenorrhea					0.02	0.886
No	267	89.90	110	89.43		
Yes	30	10.10	13	10.57		

Note: Regularity of periods indicates that the duration between consecutive first-day menses is similar.

With respect to knowledge about dysmenorrhea, there was a non-significant difference between the two groups (p = 0.238). The highest scoring items among both

groups were “applying hot compresses,” “adopting a knee-to-chest position,” and “drinking hot beverages including warm water or milk or ginger soup to ease cramps.” The lowest scoring items were “normal bleeding amount every cycle,” “dysmenorrhea is a disease of the reproductive system,” and “women with dysmenorrhea are at high risk for sterility.” Regarding attitudes towards menstruation, after standardizing, the highest scoring dimension among the dysmenorrhea group was “considering menstruation a debilitating event” (73.30) and “considering menstruation a natural event” (74.93) in the non-dysmenorrhea group. The lowest scoring dimension in both groups was “denial of any effect of menstruation” (47.18 in the dysmenorrhea group and 54.69 in the dysmenorrhea group). Women who experienced dysmenorrhea had significantly higher scores than women in the non-dysmenorrhea group with respect to the following: considering menstruation a debilitating event ($p < 0.001$), considering menstruation a bothersome event ($p = 0.024$), and anticipation and prediction of menstruation onset ($p = 0.004$). In terms of denying the effects of menstruation, scores for the dysmenorrhea group were significantly lower than those of the non-dysmenorrhea group ($p < 0.001$). No significant differences were observed between the groups in terms of considering menstruation a natural event (Table 2).

Table 2. Comparison of dysmenorrheic knowledge and attitudes towards menstruation between the dysmenorrhea and non-dysmenorrhea groups

Variables	Dysmenorrheal (n = 297)		Non-dysmenorrheal (n = 123)		t-value	p-value
	M	SD	M	SD		
Dysmenorrheic knowledge scale	14.12	2.19	13.40	2.40	1.18	0.238
Menstrual attitude scale	148.6	12.74	146.85	12.69	1.31	0.192

	4					
Menstruation as a debilitating event	56.44	8.52	52.55	7.65	4.58	<0.001
Menstruation as a bothersome event	29.05	5.01	27.54	6.64	2.27	0.024
Menstruation as a natural event	19.98	5.19	20.98	4.92	-1.87	0.062
Anticipation and prediction of the onset of menstruation	20.04	3.01	18.98	3.55	2.93	0.004
Denial of any effect of menstruation	23.12	6.75	26.80	5.70	5.70	<0.001

We conducted a multiple logistic regression analysis using dysmenorrhea and non-dysmenorrhea as dependent variables, which yielded significant differences in the variables of demographics, menstruation characteristics, DKS score, and MAS score between the two groups. The results of the analysis showed that crucial predictive factors for the occurrence of dysmenorrhea among hospital nurses included age less than 40 years, working three-shift rotations, and marital status. Moreover, using the mean as the contact point, we found that the tendency to consider menstruation to be a debilitating event and the tendency to deny the effects of menstruation were also predictive factors for dysmenorrhea occurrence. The adjusted odd ratios are shown in Table 3.

After controlling for working three-shift rotations, marital status, the tendency to consider menstruation a debilitating event, and the tendency to deny the effects of menstruation, the rate of occurrence of dysmenorrhea in women younger than 40 years was 4.46 times higher than that in women over 40 years of age. After controlling for age, marital status, the tendency to consider menstruation a debilitating

event, and tendency to deny the effects of menstruation, the rate of occurrence of dysmenorrhea among nurses who worked three-shift rotations was 2.07 times higher than that in nurses who did not. After controlling for age, working three-shift rotations, marital status, and the tendency to deny the effects of menstruation, participants who felt that menstruation was a debilitating event had a dysmenorrhea occurrence rate that was 2.72 times higher than that of participants who did not. After controlling for age, working three-shift rotations, marital status, and the tendency to think of menstruation as a debilitating event, women who did not acknowledge the effects of menstruation had a dysmenorrhea occurrence rate that was 2.59 times higher than that in women who did not deny these effects.

Table 3: Risk factors for dysmenorrhea

		Crude OR	95% CI	P-Value	Adjusted OR	95% CI	P-Value
Age	Age＜40	4.06	(1.33 , 13.7)	＜0.05	4.46	(1.24 , 17.23)	＜0.05
	Age≧40	1.00	(- , -)		1.00	(- , -)	
Three-shift rotation	Yes	2.15	(1.15 , 3.98)	＜0.05	2.07	(1.01 , 4.21)	＜0.05
	No	1.00	(- , -)		1.00	(- , -)	
Married	No	2.74	(1.75 , 4.30)	<0.001	2.59	(1.57 , 4.28)	<0.001
	Yes	1.00	(- , -)		1.00	(- , -)	
Menstruation as a debilitating event	Higher	2.53	(1.63 , 3.95)	<0.001	2.72	(1.67 , 4.52)	<0.001
	Lower	1.00	(- , -)		1.00	(- , -)	

Denial of any effect of menstruation	Lower	2.83	(1.83 , 4.46)	<0.001	2.59	(1.61 , 4.23)	<0.001
	Higher	1.00	(- , -)		1.00	(- , -)	

Reference group: Age ≥40 years, no three-shift rotation, unmarried, reduced menstruation as a debilitating event, and increased denial of any effect on menstruation

CI, confidence interval; OR, odds ratio; SE, standard error.

DISCUSSION

Although the average age of participants in the dysmenorrhea group was significantly lower than that of women in the non-dysmenorrhea group, when age was the only variable being compared, the dysmenorrhea occurrence rate among nurses younger than 40 years was 4.06 times higher than that of nurses over age 40 years; after controlling for confounding variables, the rate of dysmenorrhea in younger women was 4.46 times higher than that in women over 40 years old. Therefore, age was a risk factor for dysmenorrhea. To our knowledge, no other studies have directly discussed the correlation between age and dysmenorrhea. However, previous studies have reported dysmenorrhea occurrence rates over 76% in adolescent girls or students,[5, 6, 16] and another reported a rate of 55.9% among women aged 15–45 years,[31] wherein a decrease in the occurrence of dysmenorrhea with increasing age was observed. As dysmenorrhea is very common, periodic dysmenorrhea is a natural phenomenon observed during the menstrual cycle. With age, the number of episodes of dysmenorrhea and the number of times coping strategies were used among women also increase; therefore, women with dysmenorrhea can be thought of as “female specialists with embodied knowledge,” meaning that their experiences may affect their subjective perception and tolerance of dysmenorrhea, which can in turn affect

the occurrence of dysmenorrhea.[35] Nursing is a female-dominated occupation in Taiwan. In this study, 97% of participants were younger than 40 years old. The high prevalence rate of dysmenorrhea severely affects nurses such that they may not be able to focus on their work, thereby affecting the quality of patient care. Nurses may need to take menstrual leave, which can cause a shortage of nursing resources.

In terms of marital status, the ratio of unmarried to married women in the dysmenorrhea group was 2.74 times that of the non-dysmenorrhea group, indicating a high dysmenorrhea occurrence rate among unmarried women; after adjusting for confounding variables, it was 2.59 times higher than that among married women. This result is consistent with those of Chung (average study participant age 27 years), which reported a higher dysmenorrhea occurrence rate in single nurses than in married and divorced ones.[36] Many women are told by their doctors that their dysmenorrhea will improve after getting married and giving birth, which may improve menstrual blood discharge. Furthermore, women may engage in positive self-care for menstruation after getting married for childbearing reasons, which may also be a factor that indirectly relieves dysmenorrhea.[11] In terms of work, the dysmenorrhea occurrence rate among nurses in the dysmenorrhea group who worked three-shift rotations was 2.15 times that of nurses in the non-dysmenorrhea group; after adjusting for confounding variables, it was 2.07 times higher than among nurses who did not work three-shift rotations. This indicates that work type (e.g., rotating nightshifts) is a risk factor for dysmenorrhea in nurses. However, Chung found that rotating work shifts were not significantly related to dysmenorrhea occurrence in nurses.[36] Furthermore, one study among Japanese junior high school students also found that nightshift work was not significantly associated with dysmenorrhea.[37] However, focus group interviews conducted by Chang revealed that working rotating

shifts was highly associated with menstrual discomfort.[19] Owing to the nature of nursing work, most nurses need to work rotating night shifts, and the graveyard shift can easily cause uncomfortable menstrual cycles or obvious irregularities.[25] Owing to nurses' day/night activities and sleep patterns, along with the increased pressure of working night shifts, menstrual discomfort may be more common in those with frequent rotation changes.

In terms of attitudes towards menstruation, the dysmenorrhea group had significantly higher scores than the non-dysmenorrhea group in terms of considering menstruation to be a debilitating event, and significantly lower scores than the non-dysmenorrhea group in terms of denying the effects of menstruation. In the multiple logistic regression analysis of attitudes towards menstruation, the tendency to consider menstruation as a debilitating event in the dysmenorrhea group was 2.53 times higher than that in the non-dysmenorrhea group; after adjusting for confounding variables, women with dysmenorrhea had a 2.72 times higher tendency to think of menstruation as a debilitating event than women who did not consider menstruation to be debilitating. The tendency to deny the effects of menstruation in the dysmenorrhea group was 2.83 times higher than in the non-dysmenorrhea group; after adjusting for confounding variables, women with dysmenorrhea had a 2.59 times higher tendency to deny the effects of menstruation. In this study, attitude towards menstruation was related to dysmenorrhea occurrence. Firat found no significant correlation between menstrual discomfort and attitude towards menstruation.[38] In that study, "menstruation is a debilitating event" and "anticipation and prediction of the onset of menstruation" obtained significantly higher scores from the vocational nursing students with dysmenorrhea than those who did not have dysmenorrhea. In terms of "menstruation is a bothersome event" and "menstruation is a natural event," the

non-dysmenorrhea group demonstrated significantly higher scores than the dysmenorrhea group; no significant differences were observed between the two groups in terms of "denial of any effect of menstruation".[26] These results are different from those of the present study. The most obvious difference between the two studies is the tendency to deny the effects of menstruation. Scores in the dysmenorrhea and non-dysmenorrhea groups in the present study were 23.1 and 26.8, respectively, compared with 26.6 and 28.0 among adolescent nursing students in Firat's study. In other words, compared with adolescent nursing students, the nurses in the present study did not deny the effects caused by menstruation and recognized that they were affected by menstruation. When a nurse experiences dysmenorrhea, her work may be affected. If she requests for menstrual leave, temporary work arrangements must be made and patient care may be affected. Because dysmenorrhea is a periodic phenomenon, taking frequent menstrual leave may affect working relationships; therefore, nurses usually choose to work even when they experience dysmenorrhea.

In summary, the factors influencing dysmenorrhea occurrence included age under 40 years, working three-shift rotations, and marital status, and when mean was used as the contact point, the tendency to consider menstruation to be a debilitating event and tendency to deny the effects of menstruation. Chiou's study of adolescent nursing students revealed that menstrual regularity and health education were predictive factors for dysmenorrhea.[30] Women who had irregular menstrual cycles and had not received dysmenorrhea-related health education demonstrated higher dysmenorrhea occurrence rates;[9] however, these two factors were not predictive factors in the present study. Our participants were nurses from a wide range of age groups rather than only adolescents; therefore, they had more experience with dysmenorrhea and self-care. In addition, menstrual health is a part of nursing

education; therefore, although nurses are not directly involved in health education, education is a part of their professional training. Thus, health education was not an important predictive factor in this study. This study mainly evaluated the factors influencing dysmenorrhea in hospital nurses in order to help institutions build a caring and friendly work environment for high-risk nurses. The participants were randomly selected from only two hospitals in southern Taiwan; therefore, the results might have limited generalizability to nurses in other parts of the country. In future studies, the inclusion criteria should be extended to examine any differences across regions in Taiwan. In addition, rotating night shifts are required in many other occupations besides nursing. Considering different professional backgrounds and life experiences, future studies should also include women from different occupations who work rotating shifts, to evaluate the differences in the influence of their knowledge and attitudes on the prevalence of dysmenorrhea. The variables assessed in this study included demographic characteristics, menstruation history, dysmenorrhea-related knowledge, and attitudes towards menstruation; however, lifestyle choices such as smoking, alcohol consumption, and exercising were not included. Further studies that analyze the effects of these lifestyle choices on dysmenorrhea are warranted.

CONCLUSIONS

We assessed the various factors influencing the occurrence of dysmenorrhea with the aim of helping nursing managers to offer appropriate assistance for high-risk groups and build a caring and friendly work environment for at-risk hospital nurses, which were as follows: (a) setting up a more accommodating working hours system that is based on the nurses' menstrual cycle; (b) creating a supportive workplace environment that allows nurses to take a break from work to apply hot compresses or

drink hot beverages; (c) allowing flexible menstrual leave or scheduling menstrual leave, thereby integrating menstrual self-care into the annual occupational safety and health training; (d) providing spaces at work for nurses to take short breaks and offering supportive measures, such as thermotherapy, aromatherapy massage, and others. Such measures will enable nurses to care for themselves at work, thus improving their workplace comfort levels and increasing their work satisfaction and performance.

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Competing interests

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Contributors

Min-Hui Chiu and Hsiu-Hung Wang designed the study, analyzed and interpreted the data, and drafted the manuscript. Yi-Hsin Yang assisted in defining the statistical analysis. Min-Hui Chiu and Su-Chen Hsu contributed to the data collection and analysis. Hsiu-Fen Hsieh and Huei-Mein Chen assisted with drafting the manuscript. All authors had full access to all data in the study and take responsibility for its integrity.

Data sharing statement

No additional data are available.

REFERENCES

1. Chen CX, Kwekkeboom KL, Ward SE. Beliefs about dysmenorrhea and their relationship to self-management. *Res Nurs Health* 2016;39(4):263-76.

2. Eryilmaz G, Ozdemir F. Evaluation of menstrual pain management approaches by northeastern Anatolian adolescents. *Pain management nursing: official journal of the American Society of Pain Management Nurses* 2009;10(1):40-7.

3. Kato T. Effects of flexibility in coping with menstrual pain on depressive symptoms. *Pain practice: the official journal of World Institute of Pain* 2017;17(1):70-77.

4. Zhu X, Wong F, Bensoussan A, Lo SK, Zhou C, Yu J. Are there any cross-ethnic differences in menstrual profiles? A pilot comparative study on Australian and Chinese women with primary dysmenorrhea. *The journal of obstetrics and gynaecology research* 2010;36(5):1093-101.

5. Abdul-Razzak KK, Ayoub NM, Abu-Taleb AA, Obeidat BA. Influence of dietary intake of dairy products on dysmenorrhea. *The journal of obstetrics and gynaecology research* 2010;36(2):377-83.

6. Agarwal AK, Agarwal A. A study of dysmenorrhea during menstruation in adolescent girls. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine* 2010;35(1):159-64.

7. Loto OM, Adewumi TA, Adewuya AO. Prevalence and correlates of dysmenorrhea among Nigerian college women. *The Australian & New Zealand journal of obstetrics & gynaecology* 2008;48(4):442-4.

8. Chang YT, Chen YC. Menstrual health care behavior and associated factors among female elementary students in the Hualien region. *Journal of Nursing Research*

2008;16(1):11-6.

9. Chiou MH, Wang HH. Predictors of dysmenorrhea and self-care behavior among vocational nursing school female students. *Journal of Nursing Research* 2008;16(1):17-25.

10. Cheng HF, Lin YH. Selection and efficacy of self-management strategies for dysmenorrhea in young Taiwanese women. *Journal of clinical nursing* 2011;20:1018-25.

11. Palmer D. "To help a million sick, you must kill a few nurses": Nurses' occupational health, 1890–1914. *Nursing History Review* 2012;20(1):14-45.

12. Laschinger HK, Grau AL. The influence of personal dispositional factors and organizational resources on workplace violence, burnout, and health outcomes in new graduate nurses: a cross-sectional study. *International journal of nursing studies* 2012;49(3):282-91.

13. Payne LA, Rapkin AJ, Lung KC, Seidman LC, Zeltzer LK, Tsao JC. Pain catastrophizing predicts menstrual pain ratings in adolescent girls with chronic pain. *Pain Med* 2016;17(1):16-24.

14. Berkley KJ, McAllister SL. Don't dismiss dysmenorrhea! *Pain* 2011;152(9):1940-1.

15. Chiu MH, Wang HH, Hsu SC, Liu IP. Dysmenorrhoea and self-care behaviours among hospital nurses: a questionnaire survey. *Journal of clinical nursing* 2013;22(22):3130-40.

16. Wong LP. Attitudes towards dysmenorrhoea, impact and treatment seeking among adolescent girls: a rural school-based survey. *The Australian journal of rural health* 2011;19(4):218-23.

17. Zukr SM, Naing L, Hamzah TNT, Hussain NHN. Primary dysmenorrhea among

medical and dental university students in Kelantan: Prevalence and associated factors. *International Medical Journal* 2009;16(2):93-99.

18. Lu I-C. Dysmenorrhea and related factors in Taiwanese adolescent girls. *University of Texas at Austin* 2010.

19. Chang C, Chen FL, Chang CH, Hsu CH. A preliminary study on menstrual health and menstrual leave in the workplace in Taiwan. *Taiwan J Public Health* 2011;30(5):436-50.

20. Schluter PJ, Turner C, Huntington AD, Bain CJ, McClure RJ. Work/life balance and health: the nurses and midwives e-cohort study. *International Nursing Review* 2011(58):28-36.

21. Cady RK, Diamond ML, Diamond MP, Ballard JE, Lener ME, Dorner DP, et al. Sumatriptan-naproxen sodium for menstrual migraine and dysmenorrhea: satisfaction, productivity, and functional disability outcomes. *Headache* 2011;51(5):664-73.

22. Bettendorf B, Shay S, Tu F. Dysmenorrhea: contemporary perspectives. *Obstetrical and Gynecological Survey* 2008;63(9):597-603.

23. Perry M. Treatment options for dysmenorrhoea. *Practice Nursing* 2012;23(4):4.

24. Ju H, Jones M, Mishra GD. Smoking and trajectories of dysmenorrhoea among young Australian women. *Tobacco control* 2016;25(2):195-202.

25. Chiou MH, Wang HH. The relationship between dysmenorrhea and menstrual attitudes among female students in vocational nursing schools. *The Journal of Nursing* 2004;51(4):45-52.

26. Parker MA, Sneddon AE, Arbon P. The menstrual disorder of teenagers (MDOT) study: determining typical menstrual patterns and menstrual disturbance in a large population-based study of Australian teenagers. *BJOG : an international journal*

of obstetrics and gynaecology 2010;117(2):185-92.

27. Stubbs ML. Cultural perceptions and practices around menarche and adolescent menstruation in the United States. *Annals of the New York Academy of Sciences* 2008;1135:58-66.
28. Cheng CY, Yang K, Liou SR. Taiwanese adolescents? Gender differences in knowledge and attitudes towards menstruation. *Nursing & Health Sciences* 2007;9(2):127-34.
29. H LY. The medical utilization of chinese and western medicine in females with dysmenorrhea. Kaohsiung Medical University, 2012.
30. Chiou M-H, Wang H-H, Yang Y-H. Effect of systematic menstrual health education on dysmenorrheic female adolescents' knowledge, attitudes, and self-care behavior. *Kaohsiung J Med Sci* 2007;23(4):183-90.
31. Brooks-Gunn J, Ruble D. The menstrual attitude questionnaire. *Psychosomatic medicine* 1980;42:503-11.
32. S L. Prevalence and associated factors of premenstrual syndrome among nurses in Taiwan. In: Ministry of Science and Technology, R. O. C., editor, 1994.
33. Morrison LA, Larkspur L, Calibuso MJ, Brown S. Women's attitudes about menstruation and associated health and behavioral characteristics. *American Journal of Health Behavior* 2010;34(1):90-100.
34. Lo Sing-Kai, Lin Ching-Fen. On the use and interpretation of Cronbach's alpha. *The Journal of Nursing Research* 1998;6:82-9.
35. Lin YX. *When "Experts" meet the medical professionals: The women with menstrual pain encountering western medicine.* Kaohsiung Medical University, Taiwan, 2006.
36. Chung F, Yao C, Wan G. The associations between menstrual function and life

style/working conditions among nurses in Taiwan. *Journal of occupational health* 2005;47(2):149-56.

37. Takeuchi H, Oishi T, Harada T. Morningness-eveningness preference, and mental and physical symptoms during the menstrual cycle of Japanese junior high school students. *Sleep and Biological Rhythms* 2003(1):245-47.

38. Firat MZ, Kulakac O, Oncel S, Akcan A. Menstrual attitude questionnaire: confirmatory and exploratory factor analysis with Turkish samples. *Journal of advanced nursing* 2009;65(3):652-62.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Page No	Recommendation
Title and abstract	1	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		2	(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
		Introduction	
Background/rationale	2	4-8	Explain the scientific background and rationale for the investigation being reported
Objectives	3	4	State specific objectives, including any prespecified hypotheses
		Methods	
Study design	4	9	Present key elements of study design early in the paper
Setting	5	9	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	9	*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	10-12	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	10-12	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	3	Describe any efforts to address potential sources of bias
Study size	10	9	Explain how the study size was arrived at
Quantitative variables	11	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	12	(*a*) Describe all statistical methods, including those used to control for confounding
			(*b*) Describe any methods used to examine subgroups and interactions
			(*c*) Explain how missing data were addressed
			(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
			(*e*) Describe any sensitivity analyses

Continued on next page

		Results	
Participants	13*	9	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
			(b) Give reasons for non-participation at each stage
Descriptive data	14*	13	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	13	*Cross-sectional study*—Report numbers of outcome events or summary measures
Main results	16	13	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
			(*b*) Report category boundaries when continuous variables were categorized
			(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	-	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
		Discussion	
Key results	18	19-24	Summarise key results with reference to study objectives
Limitations	19	3	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	19-24	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	19-24	Discuss the generalisability (external validity) of the study results
		Other information	
Funding	22	26	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.