

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [editorial.bmjopen@bmj.com](mailto:editorial.bmjopen@bmj.com)

# BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-017615
Article Type:	Research
Date Submitted by the Author:	04-May-2017
Complete List of Authors:	Chiu, Min-Hui; Kaohsiung Medical University College of Nursing, Doctoral Student; Chi Mei Medical Center, Liouying, Department of Nursing Hsieh, Hsiu-Fen; Kaohsiung Medical University, College of Nursing Yang, Yi-Hsin; Kaohsiung Med Univ Chen, Huei-Mein; Chung Hwa University of Medical Technology Hsu, Su-Chen; Chi Mei Medical Center Wang, Hsiu-Hung; Kaohsiung Medical University, College of Nursing
<b>Primary Subject Heading</b>:	Communication
Secondary Subject Heading:	Intensive care
Keywords:	dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

SCHOLARONE™  
Manuscripts

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

## 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,

1  
2  
3  
4 and rotating three-shift ratio were identified between the dysmenorrhea and  
5  
6 non-dysmenorrhea groups. Analysis of the MAS results revealed significant  
7  
8 differences between the groups regarding consideration of menstruation as a  
9  
10 debilitating or a bothersome event, anticipation and prediction of menstruation onset,  
11  
12 and denial of any effects from menstruation. The results of multiple logistic  
13  
14 regression showed that the predictive factors included age less than 40 years, working  
15  
16 three-shift rotations, marital status, acknowledging menstruation as a debilitating  
17  
18 event, anticipation and prediction of the onset of menstruation, and denial of any  
19  
20 effects from menstruation.  
21  
22  
23  
24  
25  
26  
27  
28  
29

30 **Conclusions:** The risk factors of dysmenorrhea are age, working three-shift rotations,  
31  
32 marital status, acknowledging menstruation as a debilitating event, anticipation and  
33  
34 prediction of the onset of menstruation, and denial of any effects from menstruation  
35  
36 are predictive. These results will help managers design health-promoting menstrual  
37  
38 self-care programs for hospital nurses.  
39  
40  
41  
42  
43

44 **Keywords:** dysmenorrhea, prevalence rate, self-care behavior, hospital nurses  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 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<sup>1</sup> 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<sup>2</sup>, and depression<sup>3</sup>. Dysmenorrhea arises during menstrual bleeding due to lower abdominal pain brought on by menses, with no relevant diagnoses from other gynecological examinations<sup>4</sup>. 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<sup>5-7</sup> Parker et al found that 21% of Australian adolescents experienced severe dysmenorrhea, with 26% having school absences due to dysmenorrhea.<sup>8</sup>

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.<sup>10</sup> A study on hospital nurses in Taiwan reported a prevalence rate of 90.7%.<sup>11</sup> Despite the high prevalence rate, nurses often neglect their own health while working and caring for patients.<sup>12</sup>

1  
2  
3  
4 Dysmenorrhea can be cyclical or chronic. It can be possibly a result of pain  
5  
6  
7 catastrophizing, and is sensitive to anxiety<sup>13</sup>. It not only causes physical pain but also  
8  
9  
10 affects mental well-being and quality of life, leading to work or school absenteeism  
11  
12  
13 and significant health burdens<sup>14</sup>. This problem not only affects performance but also  
14  
15  
16 the daily lives of adolescent students in Taiwan<sup>9</sup> and may cause women to take days  
17  
18  
19 off, which may affect their work<sup>15</sup>. A study in Malaysia reported poor concentration,  
20  
21  
22 absenteeism, and poor grades to be common factors of dysmenorrhea that affect daily  
23  
24  
25 life. Despite its high prevalence rate and effect on daily life, 76.1% of women still  
26  
27  
28 believe that dysmenorrhea is a natural part of a women's menstrual cycle, and only  
29  
30  
31 14.8% believe that treatment is necessary. In terms of dysmenorrhea information, 62.3%  
32  
33  
34 of adolescent girls claimed that they learned about the condition from their mothers,  
35  
36  
37 while 52.9% said that they had obtained their knowledge from peers<sup>16</sup>. Besides  
38  
39  
40 influencing daily learning, dysmenorrhea also causes tiredness, depression, difficulty  
41  
42  
43 concentrating, etc. In addition, dysmenorrhea is negatively correlated with  
44  
45  
46 self-awareness of one's own health; in other words, individuals with dysmenorrhea  
47  
48  
49 have poorer self-awareness regarding their own health<sup>6</sup>. Another study of Malaysian  
50  
51  
52 college students found that social activities, responsibilities, time spent resting, class  
53  
54  
55 absenteeism, and daily life were affected in individuals with dysmenorrheal  
56  
57  
58 individuals<sup>17</sup>.

1  
2  
3  
4 In Taiwan, a study of 417 fifth- and sixth-grade students reported that  
5  
6  
7 dysmenorrhea affected the emotions, daily lives, school activities, and social activities  
8  
9  
10 of 74.8%, 73.1%, 61.6%, and 50.1% of students, respectively <sup>8</sup>. Another study of 165  
11  
12  
13 15- to 19-year-old students found that 82.4% experienced disruptions in daily  
14  
15  
16 activities because of dysmenorrhea and 12.7% reported school absences due to  
17  
18  
19 dysmenorrhea <sup>18</sup>. A study of 297 nurses (average age: 30.3 years) found that 8.4% had  
20  
21  
22 taken menstrual leave, 11.8% had booked a leave of absence for dysmenorrhea, and  
23  
24  
25 28.6% saw their doctors due to the condition. <sup>15</sup>. Furthermore, 20.8% of adolescent  
26  
27  
28 girls from vocational schools in the same region had seen doctors for dysmenorrhea <sup>9</sup>.  
29  
30  
31 Menstrual leave is currently available in Japan, Indonesia, South Korea, and Taiwan.  
32  
33  
34 Focus groups studies in Taiwan showed that most interviewed women had menstrual  
35  
36  
37 discomfort and that they understood the implementation and regulation of menstrual  
38  
39  
40 leave in different companies. Yet in reality, the application rate is low due to factors  
41  
42  
43 including “the regulations are too rigid,” “no one else has taken menstrual leave,”  
44  
45  
46 “other kinds of leaves are available,” “no one will take my shift,” or “there has to be a  
47  
48  
49 doctor’s note”<sup>19</sup>.

50  
51  
52 Previous studies showed that the physical and mental health of nurses are  
53  
54  
55 significantly correlated with job satisfaction, tiredness, and comfort <sup>19,20</sup>. The Gender  
56  
57  
58 Equality in Employment Act of Taiwan, approved in 2002, clearly defines regulations  
59  
60



1  
2  
3  
4 regarding menstrual leave in which a female employee who has trouble working due  
5  
6  
7 to discomfort during menstruation should take one day of menstrual leave every  
8  
9  
10 month<sup>21</sup>. However, because of the particularity of nursing, temporary leave affects  
11  
12 the allocation of nurses. Cheng<sup>10</sup> found that the long-term use of medicine to maintain  
13  
14 a ready-to-work status is a common experience among women; nurses, who have  
15  
16 frequent contact with drugs, use them extensively to overcome menstrual discomfort  
17  
18 at work<sup>21</sup>, including the use of sumatriptan–naproxen sodium to reduce the effect of  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

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<sup>21</sup>. However, because of the particularity of nursing, temporary leave affects the allocation of nurses. Cheng<sup>10</sup> 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<sup>21</sup>, including the use of sumatriptan–naproxen sodium to reduce the effect of dysmenorrhea during work and leisure<sup>22</sup>.

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<sup>7 17</sup> (c) Duration of menstrual cycle: a Nigerian study noted that longer menstrual flows are an important predictive factor of dysmenorrhea.<sup>7</sup> (d) Regularity of menstrual cycle: women with irregular menstrual cycles are more likely to have dysmenorrhea<sup>9</sup>. 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<sup>23</sup>

1  
2  
3  
4<sup>24</sup> With regard to work, several studies found that women who work rotations,  
5  
6  
7 especially nurses who have to work “sometimes day shifts, sometimes night shifts,”  
8  
9  
10 have relatively more serious menstrual discomfort<sup>21</sup>. Nurses who work night shifts  
11  
12 are more likely to have dysmenorrheal symptoms during their menstrual cycles  
13  
14 compared to those who work regular shifts<sup>15</sup>.  
15  
16

17  
18 Furthermore, the attitudes of adolescent students toward menstruation correlate  
19  
20 with the occurrence of dysmenorrheal<sup>25</sup>. Those who tend to agree that menstruation is  
21  
22 a debilitating experience and those who anticipate and predict the onset of  
23  
24 menstruation are more likely to have dysmenorrhea<sup>26</sup>. The effect of dysmenorrhea on  
25  
26 women varies based on the degree and frequency of their pain.  
27  
28  
29  
30  
31

32  
33 Previous studies have revealed that women have inadequate knowledge about  
34  
35 menstruation and that educational information about menstrual health care contains  
36  
37 contradictory messages, including the idea that menstruation is a normal and natural  
38  
39 event, but should be hidden<sup>27</sup>. Cheng<sup>28</sup> observed that some female students knew  
40  
41 about menstruation taboos; while they had doubts about those taboos, they still had  
42  
43 negative attitudes about menstruation. Medical expenses due to dysmenorrhea  
44  
45 increase with age, besides the topic of women menstrual health and their emotional  
46  
47 problems, should also be taken seriously<sup>29</sup>. Nevertheless, since dysmenorrhea is so  
48  
49 common, and women consider it a normal phenomenon and rarely seek medical  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 treatment due to their cultural and religious attitudes<sup>15</sup> or due to the feeling that they  
5  
6  
7 can tolerate the pain<sup>23</sup>.  
8

9  
10 In Taiwan, 98.8% of hospital nurses are women. There is a high prevalence rate  
11  
12 of dysmenorrhea in women; due to the nature of nursing work, nurses are at a  
13  
14 high-risk for dysmenorrhea. However, previous studies on nurses did not discuss the  
15  
16 influencing factors. The purposes of this study were to (1) describe the basic  
17  
18 demographic data as well as menstruation characteristics, knowledge about  
19  
20 dysmenorrhea, and menstrual attitude of dysmenorrheal and non-dysmenorrheal  
21  
22 clinical nurses; (2) analyze the demographic data as well as menstruation  
23  
24 characteristics, knowledge about dysmenorrhea, and menstrual attitude of  
25  
26 dysmenorrheal and non-dysmenorrheal clinical nurses, and identify significant  
27  
28 differences between these groups; and (3) examine the risk factors of dysmenorrhea in  
29  
30 clinical nurses.  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43

## 44 **METHODS**

### 45 **Study design and participants**

46  
47  
48 This study used a cross-sectional questionnaire survey based on structured  
49  
50 questionnaires for data collection. The participants were recruited from two medical  
51  
52 institutions in southern Taiwan. One institution was a medical center with 1,300 beds;  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 the other was a regional hospital with 650 beds. The participants included 2,000  
5  
6  
7 clinical nurses. The inclusion criteria for this study included (1) full-time nurses at the  
8  
9  
10 study hospitals (2) at least 18 years of age who (3) agreed to participate in this study  
11  
12  
13 after reading an informed consent document. The sample size was estimated using  
14  
15  
16 JMP 7.0 with an effect size of 0.3,  $\alpha$  of 0.05, power of 0.80, resulting in a required  
17  
18  
19 sample size of 350 individuals. With a predicted questionnaire recovery rate of 80%,  
20  
21  
22 the sample size was estimated to be 438. We randomly sampled 450 nurses and  
23  
24  
25 recovered 420 valid questionnaires (93.3%). Among the 420 nurses, 297 (70.7%) had  
26  
27  
28 experienced dysmenorrhea in the past six months and were categorized in the  
29  
30  
31 dysmenorrhea group, while the 123 (29.3%) nurses who had not experienced  
32  
33  
34 dysmenorrhea were classified as the non-dysmenorrhea group.

35  
36 Random sampling was conducted after this study received approval from the  
37  
38  
39 Institutional Review Board (IRBD No. CLH0088) using lists of nurses from the two  
40  
41  
42 hospitals. The questionnaires were delivered to the nurses by a trained research  
43  
44  
45 assistant. The participants provided written consent and answered the questionnaires  
46  
47  
48 independently. The written consent form indicated that participation in this study was  
49  
50  
51 not compulsory and the questionnaire was anonymous. Anyone who was not willing  
52  
53  
54 to participate in this study could simply choose not to return the questionnaire. No  
55  
56  
57 individual rights or interests were compromised during this process. Those who  
58  
59  
60

1  
2  
3  
4 completed the questionnaire received a gift. The questionnaires were collected two  
5  
6  
7 weeks after being issued, upon which the written consents and questionnaires were  
8  
9  
10 filed separately and placed in locations chosen by the participants to protect their  
11  
12  
13 personal privacy.

### 14 15 16 17 18 *Measurements*

19  
20  
21 This study was conducted in May 2010. The study instruments included the  
22  
23  
24 Demographic Inventory (DI), Dysmenorrheal Knowledge Scale (DKS), and  
25  
26  
27 Menstrual Attitude Scale (MAS). The DI was designed based on related studies<sup>9 30</sup>  
28  
29  
30 and included age, age of menarche, marital and childbirth status, discussion of  
31  
32  
33 menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea,  
34  
35  
36 working conditions, self-care health education experience regarding menstruation,  
37  
38  
39 dysmenorrhea influences, and work coping. The DKS was designed using both the  
40  
41  
42 researchers' clinical experiences and previous studies.[30] The scale included 20  
43  
44  
45 questions with yes/no answers. Correct answers received a score of 1, while incorrect  
46  
47  
48 answers received a score of 0. The total summed scores ranged from 0 to 20, with  
49  
50  
51 higher scores representing a better knowledge of dysmenorrhea. The  
52  
53  
54 Kuder-Richardson reliability coefficient was 0.63 in a previous study<sup>30</sup>, and 0.72 in  
55  
56  
57 this study. The MAS was developed by Brooks-Gunn and Ruble (1980) and modified  
58  
59  
60

1  
2  
3  
4 by Lee (1994). It includes 32 items with five dimensions, including menstruation as a  
5  
6  
7 debilitating event, menstruation as a bothersome event, menstruation as a natural  
8  
9  
10 event, anticipation and prediction of the onset of menstruation, and denial of the  
11  
12 effects of menstruation. Each item was scored on a 7-point Likert scale from 1  
13  
14 (disagree strongly) to 7 (agree strongly). The total summed scores ranged from 32 to  
15  
16 224, with higher scores representing a more positive attitude toward menstruation.  
17  
18  
19  
20  
21 Cronbach's  $\alpha$  was 0.58 in the original scale<sup>31</sup>, 0.61 and 0.75 in Morrison's study<sup>32</sup>,  
22  
23  
24 and 0.57 in the present study.  
25  
26  
27  
28  
29

### 30 *Data Analysis*

31  
32  
33  
34  
35  
36 The data in this study were stored using Microsoft Excel. JMP 7.0 (a business  
37  
38 unit of SAS) for statistical analysis. Based on the study's variables and purposes,  
39  
40  
41 percentage, mean, and standard deviation were used to describe the demographics and  
42  
43  
44 menstruation characteristics as well as the DKS and MAS distributions in the  
45  
46  
47 dysmenorrhea and the non-dysmenorrhea groups. T- and chi-square tests were used to  
48  
49  
50 detect differences in demographics, menstruation characteristics, DKS, and MAS  
51  
52  
53 between the two groups. Finally, multiple logistic regression analysis was used to  
54  
55  
56 examine the relationships between each variable and the occurrence of dysmenorrhea.  
57  
58  
59  
60

## 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 $\chi^2$	p-value
	n	%	n	%		
Age (years) M $\pm$ SD	30.33 $\pm$ 3.61		32.04 $\pm$ 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		
$\geq$ 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
$\leq$ 4 days	110	37.04	43	34.96		
5-6 days	157	52.86	70	56.91		
$\geq$ 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 $\chi^2$	p-value
	n	%	n	%		
	Whether to know it is allowed to ask for menstrual leave					
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		
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

1  
2  
3  
4 higher than that in those over 40 years of age. After controlling for age, marital status,  
5  
6  
7 the tendency to acknowledge menstruation as a debilitating event, and the tendency to  
8  
9  
10 acknowledge the effects of menstruation, the dysmenorrhea occurrence rate for those  
11  
12 who worked three-shift rotations was 2.07 times higher than that in those who did not.  
13  
14  
15 After controlling for age, working three-shift rotations, marital status, and the  
16  
17  
18 tendency to acknowledge the effects of menstruation, those who acknowledged that  
19  
20  
21 menstruation was a debilitating event had a dysmenorrhea occurrence rate that was  
22  
23  
24 2.72 times higher than that of those who did not. After controlling for age, working  
25  
26  
27 three-shift rotations, marital status, and the tendency to acknowledge menstruation as  
28  
29  
30 a debilitating event, those who acknowledged the effects of menstruation had a  
31  
32  
33 dysmenorrhea occurrence rate that was 2.59 times higher than that in those who did  
34  
35  
36 not (Table 3).  
37  
38  
39  
40  
41

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 rotation	Rotating	2.15	( 1.15 , 3.98 )	<0.05	2.07	( 1.01 , 4.21 )	<0.05
	3-shift	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 Higher debilitating event	Lower	2.53 ( 1.63 , 3.95 )	<0.001	2.72 ( 1.67 , 4.52 )	<0.001
	Higher	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  $\geq$ 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%

1  
2  
3  
4 in adolescent girls or students<sup>5 6 16</sup>, compared to a rate of 55.9% in a study with 15- to  
5  
6  
7 45-year-old women<sup>33</sup>, with a decrease in the occurrence rate with increasing  
8  
9  
10 participants' age. Since dysmenorrhea is part of being a woman, periodic  
11  
12  
13 dysmenorrhea comes with the menstrual cycle. With age, women's dysmenorrhea and  
14  
15  
16 coping experience also increase; therefore, dysmenorrheal women are "female  
17  
18  
19 specialists with embodied knowledge," meaning that their experiences may affect  
20  
21  
22 their subjective perceptions and tolerance of dysmenorrhea, which in turn affect the  
23  
24  
25 occurrence of dysmenorrhea<sup>34</sup>.

26  
27  
28  
29  
30 In terms of marital and childbirth status, both the marital status ratio and  
31  
32  
33 childbirth ratio in the dysmenorrhea group were significantly lower than those in the  
34  
35  
36 non-dysmenorrhea group, indicating a high dysmenorrhea occurrence rate among  
37  
38  
39 unmarried, non-childbearing women. After adjusting for age, working three-shift  
40  
41  
42 rotations, marital status, the tendency to acknowledge menstruation as a debilitating  
43  
44  
45 event, and the tendency to deny the effects of menstruation, the dysmenorrhea  
46  
47  
48 occurrence rate in unmarried women was 2.59 times higher than that in married  
49  
50  
51 women. This result is consistent with the results of Chung<sup>35</sup> (average age = 27 years),  
52  
53  
54 which reported a higher dysmenorrhea occurrence rate in single than in married and  
55  
56  
57 divorced nurses<sup>35</sup>. Many women are by their doctors that their dysmenorrhea will  
58  
59  
60

1  
2  
3  
4 improve after getting married and giving birth, which may improve menstrual blood  
5  
6 discharge. Furthermore, women may perform positive self-care behaviors for  
7  
8 menstruation after getting married due to childbearing needs, which may also be a  
9  
10 factor that indirectly relieves dysmenorrhea.<sup>11</sup> In terms of menstruation history, the  
11  
12 dysmenorrhea occurrence rate in women who had their menarche after 12 years of age  
13  
14 was significantly lower in the dysmenorrhea group than that in the non-dysmenorrhea  
15  
16 group, indicating that those who had menarche at a younger age were more likely to  
17  
18 have dysmenorrhea; however, after performing further logistic regression analysis,  
19  
20 this variable was not significant. Therefore, after adjusting, age of menarche was not  
21  
22 an important influencing factor for dysmenorrhea. Previous studies of dysmenorrhea  
23  
24 in adolescent girls or students found early menarche to be a risk factor for  
25  
26 dysmenorrhea.<sup>7 17 36</sup> With age and dysmenorrhea experience, women develop coping  
27  
28 abilities; together with marital and childbearing status, these factors could weaken the  
29  
30 effect of age of menarche on dysmenorrhea occurrence.  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

47 In terms of work, the dysmenorrhea occurrence rate among those who worked  
48  
49 three-shift rotations was significantly higher in the dysmenorrhea group than that in  
50  
51 the non-dysmenorrhea group. After controlling for age, marital status, the tendency to  
52  
53 acknowledge menstruation as a debilitating event, and the tendency to deny the  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 effects of menstruation, the dysmenorrhea occurrence rate in those who worked  
5  
6  
7 three-shift rotations was 2.07 times higher than the rate in those who did not. This  
8  
9  
10 indicates that work type (e.g., rotating nightshift) is a risk factor for dysmenorrhea  
11  
12  
13 occurrence in nurses. However, Chung<sup>35</sup> found that rotating work shifts were not  
14  
15  
16 significantly related to dysmenorrhea occurrence in nurses. Furthermore, one study on  
17  
18  
19 Japanese junior high school students also found that nightshift work was not  
20  
21  
22 significantly associated with dysmenorrhea<sup>37</sup>. However, an interview of focus groups  
23  
24  
25 conducted by Chang found that working rotating shifts was highly associated with  
26  
27  
28 menstrual discomfort<sup>19</sup>. Due to the nature of nursing work, most nurses need to work  
29  
30  
31 rotating night shifts, and the graveyard shift can easily cause uncomfortable menstrual  
32  
33  
34 cycles or obvious irregularities<sup>25</sup>. Coupling nurses' day/night activities and sleep  
35  
36  
37 patterns with the increased pressure from working night shifts, menstrual discomfort  
38  
39  
40 may be more common in those with frequent rotation changes.

41  
42  
43  
44 In terms of menstrual attitude, the dysmenorrhea group was significantly higher  
45  
46  
47 than the non-dysmenorrhea group in considering menstruation to be a debilitating  
48  
49  
50 event, considering menstruation to be a bothersome event, and anticipating and  
51  
52  
53 predicting the onset of menstruation, while significantly lower than the  
54  
55  
56 non-dysmenorrhea group in denying the effects of menstruation. There was no  
57  
58  
59  
60

1  
2  
3  
4 significant difference between the two groups with regard to considering menstruation  
5  
6  
7 to be a natural event. In multiple logistic regressions, the tendency to acknowledge  
8  
9  
10 menstruation as a debilitating event and the tendency to deny the effects of  
11  
12  
13 menstruation were influencing factors for the occurrence of dysmenorrhea. In this  
14  
15  
16 study, menstrual attitude was related to dysmenorrhea occurrence, particularly  
17  
18  
19 considering menstruation to be a debilitating event and denying the effects of  
20  
21  
22 menstruation. Firat found no significant correlation between menstrual discomfort and  
23  
24  
25 menstrual attitude <sup>38</sup>. In vocational nursing students, “menstruation is a debilitating  
26  
27  
28 event” and “anticipation and prediction of the onset of menstruation” in the  
29  
30  
31 dysmenorrhea group scored significantly higher than those in the non-dysmenorrhea  
32  
33  
34 group. In terms of “menstruation is a bothersome event” and “menstruation is a  
35  
36  
37 natural event,” the non-dysmenorrhea group was significantly higher than the  
38  
39  
40 dysmenorrhea group; and no significant differences were observed between the two  
41  
42  
43 groups in terms of “denial of any effect of menstruation” <sup>26</sup>. These results are different  
44  
45  
46 from those of the present study. The most obvious difference between the two studies  
47  
48  
49 is the tendency to deny the effect of menstruation. The scores in the dysmenorrhea  
50  
51  
52 and non-dysmenorrhea groups in the present study were 23.1 and 26.8, respectively,  
53  
54  
55 compared to 26.6 and 28.0 in adolescent nursing students. In other words, compared  
56  
57  
58 to adolescent nursing students, nurses in the present study did not deny the effects  
59  
60



1  
2  
3  
4 caused by menstruation and recognized that they were affected by menstruation.  
5  
6  
7 When a nurse experiences dysmenorrhea, her work may be affected. If she asks for  
8  
9  
10 menstrual leave, temporary work arrangements and patient care may be affected.  
11  
12 Since dysmenorrhea is a periodic phenomenon, frequently asking for menstrual leave  
13  
14 may affect working relationships; therefore, nurses usually choose to work even when  
15  
16 they experience dysmenorrhea.  
17  
18  
19

20  
21  
22  
23  
24 In this study, age under 40 years, working three-shift rotations, marital status,  
25  
26 using mean as the contact point, the tendency to acknowledge menstruation as a  
27  
28 debilitating event, and the tendency to deny the effects of menstruation were  
29  
30 predictive factors for dysmenorrhea occurrence. Chiou's <sup>30</sup> study of adolescent  
31  
32 nursing students found that menstrual regularity and health education were predictive  
33  
34 factors for dysmenorrhea. Those who had irregular menstruations and had not  
35  
36 received dysmenorrhea-related health education had higher dysmenorrhea occurrence  
37  
38 rates <sup>9</sup>; however, these two factors were not predictive factors in the present study.  
39  
40  
41 Our participants were nurses from a wide range of age groups rather than adolescents;  
42  
43  
44 therefore, they had more dysmenorrhea and self-care experience. In addition,  
45  
46  
47 menstrual health is a part of nursing education; therefore, although nurses are not  
48  
49  
50 directly involved in health education, education is a part of their professional training.  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 Thus, health education was not an important predictive factor in this study.  
5  
6  
7  
8

9  
10 This study mainly evaluated the predictive factors for dysmenorrhea in hospital  
11  
12 nurses and aimed to build a friendly work environment for high-risk women. The  
13  
14 participants were randomly selected nurses from only two hospitals in southern  
15  
16 Taiwan; therefore, the results might be limited. In future studies, inclusion research  
17  
18 settings can be extended to examine any differences between different living areas. In  
19  
20 addition, rotating night shifts are required in many other occupations besides nursing.  
21  
22 Considering different professional backgrounds and life experiences, future studies  
23  
24 should also study women from different occupations with rotating shifts to evaluate  
25  
26 differences in the influence of their knowledge and attitudes on dysmenorrhea  
27  
28 occurrence. The variables assessed in this study included demographic characteristics,  
29  
30 menstruation history, dysmenorrheal knowledge, menstrual attitudes, etc.; however,  
31  
32 lifestyle choices such as smoking, drinking, and exercising were not included. Future  
33  
34 studies are necessary to analyze the effects of these lifestyle choices on dysmenorrhea.  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

## 50 CONCLUSIONS

51  
52

53 Nursing is a female-dominated occupation in Taiwan. The high prevalence rate  
54  
55 of dysmenorrhea severely affects nurses such that they may not be able to focus on  
56  
57  
58  
59  
60

1  
2  
3  
4 their work, thereby affecting the quality of patient care. Nurses may need to take  
5  
6  
7 menstrual leave, which can cause a shortage of nursing resources. The predictive  
8  
9  
10 factors for dysmenorrhea occurrence were assessed with the hope to produce  
11  
12  
13 interventions for high-risk groups and improve workplace comfort for nurses. In this  
14  
15  
16 study, age less than 40 years, working three-shift rotations, marital status, using mean  
17  
18  
19 as the contact point, the tendency to acknowledge menstruation as a debilitating event,  
20  
21  
22 and the tendency to deny the effects of menstruation were predictive factors for the  
23  
24  
25 occurrence of dysmenorrhea. This finding could help nursing managers to offer  
26  
27  
28 appropriate assistance for high-risk groups and build a health-promoting self-care and  
29  
30  
31 friendly environment for hospital nurses.  
32  
33  
34  
35

36 In terms of clinical practices, if the majority of nurses are under 40 years of age  
37  
38  
39 and unmarried, establishing a menstruation-supporting environment should be  
40  
41  
42 considered. Since women with dysmenorrhea do not necessarily need to take a full  
43  
44  
45 day off, if a supportive environment can be created that allows them to take a break  
46  
47  
48 from work, then their comfort will be improved. Work environments, particularly  
49  
50  
51 hospitals, can provide measures such as flexibility with menstrual leave or scheduling  
52  
53  
54 menstrual leave, integrating menstrual self-care measures into annual occupational  
55  
56  
57 safety and health training, and providing spaces at work for short breaks together with  
58  
59  
60

1  
2  
3  
4 thermotherapy, aromatherapy massage, etc. These measures will enable nurses to care  
5  
6  
7 for themselves at work, thus improving their workplace comfort and increasing their  
8  
9  
10 work satisfaction.

## 11 12 **ACKNOWLEDGEMENTS**

13  
14  
15 The authors thank the participants for their participation and the nurse managers of  
16  
17  
18 these two hospitals for their administrative assistance. We also thank Editage for their  
19  
20  
21 professional English review of this manuscript.  
22

## 23 24 **Competing interests**

25  
26  
27 None.  
28

## 29 30 **Funding**

31  
32  
33 This research received no specific grant from any funding agency in the public,  
34  
35  
36 commercial, or not-for-profit sectors.  
37

## 38 39 **Contributors**

40  
41  
42 Min-Hui Chiu and Hsiu-Hung Wang designed the study, analyzed and interpreted the  
43  
44  
45 data, and drafted the manuscript. Min-Hui Chiu contributed to the study design,  
46  
47  
48 analysis, and interpretation of the data. All authors had full access to all data in the  
49  
50  
51 study and take responsibility for its integrity.  
52

## 53 54 **Data sharing statement**

55  
56  
57 No additional data are available.  
58  
59  
60

## REFERENCES

1. Chen CX, Kwেকেboom 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.

- 1
- 2
- 3 27. Stubbs ML. Cultural perceptions and practices around menarche and adolescent
- 4 menstruation in the United States. *Annals of the New York Academy of Sciences*
- 5 2008;1135:58-66.
- 6
- 7 28. Cheng CY, Yang K, Liou SR. Taiwanese adolescents? gender differences in
- 8 knowledge and attitudes towards menstruation. *Nursing & Health Sciences*
- 9 2007;9(2):127-34.
- 10
- 11 29. H LY. The Medical Utilization of Chinese and Western Medicine in Females with
- 12 Dysmenorrhea. Kaohsiung Medical University, 2012.
- 13
- 14 30. Chiou M-H, Wang H-H, Yang Y-H. Effect of Systematic Menstrual Health
- 15 Education on Dysmenorrheic Female Adolescents' Knowledge, Attitudes, and
- 16 Self-care Behavior. *Kaohsiung J Med Sci* 2007;23(4):183-90.
- 17
- 18 31. S L. Prevalence and Associated Factors of Premenstrual Syndrome Among Nurses
- 19 in Taiwan. In: Ministry of Science and Technology, R. O. C., editor, 1994.
- 20
- 21 32. Morrison LA, Larkspur L, Calibuso MJ, Brown S. Women's Attitudes About
- 22 Menstruation and Associated Health and Behavioral Characteristics. *American*
- 23 *Journal of Health Behavior* 2010;34(1):90-100.
- 24
- 25 33. Brooks-Gunn J, Ruble D. The menstrual attitude questionnaire. *Psychosomatic*
- 26 *medicine* 1980;42:503-11.
- 27
- 28 34. Lin YX. *When "Experts" Meet the Medical Professionals: The Women with*
- 29 *Menstrual Pain Encountering Western Medicine*. Kaohsiung Medical University,
- 30 Taiwan, 2006.
- 31
- 32 35. Chung F, Yao C, Wan G. The associations between menstrual function and life
- 33 style/working conditions among nurses in Taiwan. *Journal of occupational health*
- 34 2005;47(2):149-56.
- 35
- 36 36. Nagata C, Hirokawa K, Shimizu N, Shimizu H. Associations of menstrual pain
- 37 with intakes of soy, fat and dietary fiber in Japanese women. *European journal of*
- 38 *clinical nutrition* 2005;59(1):88-92.
- 39
- 40 37. Takeuchi H, Oishi T, Harada T. Morningness-eveningness preference, and mental
- 41 and physical symptoms during the menstrual cycle of Japanese junior high school
- 42 students. *Sleep and Biological Rhythms* 2003(1):245-47.
- 43
- 44 38. Firat MZ, Kulakac O, Oncel S, Akcan A. Menstrual Attitude Questionnaire:
- 45 confirmatory and exploratory factor analysis with Turkish samples. *Journal of*
- 46 *advanced nursing* 2009;65(3):652-62.
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

# BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-017615.R1
Article Type:	Research
Date Submitted by the Author:	13-Sep-2017
Complete List of Authors:	Chiu, Min-Hui; Kaohsiung Medical University College of Nursing, Doctoral Student; Chi Mei Medical Center, Liouying, Department of Nursing Hsieh, Hsiu-Fen; Kaohsiung Medical University, College of Nursing Yang, Yi-Hsin; Kaohsiung Med Univ Chen, Huei-Mein; Chung Hwa University of Medical Technology Hsu, Su-Chen; Chi Mei Medical Center Wang, Hsiu-Hung; Kaohsiung Medical University, College of Nursing
<b>Primary Subject Heading</b>:	Communication
Secondary Subject Heading:	Intensive care
Keywords:	dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

SCHOLARONE™  
Manuscripts



## Title Page

**Manuscript title**

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

**Running head**

Dysmenorrhea and influencing factors

**Authors****Min-Hui Chiu**

1. Doctoral Student, College of Nursing, Kaohsiung Medical University, Taiwan  
Address: No. 100 Shih-Chuan 1st Road, San-Ming District, Kaohsiung 80708, Taiwan
2. Director, Chi Mei Medical Center, Liouying, Tainan, Taiwan  
Address: No.201, Taikang, Liouying Dist., Tainan City 736, Taiwan  
Email: 300015@mail.chimei.org.tw

**Hsiu-Fen Hsieh**

Associate Professor, College of Nursing, Kaohsiung Medical University, Taiwan  
Address: No. 100 Shih-Chuan 1st Road, San-Ming District, Kaohsiung 80708, Taiwan  
Email: [hsiufen96@gmail.com](mailto:hsiufen96@gmail.com)

**Yi-Hsin Yang**

Professor, College of Pharmacy, Kaohsiung Medical University, Kaohsiung, Taiwan  
Address: No. 100 Shih-Chuan 1st Road, San-Ming District, Kaohsiung 80708, Taiwan  
E-mail: [yihhsya@kmu.edu.tw](mailto:yihhsya@kmu.edu.tw)  
Telephone: 886-7-3121101 ext. 2262

**Huei-Mein Chen**

Associate Professor, Chung Hwa University of Medical Technology, Tainan, Taiwan  
Address: No. 89, Wen-hua1st St, Rende District, Tainan 71703, Taiwan  
E-mail: [hueimein@mail.hwai.edu.tw](mailto:hueimein@mail.hwai.edu.tw)  
Telephone: 886-6-2671214 ext. 512

**Su-Chen Hsu**

Chi Mei Medical Center, Tainan, Taiwan

1  
2  
3 Address: No.901, Zhonghua Rd., Yongkang Dist., Tainan City 710, Taiwan

4 E-mail: 300001@mail.chimei.org.tw

5  
6 Telephone: 886-6-2812811 ext. 53000

7  
8 Fax: 886-6-2827480

9  
10  
11 **Hsiu-Hung Wang\***

12 Professor, College of Nursing, Kaohsiung Medical University, Taiwan

13 No. 100, Shih-Chuan 1st Road, Kaohsiung City 80708, Taiwan

14 Tel: 886-7-3121101 ext 2624

15 Fax: 886-7-3218364

16 E-mail: hhwang@kmu.edu.tw

17  
18  
19  
20  
21 **Corresponding author**

22 Hsiu-Hung Wang, RN, FAAN, PhD

23 Professor, College of Nursing, Kaohsiung Medical University

24 No. 100, Shih-Chuan 1st Road, Kaohsiung City 80708, Taiwan

25 Tel: 886-7-3121101 ext 2624

26 Fax: 886-7-3218364

27 E-mail: hhwang@kmu.edu.tw

28  
29  
30  
31  
32  
33 **keywords**

34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
Dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

**Word count**

4718

# 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%)

1  
2  
3  
4 had experienced dysmenorrhea in the past 6 months; 123 (29.3%) had not. Significant  
5  
6 differences in age ( $p < 0.001$ ), marital status ( $p < 0.001$ ), childbearing status ( $p < 0.001$ ),  
7  
8 age of menarche ( $p < 0.05$ ), and rotating three-shift ratio ( $p < 0.05$ ) were identified  
9  
10 between the dysmenorrhea and non-dysmenorrhea groups. Analysis of MAS results  
11  
12 revealed significant differences between the groups regarding consideration of  
13  
14 menstruation as a debilitating ( $p < 0.001$ ) or bothersome event ( $p < 0.05$ ), anticipation  
15  
16 and prediction of menstruation onset ( $p < 0.01$ ), and denial of any effects from  
17  
18 menstruation ( $p < 0.001$ ). Results of multiple logistic regression showed that predictive  
19  
20 factors included age less than 40 years (4.46 vs. 1.00), working three-shift rotations  
21  
22 (2.07 vs. 1.00), marital status (2.59 vs. 1.00), acknowledging menstruation as a  
23  
24 debilitating event (2.72 vs. 1.00), and denial of effects from menstruation (2.59 vs.  
25  
26 1.00).  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36

37  
38 **Conclusions:** These findings could help nursing managers to create a caring climate  
39  
40 and friendly work environment for hospital nurses at risk of dysmenorrhea.  
41  
42  
43

44 **Keywords:** Dysmenorrhea, prevalence rate, self-care behavior, hospital nurses  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 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.<sup>1</sup> 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,<sup>2</sup> and depression.<sup>3</sup> Dysmenorrhea arises during menstrual bleeding owing to lower abdominal pain brought on by menses, with no relevant diagnoses of other gynecological disorders.<sup>4</sup> 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%.<sup>5-7</sup> Parker et al. found that 21% of Australian adolescents experienced severe dysmenorrhea, with 26% having school absences due to dysmenorrhea.<sup>8</sup>

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

1  
2  
3  
4 patients.<sup>12</sup>  
5  
6

7         Dysmenorrhea can be cyclical or chronic; in some cases, it can be a possible result  
8  
9 of pain catastrophizing and anxiety sensitivity.<sup>13</sup> Dysmenorrhea not only causes  
10 physical pain, it also affects mental well-being and quality of life, leading to work or  
11 school absenteeism and significant health burdens.<sup>14-18</sup> Despite its high prevalence  
12 rate and effect on daily life, 76.1% of women still believe that dysmenorrhea is a  
13 natural part of a women's menstrual cycle, and only 14.8% believe that treatment is  
14 necessary.<sup>16</sup> In terms of dysmenorrhea information, 62.3% of adolescent girls claim  
15 that they learned about the condition from their mothers, and 52.9% state that they  
16 obtained their knowledge from peers.<sup>16</sup> In addition, dysmenorrhea is negatively  
17 correlated with self-awareness of one's own health; in other words, individuals with  
18 dysmenorrhea have poorer self-awareness regarding their own health.<sup>6</sup>  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38

39         A study of 297 nurses (average age 30.3 years) found that 8.4% had taken  
40 menstrual leave, 11.8% had taken a leave of absence for dysmenorrhea, and 28.6%  
41 saw their doctors owing to the condition.<sup>15</sup> Furthermore, 20.8% of adolescent girls  
42 from vocational schools in the same region had seen doctors for dysmenorrhea.<sup>9</sup>  
43  
44  
45  
46  
47  
48  
49

50         Menstrual leave is currently available in Japan, Indonesia, South Korea, and Taiwan.

51  
52  
53         Focus group studies in Taiwan have showed that most women had menstrual  
54 discomfort and they understood the implementation and regulation of menstrual leave  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 in different companies. However, in reality, the application rate is low because of  
5  
6  
7 factors expressed as follows: “the regulations are too rigid”, “no one else has taken  
8  
9  
10 menstrual leave”, “other kinds of leave are available”, “no one will take my shift”, or  
11  
12 “there has to be a doctor’s note”.<sup>19</sup>  
13

14  
15 Previous studies have showed that the physical and mental health of nurses are  
16  
17 significantly correlated with job satisfaction, tiredness, and comfort.<sup>19, 20</sup> The Gender  
18  
19 Equality in Employment Act of Taiwan, approved in 2002, clearly defines the  
20  
21 regulations regarding menstrual leave, in which a female employee who has trouble  
22  
23 working due to discomfort during menstruation should take 1 day of menstrual leave  
24  
25 every month.<sup>21</sup> However, because of the particularities of nursing, temporary leave  
26  
27 affects the allocation of nurses. Cheng found that the long-term use of medication to  
28  
29 maintain a ready-to-work status is common among women. Nurses, who have  
30  
31 frequent contact with drugs, use them extensively to overcome menstrual discomfort  
32  
33 at work,<sup>10</sup> including the use of sumatriptan–naproxen sodium to reduce the effects of  
34  
35 dysmenorrhea during work and leisure.<sup>21, 22</sup>  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

47 Several risk factors affect dysmenorrhea, as follows. (a) Age: older women are  
48  
49 generally less likely to have dysmenorrhea, although the relationships with marital  
50  
51 status or childbirth history remain unclear. (b) Age of menarche: age of menarche is  
52  
53 significantly related to the occurrence of dysmenorrhea, with women who have an  
54  
55  
56  
57  
58  
59  
60



1  
2  
3  
4 earlier age of menarche more likely to experience more severe dysmenorrhea.<sup>7, 17</sup> (c)  
5  
6  
7 Duration of menstrual cycle: a Nigerian study noted that longer menstrual flow is an  
8  
9  
10 important predictive factor of dysmenorrhea.<sup>7</sup> (d) Regularity of menstrual cycle:  
11  
12 women with irregular menstrual cycles are more likely to have dysmenorrhea.<sup>9</sup> In  
13  
14 terms of lifestyle factors, the results of several studies indicate that smoking and  
15  
16 alcohol consumption are risk factors for primary dysmenorrhea and that women who  
17  
18 habitually smoke or drink alcohol are more likely to have dysmenorrhea.<sup>23, 24</sup> With  
19  
20 regard to work, several studies have found that women who work rotations, especially  
21  
22 nurses who have to alternate between day and night shifts, have relatively more  
23  
24 serious menstrual discomfort.<sup>21</sup> Nurses who work night shifts are more likely to have  
25  
26 dysmenorrheal symptoms during their menstrual cycles compared with those who  
27  
28 work regular shifts.<sup>15</sup>  
29  
30  
31  
32  
33  
34  
35  
36  
37

38  
39 Furthermore, the attitudes of adolescent students toward menstruation correlate  
40  
41 with the occurrence of dysmenorrhea.<sup>25</sup> Adolescent girls who tend to feel that  
42  
43 menstruation is a debilitating experience and those who anticipate and predict the  
44  
45 onset of menstruation are more likely to experience dysmenorrhea.<sup>26</sup> The effect of  
46  
47 dysmenorrhea on women varies based on the degree and frequency of their pain.  
48  
49  
50  
51  
52

53  
54 Previous studies have revealed that women have inadequate knowledge about  
55  
56 menstruation and that educational information about menstrual health care contains  
57  
58  
59  
60

1  
2  
3  
4 contradictory messages, including the idea that menstruation is a normal and natural  
5  
6 event but should be “invisible”.<sup>27</sup> Cheng observed that some female students knew  
7  
8 about menstruation taboos; while they had doubts about those taboos, they still had  
9  
10 negative attitudes about menstruation.<sup>28</sup> Medical expenses due to dysmenorrhea  
11  
12 increase with age; therefore, the topic of women’s menstrual health and  
13  
14 accompanying emotional challenges should be taken seriously.<sup>29</sup> Nevertheless,  
15  
16 because dysmenorrhea is so common, many women consider it a normal phenomenon  
17  
18 and rarely seek medical treatment owing to their cultural and religious attitudes<sup>15</sup> or  
19  
20 because they feel that they can tolerate the pain.<sup>23</sup>  
21  
22  
23  
24  
25  
26  
27  
28  
29

30 In this study, we define dysmenorrhea as lower abdominal pain brought on by  
31  
32 menses at any time during the last 6 months.<sup>11</sup> In Taiwan, 98.8% of hospital nurses are  
33  
34 women. There is a high prevalence rate of dysmenorrhea among women; owing to the  
35  
36 nature of nursing work, nurses are at high risk for dysmenorrhea. However, previous  
37  
38 studies on nurses have not discussed the influencing factors. The objectives of this  
39  
40 study were to: (1) describe the basic demographic data as well as menstruation  
41  
42 characteristics, knowledge about dysmenorrhea, and menstrual attitudes of  
43  
44 dysmenorrheal and non-dysmenorrheal clinical nurses; (2) analyze the demographic  
45  
46 data as well as menstruation characteristics, knowledge about dysmenorrhea, and  
47  
48 menstrual attitudes of dysmenorrheal and non-dysmenorrheal clinical nurses, and  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 identify significant differences between these groups; and (3) examine the risk factors  
5  
6  
7 of dysmenorrhea among clinical nurses.  
8  
9

## 10 11 12 **METHODS**

### 13 14 15 **Study design and participants**

16  
17  
18 This study used a cross-sectional questionnaire survey based on structured  
19  
20  
21 questionnaires for data collection. Participants were recruited at two medical  
22  
23  
24 institutions in southern Taiwan; one institution was a medical center with 1,300 beds,  
25  
26  
27 the other was a regional hospital with 650 beds. The two institutions were at different  
28  
29  
30 hospital levels within the same health care system. All 2,000 nurses at the two  
31  
32  
33 institutions were potential participants. The inclusion criteria for this study were  
34  
35  
36 full-time nurses at the study hospitals who were at least 18 years of age and agreed to  
37  
38  
39 participate in the study after reading an informed consent document. The sample size  
40  
41  
42 was estimated using JMP 7.0 (SAS Institute, Cary, NC, USA) with an effect size of  
43  
44  
45 0.3,  $\alpha$  of 0.05, and a power of 0.80, resulting in a required sample size of 350  
46  
47  
48 individuals. With a predicted questionnaire recovery rate of 80%, the sample size was  
49  
50  
51 estimated to be 438. We used simple random sampling to recruit the estimated number  
52  
53  
54 of study participants. Each participant was chosen randomly and entirely by chance.  
55  
56  
57 In total, 450 nurses were chosen for inclusion in the study. Among these 450 nurses,  
58  
59  
60

1  
2  
3  
4 finally 420 valid questionnaires were returned, with a response rate of 93.3%. Among  
5  
6 these 420 nurses, 297 (70.7%) had experienced dysmenorrhea in the past 6 months  
7  
8 and were categorized in the dysmenorrhea group; 123 (29.3%) nurses who had not  
9  
10 experienced dysmenorrhea were classified as the non-dysmenorrhea group.  
11  
12

13  
14  
15 Random sampling was conducted after the study received approval from the  
16  
17 Institutional Review Boards (IRBD No. CLH0088) of the two hospitals. The  
18  
19 questionnaires were administered to the nurses by a trained research assistant. All  
20  
21 participants provided their written consent and answered the questionnaires  
22  
23 independently. The written consent form indicated that participation in this study was  
24  
25 not compulsory and the questionnaire was anonymous. Anyone who was not willing  
26  
27 to participate in the study could simply choose not to return the questionnaire. No  
28  
29 individual rights or interests were compromised during this process. Those who  
30  
31 completed the questionnaire received a small gift. The questionnaires were collected 2  
32  
33 weeks after being issued, upon which the written consent forms and questionnaires  
34  
35 were filed separately and placed in locations chosen by participants, to protect their  
36  
37 personal privacy.  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52

### 53 **Measurements**

54  
55  
56 This study was conducted in May 2010. The study instruments included the  
57  
58

1  
2  
3  
4 Demographic Inventory (DI), Dysmenorrheal Knowledge Scale (DKS), and  
5  
6 Menstrual Attitude Scale (MAS). The DI was designed based on related studies<sup>9, 30</sup>  
7  
8 and included age, age of menarche, marital and childbirth status, discussion of  
9  
10 menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea,  
11  
12 menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea,  
13  
14 working conditions, self-care health education experience regarding menstruation,  
15  
16 dysmenorrhea influences, and work coping methods. The DKS was designed using  
17  
18 both the researchers' clinical experiences and previous studies.<sup>30</sup> The scale included  
19  
20 20 questions with yes/no answers, for example, "Women with dysmenorrhea are at  
21  
22 high risk for sterility" and "Applying hot compresses to the lower abdomen can ease  
23  
24 menstrual cramps". Correct answers received a score of 1, and incorrect answers  
25  
26 received a score of 0. The total summed scores ranged from 0 to 20, with higher  
27  
28 scores representing a better knowledge of dysmenorrhea. The Kuder-Richardson  
29  
30 reliability coefficient was 0.63 in a previous study<sup>30</sup> and 0.72 in this study. The MAS  
31  
32 was developed by Brooks-Gunn and Ruble (1980)<sup>31</sup> and modified by Lee (1994). Lee  
33  
34 translated this scale into a Chinese version and deleted one items owing to cultural  
35  
36 differences.<sup>32</sup> The Chinese version of MAS includes 32 items with five dimensions,  
37  
38 including consideration of menstruation as a debilitating event, menstruation as a  
39  
40 bothersome event, menstruation as a natural event, anticipation and prediction of the  
41  
42 onset of menstruation, and denial of the effects of menstruation. Each item is scored  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The total  
5  
6  
7 summed scores range from 32 to 224, with higher scores representing a more positive  
8  
9  
10 attitude toward menstruation. Cronbach's  $\alpha$  was 0.58 in the original scale<sup>31</sup> and 0.61 in  
11  
12 Morrison's study.<sup>33</sup> Lo and Lin (1998) suggested that an acceptable Cronbach's  $\alpha$  was  
13  
14 from 0.3 to 0.7.<sup>34</sup> As we were concerned about comparability with other studies, we  
15  
16  
17 decided to use this scale with a Cronbach's  $\alpha$  of 0.57 in the present study.  
18  
19

#### 20 21 22 23 24 Data analysis

25  
26  
27 The data in this study were entered using Microsoft Excel. JMP 7.0 was used for  
28  
29  
30 statistical analysis. Based on the study variables and objectives, percentage, mean,  
31  
32  
33 and standard deviation were used to describe participant demographics and  
34  
35  
36 menstruation characteristics as well as DKS and MAS distributions in the  
37  
38  
39 dysmenorrhea and non-dysmenorrhea groups. We used *t*-tests and chi-square tests to  
40  
41  
42 detect differences in demographics, menstruation characteristics, DKS, and MAS  
43  
44  
45 between the two groups. Finally, multiple logistic regression analysis was used to  
46  
47  
48 examine influencing factors (independent variables) of the occurrence of  
49  
50  
51 dysmenorrhea (dependent variable). Independent variables with significant  
52  
53  
54 differences were included in the multiple logistic regression analysis.  
55  
56  
57  
58  
59  
60

## 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 $\chi^2$	p-value
	n	%	n	%		
Age (years) M $\pm$ SD	30.33 $\pm$ 3.61		32.04 $\pm$ 4.47		-3.78	<0.001
Age < 40	292	98.32	115	93.50	6.74	<0.01
Age $\geq$ 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		
$\geq$ 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
$\leq$ 4 days	110	37.04	43	34.96		
5-6 days	157	52.86	70	56.91		
$\geq$ 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 $\chi^2$	p-value
	n	%	n	%		
	Whether to know it is allowed to ask for menstrual leave					
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

1  
2  
3  
4 is a disease of the reproductive system”, and “women with dysmenorrhea are at high  
5  
6  
7 risk for sterility.” Regarding menstrual attitudes, after standardizing, the highest  
8  
9  
10 scoring dimension among the dysmenorrhea group was “considering menstruation a  
11  
12 debilitating event” (73.30) and “considering menstruation a natural event” (74.93) in  
13  
14 the non-dysmenorrhea group. The lowest scoring dimension in both groups was  
15  
16  
17 “denial of any effect of menstruation” (47.18 in the dysmenorrhea group and 54.69 in  
18  
19 the dysmenorrhea group). Women with dysmenorrhea had significantly higher scores  
20  
21 than women in the non-dysmenorrhea group with respect to the following:  
22  
23  
24 considering menstruation a debilitating event ( $p < 0.001$ ), considering menstruation a  
25  
26 bothersome event ( $p = 0.024$ ), and anticipation and prediction of menstruation onset  
27  
28 ( $p = 0.004$ ). In terms of denying the effects of menstruation, scores for the  
29  
30 dysmenorrhea group were significantly lower than those of the non-dysmenorrhea  
31  
32 group ( $p < 0.001$ ). No significant differences were observed between the groups in  
33  
34 terms of considering menstruation a natural event (Table 2).  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

47 Table 2. Comparison of dysmenorrheic knowledge and menstrual attitude between the  
48  
49 dysmenorrhea and non-dysmenorrhea groups  
50  
51

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

1							
2							
3	scale						
4	Menstrual attitude scale	148.64	12.74	146.85	12.69	1.31	0.192
5	Menstruation as a						
6	debilitating event	56.44	8.52	52.55	7.65	4.58	<0.001
7	Menstruation as a						
8	bothersome event	29.05	5.01	27.54	6.64	2.27	0.024
9	Menstruation as a natural						
10	event	19.98	5.19	20.98	4.92	-1.87	0.062
11	Anticipation and prediction						
12	of the onset of menstruation	20.04	3.01	18.98	3.55	2.93	0.004
13	Denial of any effect of						
14	menstruation	23.12	6.75	26.80	5.70	5.70	<0.001
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							

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 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 Higher debilitating event	Lower	2.53 ( 1.63 , 3.95 )	<0.001	2.72 ( 1.67 , 4.52 ) <0.001
	Higher	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  $\geq 40$  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,<sup>5, 6, 16</sup> compared with a rate of 55.9% in a study among women aged 15–45-years,<sup>31</sup> with a

1  
2  
3  
4 decrease in the occurrence with increasing age. As dysmenorrhea is very common,  
5  
6  
7 periodic dysmenorrhea comes naturally with the menstrual cycle. With age,  
8  
9  
10 experiences of dysmenorrhea and coping among women also increase; therefore,  
11  
12  
13 women with dysmenorrhea can be thought of as “female specialists with embodied  
14  
15  
16 knowledge,” meaning that their experiences may affect their subjective perception and  
17  
18  
19 tolerance of dysmenorrhea, which can in turn affect the occurrence of  
20  
21  
22 dysmenorrhea.<sup>35</sup> Nursing is a female-dominated occupation in Taiwan. In this study,  
23  
24  
25 97% of participants were younger than 40 years old. The high prevalence rate of  
26  
27  
28 dysmenorrhea severely affects nurses such that they may not be able to focus on their  
29  
30  
31 work, thereby affecting the quality of patient care. Nurses may need to take menstrual  
32  
33  
34 leave, which can cause a shortage of nursing resources.

35  
36 In terms of marital status, the unmarried ratio in the dysmenorrhea group was  
37  
38  
39 2.74 times that of the non-dysmenorrhea group, indicating a high dysmenorrhea  
40  
41  
42 occurrence rate among unmarried women; after adjusting for confounding variables, it  
43  
44  
45 was 2.59 times higher than that among married women. This result is consistent with  
46  
47  
48 those of Chung (average study participant age 27 years), which reported a higher  
49  
50  
51 dysmenorrhea occurrence rate in single nurses than in married and divorced ones.<sup>36</sup>  
52  
53  
54 Many women are told by their doctors that their dysmenorrhea will improve after  
55  
56  
57 getting married and giving birth, which may improve menstrual blood discharge.  
58  
59  
60

1  
2  
3  
4 Furthermore, women may engage in positive self-care for menstruation after getting  
5  
6  
7 married for childbearing reasons, which may also be a factor that indirectly relieves  
8  
9  
10 dysmenorrhea.<sup>11</sup> In terms of work, the dysmenorrhea occurrence rate among nurses in  
11  
12  
13 the dysmenorrhea group who worked three-shift rotations was 2.15 times that of  
14  
15  
16 nurses in the non-dysmenorrhea group; after adjusting for confounding variables, it  
17  
18  
19 was 2.07 times higher than among nurses who did not work three-shift rotations. This  
20  
21  
22 indicates that work type (e.g., rotating nightshifts) is a risk factor for dysmenorrhea in  
23  
24  
25 nurses. However, Chung found that rotating work shifts were not significantly related  
26  
27  
28 to dysmenorrhea occurrence in nurses.<sup>36</sup> Furthermore, one study among Japanese  
29  
30  
31 junior high school students also found that nightshift work was not significantly  
32  
33  
34 associated with dysmenorrhea.<sup>37</sup> However, an interview of focus groups conducted by  
35  
36  
37 Chang found that working rotating shifts was highly associated with menstrual  
38  
39  
40 discomfort.<sup>19</sup> Owing to the nature of nursing work, most nurses need to work rotating  
41  
42  
43 night shifts, and the graveyard shift can easily cause uncomfortable menstrual cycles  
44  
45  
46 or obvious irregularities.<sup>25</sup> Coupling nurses' day/night activities and sleep patterns  
47  
48  
49 with the increased pressure of working night shifts, menstrual discomfort may be  
50  
51  
52 more common in those with frequent rotation changes.

53  
54 In terms of menstrual attitude, the dysmenorrhea group had significantly higher  
55  
56  
57 scores than the non-dysmenorrhea group in considering menstruation to be a  
58  
59  
60

1  
2  
3  
4 debilitating event and significantly lower scores than the non-dysmenorrhea group in  
5  
6  
7 denying the effects of menstruation. In multiple logistic regression for menstrual  
8  
9  
10 attitude, the tendency to consider menstruation as a debilitating event in the  
11  
12  
13 dysmenorrhea group was 2.53 times higher than that of the non-dysmenorrhea group;  
14  
15  
16 after adjusting for confounding variables, women with dysmenorrhea had a 2.72 times  
17  
18  
19 higher tendency to think of menstruation as a debilitating event than women who did  
20  
21  
22 not consider menstruation to be debilitating. The tendency to deny the effects of  
23  
24  
25 menstruation in the dysmenorrhea group was 2.83 times higher than the  
26  
27  
28 non-dysmenorrhea group; after adjusting for confounding variables, women with  
29  
30  
31 dysmenorrhea had a 2.59 times higher tendency to deny the effects of menstruation.  
32  
33  
34 In this study, menstrual attitude was related to dysmenorrhea occurrence. Firat found  
35  
36  
37 no significant correlation between menstrual discomfort and menstrual attitude.<sup>38</sup> In  
38  
39  
40 that study among vocational nursing students with dysmenorrhea, “menstruation is a  
41  
42  
43 debilitating event” and “anticipation and prediction of the onset of menstruation”  
44  
45  
46 scored significantly higher than in those who did not have dysmenorrhea. In terms of  
47  
48  
49 “menstruation is a bothersome event” and “menstruation is a natural event,” the  
50  
51  
52 non-dysmenorrhea group scored significantly higher than the dysmenorrhea group; no  
53  
54  
55 significant differences were observed between the two groups in terms of “denial of  
56  
57  
58 any effect of menstruation”.<sup>26</sup> These results are different from those of the present  
59  
60



1  
2  
3  
4 study. The most obvious difference between the two studies is the tendency to deny  
5  
6 the effects of menstruation. Scores in the dysmenorrhea and non-dysmenorrhea  
7  
8 groups in the present study were 23.1 and 26.8, respectively, compared with 26.6 and  
9  
10 28.0 among adolescent nursing students in Firat's study. In other words, compared  
11  
12 with adolescent nursing students, nurses in the present study did not deny the effects  
13  
14 caused by menstruation and recognized that they were affected by menstruation.  
15  
16 When a nurse experiences dysmenorrhea, her work may be affected. If she requests  
17  
18 menstrual leave, temporary work arrangements must be made and patient care may be  
19  
20 affected. Because dysmenorrhea is a periodic phenomenon, taking frequent menstrual  
21  
22 leave may affect working relationships; therefore, nurses usually choose to work even  
23  
24 when they experience dysmenorrhea.  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35

36 In summary, influencing factors for dysmenorrhea occurrence included age under  
37  
38 40 years, working three-shift rotations, marital status, and using mean as the contact  
39  
40 point, the tendency to consider menstruation to be a debilitating event and tendency to  
41  
42 deny the effects of menstruation. Chiou's study of adolescent nursing students found  
43  
44 that menstrual regularity and health education were predictive factors for  
45  
46 dysmenorrhea.<sup>30</sup> Women who had irregular menstrual cycles and had not received  
47  
48 dysmenorrhea-related health education had higher dysmenorrhea occurrence rates;<sup>9</sup>  
49  
50 however, these two factors were not predictive factors in the present study. Our  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 participants were nurses from a wide range of age groups rather than only adolescents;  
5  
6  
7 therefore, they had more experience with dysmenorrhea and self-care. In addition,  
8  
9  
10 menstrual health is a part of nursing education; therefore, although nurses are not  
11  
12 directly involved in health education, education is a part of their professional training.  
13  
14 Thus, health education was not an important predictive factor in this study. This study  
15  
16 mainly evaluated the influencing factors for dysmenorrhea in hospital nurses with the  
17  
18 aim of helping to build a caring climate and friendly work environment for high-risk  
19  
20 nurses. The participants were randomly selected nurses from only two hospitals in  
21  
22 southern Taiwan; therefore, the results might have limited generalizability to nurses in  
23  
24 other parts of the country. In future studies, inclusion criteria should be extended to  
25  
26 examine any differences between different areas of Taiwan. In addition, rotating night  
27  
28 shifts are required in many other occupations besides nursing. Considering different  
29  
30 professional backgrounds and life experiences, future studies should also include  
31  
32 women from different occupations who work rotating shifts, to evaluate differences in  
33  
34 the influence of their knowledge and attitudes on dysmenorrhea occurrence. The  
35  
36 variables assessed in this study included demographic characteristics, menstruation  
37  
38 history, dysmenorrhea knowledge, and menstrual attitudes, among others; however,  
39  
40 lifestyle choices such as smoking, drinking, and exercising were not included. Future  
41  
42 studies are necessary to analyze the effects of these lifestyle choices on dysmenorrhea.  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 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.

## ACKNOWLEDGEMENTS

The authors thank the participants for their participation and the nurse managers of the two hospitals for their administrative assistance. We also thank Editage for their professional English review of this manuscript.

### Competing interests

None.

### Funding

This research received no specific grants from any funding agency in the public, commercial, or not-for-profit sectors.

### 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.

- 1
- 2
- 3 28. Cheng CY, Yang K, Liou SR. Taiwanese adolescents? Gender differences in
- 4 knowledge and attitudes towards menstruation. *Nursing & Health Sciences*
- 5 2007;9(2):127-34.
- 6
- 7 29. H LY. The medical utilization of chinese and western medicine in females with
- 8 dysmenorrhea. Kaohsiung Medical University, 2012.
- 9
- 10 30. Chiou M-H, Wang H-H, Yang Y-H. Effect of systematic menstrual health
- 11 education on dysmenorrheic female adolescents' knowledge, attitudes, and
- 12 self-care behavior. *Kaohsiung J Med Sci* 2007;23(4):183-90.
- 13
- 14 31. Brooks-Gunn J, Ruble D. The menstrual attitude questionnaire. *Psychosomatic*
- 15 *medicine* 1980;42:503-11.
- 16
- 17 32. S L. Prevalence and associated factors of premenstrual syndrome among nurses in
- 18 Taiwan. In: Ministry of Science and Technology, R. O. C., editor, 1994.
- 19
- 20 33. Morrison LA, Larkspur L, Calibuso MJ, Brown S. Women's attitudes about
- 21 menstruation and associated health and behavioral characteristics. *American*
- 22 *Journal of Health Behavior* 2010;34(1):90-100.
- 23
- 24 34. Lo Sing-Kai, Lin Ching-Fen. On the use and interpretation of Cronbach's alpha.
- 25 *The Journal of Nursing Research* 1998;6:82-9.
- 26
- 27 35. Lin YX. *When "Experts" meet the medical professionals: The women with*
- 28 *menstrual pain encountering western medicine*. Kaohsiung Medical University,
- 29 Taiwan, 2006.
- 30
- 31 36. Chung F, Yao C, Wan G. The associations between menstrual function and life
- 32 style/working conditions among nurses in Taiwan. *Journal of occupational health*
- 33 2005;47(2):149-56.
- 34
- 35 37. Takeuchi H, Oishi T, Harada T. Morningness-eveningness preference, and mental
- 36 and physical symptoms during the menstrual cycle of Japanese junior high school
- 37 students. *Sleep and Biological Rhythms* 2003(1):245-47.
- 38
- 39 38. Firat MZ, Kulakac O, Oncel S, Akcan A. Menstrual attitude questionnaire:
- 40 confirmatory and exploratory factor analysis with Turkish samples. *Journal of*
- 41 *advanced nursing* 2009;65(3):652-62.
- 42
- 43
- 44
- 45
- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

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

	Item No	Page No	Recommendation
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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	<i>Cross-sectional study</i> —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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed
			<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed
			<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy
			(e) Describe any sensitivity analyses

Continued on next page



<b>Results</b>			
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	<i>Cross-sectional study</i> —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
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://www.strobe-statement.org).

# BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-017615.R2
Article Type:	Research
Date Submitted by the Author:	15-Nov-2017
Complete List of Authors:	Chiu, Min-Hui; Kaohsiung Medical University College of Nursing, Doctoral Student; Chi Mei Medical Center, Liouying, Department of Nursing Hsieh, Hsiu-Fen; Kaohsiung Medical University, College of Nursing Yang, Yi-Hsin; Kaohsiung Med Univ Chen, Huei-Mein; Chung Hwa University of Medical Technology Hsu, Su-Chen; Chi Mei Medical Center Wang, Hsiu-Hung; Kaohsiung Medical University, College of Nursing
<b>Primary Subject Heading</b>:	Communication
Secondary Subject Heading:	Intensive care
Keywords:	dysmenorrhea, prevalence rate, self-care behavior, hospital nurses

SCHOLARONE™  
Manuscripts

## Title Page

### Manuscript title

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

### Running head

Dysmenorrhea and influencing factors

### Authors

#### Min-Hui Chiu

1. Doctoral Student, College of Nursing, Kaohsiung Medical University, Taiwan  
Address: No. 100 Shih-Chuan 1st Road, San-Ming District, Kaohsiung 80708, Taiwan
2. Director, Chi Mei Medical Center, Liouying, Tainan, Taiwan  
Address: No.201, Taikang, Liouying Dist., Tainan City 736, Taiwan  
Email: 300015@mail.chimei.org.tw

#### Hsiu-Fen Hsieh

Associate Professor, College of Nursing, Kaohsiung Medical University, Taiwan  
Address: No. 100 Shih-Chuan 1st Road, San-Ming District, Kaohsiung 80708, Taiwan  
Email: [hsiufen96@gmail.com](mailto:hsiufen96@gmail.com)

#### Yi-Hsin Yang

Professor, College of Pharmacy, Kaohsiung Medical University, Kaohsiung, Taiwan  
Address: No. 100 Shih-Chuan 1st Road, San-Ming District, Kaohsiung 80708, Taiwan  
E-mail: [yihnya@kmu.edu.tw](mailto:yihnya@kmu.edu.tw)  
Telephone: 886-7-3121101 ext. 2262

#### Huei-Mein Chen

Associate Professor, Chung Hwa University of Medical Technology, Tainan, Taiwan  
Address: No. 89, Wen-hua1st St, Rende District, Tainan 71703, Taiwan  
E-mail: [hueimein@mail.hwai.edu.tw](mailto:hueimein@mail.hwai.edu.tw)  
Telephone: 886-6-2671214 ext. 512

#### Su-Chen Hsu

Chi Mei Medical Center, Tainan, Taiwan

1  
2  
3 Address: No.901, Zhonghua Rd., Yongkang Dist., Tainan City 710, Taiwan

4 E-mail: 300001@mail.chimei.org.tw

5 Telephone: 886-6-2812811 ext. 53000

6 Fax: 886-6-2827480

7  
8  
9  
10 **Hsiu-Hung Wang\***

11 Professor, College of Nursing, Kaohsiung Medical University, Taiwan

12  
13  
14 **Corresponding author**

15  
16 Hsiu-Hung Wang, RN, FAAN, PhD

17 Dean and Professor, College of Nursing, Kaohsiung Medical University

18 No. 100, Shih-Chuan 1st Road, Kaohsiung City 80708, Taiwan

19 Tel: 886-7-3121101 ext 2624

20 Fax: 886-7-3218364

21 E-mail: hhwang@kmu.edu.tw  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**keywords**

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

**Word count**

4005

For peer review only

## 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

1  
2  
3 showed that predictive factors included age less than 40 years (4.46 vs. 1.00), working  
4  
5 three-shift rotations (2.07 vs. 1.00), marital status (2.59 vs. 1.00), acknowledging  
6  
7 menstruation as a debilitating event (2.72 vs. 1.00), and denial of effects from  
8  
9 menstruation (2.59 vs. 1.00).  
10

11 **Conclusions:** These findings could help nursing managers to create a caring climate  
12  
13 and friendly work environment for hospital nurses at risk for dysmenorrhea.  
14

15 **Keywords:** Dysmenorrhea, prevalence rate, self-care behavior, hospital nurses  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

### 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.<sup>1</sup> 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,<sup>2</sup> and depression.<sup>3</sup> Dysmenorrhea arises during menstrual bleeding owing to lower abdominal pain brought on by menses, and is not any other gynecological disorders.<sup>4</sup> 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%.<sup>5-7</sup> Parker et al. found that 21% of Australian adolescents experienced severe dysmenorrhea, with 26% requiring absence from school due to dysmenorrhea.<sup>8</sup>

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

Dysmenorrhea can be cyclical or chronic; in some cases, it can be a possible result of pain catastrophizing and anxiety sensitivity.<sup>13</sup> 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.<sup>14-18</sup> 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

1  
2  
3 necessary.<sup>16</sup> In terms of dysmenorrhea information, 62.3% of adolescent girls claim  
4 that they learned about the condition from their mothers, and 52.9% state that they  
5 obtained their knowledge from peers.<sup>16</sup> In addition, dysmenorrhea is negatively  
6 correlated with self-awareness of one's own health; in other words, individuals with  
7 dysmenorrhea have poorer self-awareness regarding their own health.<sup>6</sup>  
8  
9  
10  
11  
12

13  
14 A study of 297 nurses (average age 30.3 years) revealed that 8.4% had taken  
15 menstrual leave, 11.8% had taken a leave of absence for dysmenorrhea, and 28.6%  
16 saw their doctors owing to the condition.<sup>15</sup> Furthermore, 20.8% of adolescent girls  
17 from vocational schools in the same region had visited doctors for consultation  
18 regarding dysmenorrhea.<sup>9</sup> Menstrual leave is currently available in Japan, Indonesia,  
19 South Korea, and Taiwan. Focus group studies in Taiwan have shown that most  
20 women have experienced menstrual discomfort and that they understand the  
21 implementation and regulation of menstrual leave in different companies. However, in  
22 reality, menstrual leave is rarely availed of owing to the following factors: "the  
23 regulations are too rigid," "no one else has taken menstrual leave," "other kinds of  
24 leave are available," "no one will take my shift," or "there has to be a doctor's note."<sup>19</sup>  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36

37  
38 Previous studies have shown that the physical and mental health of nurses is  
39 significantly correlated with job satisfaction, tiredness, and comfort.<sup>19, 20</sup> The Gender  
40 Equality in Employment Act of Taiwan, approved in 2002, clearly defines the  
41 regulations regarding menstrual leave, in which a female employee who has trouble  
42 working due to discomfort during menstruation should take 1 day of menstrual leave  
43 every month.<sup>21</sup> However, because of the particularities of nursing, temporary leave  
44 affects the allocation of nurses. Cheng found that the long-term use of medication to  
45 maintain a ready-to-work status is common among women. Nurses, who have  
46 frequent contact with drugs, use them extensively to overcome menstrual discomfort  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 at work,<sup>10</sup> including the use of sumatriptan–naproxen sodium to reduce the effects of  
4  
5 dysmenorrhea during work and leisure.<sup>21, 22</sup>  
6

7 Several risk factors affect dysmenorrhea. (a) Age: older women are generally less  
8  
9 likely to experience dysmenorrhea, although the relationships with marital status or  
10  
11 childbirth history remain unclear. (b) Age at menarche: age at menarche is  
12  
13 significantly related to the occurrence of dysmenorrhea, and women who demonstrate  
14  
15 an earlier age at menarche are more likely to experience more severe dysmenorrhea.<sup>7,</sup>  
16  
17 <sup>17</sup> (c) Duration of menstrual cycle: a Nigerian study noted that longer menstrual flow  
18  
19 duration is an important predictive factor of dysmenorrhea.<sup>7</sup> (d) Regularity of  
20  
21 menstrual cycle: women with irregular menstrual cycles are more likely to have  
22  
23 dysmenorrhea.<sup>9</sup> In terms of lifestyle factors, the results of several studies indicate that  
24  
25 smoking and alcohol consumption are risk factors for primary dysmenorrhea and that  
26  
27 women who habitually smoke or drink alcohol are more likely to have  
28  
29 dysmenorrhea.<sup>23, 24</sup> With regards to work, several studies have found that women who  
30  
31 work rotations, especially nurses who have to alternate between day and night shifts,  
32  
33 experience relatively more serious menstrual discomfort.<sup>21</sup> Nurses who work night  
34  
35 shifts are more likely to experience dysmenorrheal symptoms during their menstrual  
36  
37 cycles than those who work regular shifts.<sup>15</sup>  
38  
39  
40

41 Furthermore, the attitudes of adolescent students toward menstruation correlate  
42  
43 with the occurrence of dysmenorrhea.<sup>25</sup> Adolescent girls who tend to feel that  
44  
45 menstruation is a debilitating experience and those who anticipate and predict the  
46  
47 onset of menstruation are more likely to experience dysmenorrhea.<sup>26</sup> The effect of  
48  
49 dysmenorrhea on women varies based on the degree and frequency of their pain.  
50  
51

52 Previous studies have revealed that women have inadequate knowledge about  
53  
54 menstruation and that educational information about menstrual health care contains  
55  
56

1  
2  
3 contradictory messages, including the idea that menstruation is a normal and natural  
4 event but should be “invisible.”<sup>27</sup> Cheng observed that some female students knew  
5 about menstruation taboos; although they did have doubts about those taboos, they  
6 still had negative attitudes towards menstruation.<sup>28</sup> Medical expenses due to  
7 dysmenorrhea increase with age; therefore, the topic of women’s menstrual health and  
8 accompanying emotional challenges should be taken seriously.<sup>29</sup> Nevertheless,  
9 because dysmenorrhea is so common, many women consider it a natural phenomenon  
10 and rarely seek medical treatment owing to their cultural and religious attitudes<sup>15</sup> or  
11 because they feel that they can tolerate the pain.<sup>23</sup>

12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Herein, we defined dysmenorrhea as lower abdominal pain brought on by menses at any time during the past 6 months.<sup>11</sup> 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

1  
2  
3 This study used a cross-sectional survey based on structured questionnaires for  
4 data collection. Participants were recruited from two medical institutions in southern  
5 Taiwan; one institution was a medical center with 1,300 beds, the other was a regional  
6 hospital with 650 beds. The two institutions were at different hospital levels within  
7 the same health care system. All 2,000 nurses at the two institutions were potential  
8 participants. The inclusion criteria for this study were full-time nurses employed at  
9 the study hospitals who were at least 18 years of age and agreed to participate in the  
10 study after providing informed consent. The sample size was estimated using JMP 7.0  
11 (SAS Institute, Cary, NC, USA) with an effect size of 0.3,  $\alpha$  of 0.05, and a power of  
12 0.80, resulting in a required sample size of 350 individuals. With a predicted  
13 questionnaire recovery rate of 80%, the sample size was estimated to be 438. After  
14 obtaining a list of the names of the potential participants, serial numbers were  
15 assigned to each participant. The estimated number of study participants were  
16 randomly selected using the sampling function of Microsoft Excel 2007. In total, 450  
17 nurses were chosen for inclusion in the study, and finally, 420 valid questionnaires  
18 were returned, yielding a response rate of 93.3%. Among these 420 nurses, 297  
19 (70.7%) had experienced dysmenorrhea in the past 6 months and were classified as  
20 the dysmenorrhea group; 123 (29.3%) nurses who had not experienced dysmenorrhea  
21 were classified as the non-dysmenorrhea group.

22  
23  
24 The random sampling was conducted after the study received approval from the  
25 Institutional Review Boards (IRBD No. CLH0088) of the two hospitals. The  
26 questionnaires were administered to the nurses by a trained research assistant. All  
27 participants provided their written consent and answered the questionnaires  
28 independently. The written consent form indicated that participation in this study was  
29 not compulsory and the questionnaire was anonymous. Anyone who was not willing

1  
2  
3 to participate in the study could simply choose not to return the questionnaire. No  
4 individual rights or interests were compromised during this process. Those who  
5 completed the questionnaire received a small gift. The questionnaires were collected 2  
6 weeks after being issued, upon which the written consent forms and questionnaires  
7 were filed separately and placed in locations chosen by participants, to protect their  
8 personal privacy.  
9  
10  
11  
12  
13  
14

### 15 16 17 18 **Measurements**

19  
20 This study was conducted in May 2010. The study instruments included the  
21 Demographic Inventory (DI), Dysmenorrheal Knowledge Scale (DKS), and  
22 Menstrual Attitude Scale (MAS). The DI was designed based on related studies<sup>9, 30</sup>  
23 and included age, age at menarche, marital and childbirth status, discussion of  
24 menstrual hygiene, dysmenorrhea experience, medical experience of dysmenorrhea,  
25 working conditions, self-care health education regarding menstruation, factors  
26 affecting dysmenorrhea, and work coping methods. The DKS was designed using  
27 both the researchers' clinical experiences and previous studies.<sup>30</sup> The scale included  
28 20 questions with yes/no answers, for example, "Women with dysmenorrhea are at  
29 high risk for sterility" and "Applying hot compresses to the lower abdomen can ease  
30 menstrual cramps". Correct answers received a score of 1, and incorrect answers  
31 received a score of 0. The total summed scores ranged from 0 to 20, with higher  
32 scores representing better knowledge of dysmenorrhea. The Kuder-Richardson  
33 reliability coefficient was 0.63, according to a previous study<sup>30</sup> and 0.72 in this study.  
34 The MAS was developed by Brooks-Gunn and Ruble (1980)<sup>31</sup> and modified by Lee  
35 (1994). Lee translated this scale into a Chinese version and deleted one item owing to  
36 cultural differences.<sup>32</sup> The Chinese version of the MAS includes 32 items with five  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 dimensions, including consideration of menstruation as a debilitating event,  
4  
5 menstruation as a bothersome event, menstruation as a natural event, anticipation and  
6  
7 prediction of the onset of menstruation, and denial of the effects of menstruation.  
8  
9 Each item is scored on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly  
10  
11 agree). The total summed scores range from 32 to 224, with higher scores  
12  
13 representing a more positive attitude toward menstruation. Cronbach's  $\alpha$  was 0.58 in  
14  
15 the original scale<sup>31</sup> and 0.61 in Morrison's study.<sup>33</sup> Lo and Lin (1998) suggested that  
16  
17 an acceptable Cronbach's  $\alpha$  ranged from 0.3 to 0.7.<sup>34</sup> Because we were concerned  
18  
19 about the comparability of our study with other studies, we decided to use this scale  
20  
21 with a Cronbach's  $\alpha$  of 0.57 in the present study.  
22  
23  
24  
25

#### 26 Data analysis

27  
28 The data in this study were entered using Microsoft Excel. JMP 7.0 was used for  
29  
30 the statistical analysis. Based on the study variables and objectives, percentage, mean,  
31  
32 and standard deviation were used to describe participant demographics and  
33  
34 menstruation characteristics as well as DKS and MAS score distributions in the  
35  
36 dysmenorrhea and non-dysmenorrhea groups. We used *t*-tests and chi-square tests to  
37  
38 detect differences in demographics, menstruation characteristics, DKS score, and  
39  
40 MAS score between the two groups. Finally, multiple logistic regression analysis was  
41  
42 used to examine factors (independent variables) influencing the occurrence of  
43  
44 dysmenorrhea (dependent variable). Independent variables with significant  
45  
46 differences were included in the multiple logistic regression analysis.  
47  
48  
49  
50  
51

## 52 RESULTS

53  
54 A total of 420 participants completed the questionnaire. Among them, 297  
55  
56

1  
2  
3 (70.7%) had experienced dysmenorrhea in the past 6 months, and 123 (29.3%) had  
4  
5 not. Compared with the non-dysmenorrhea group, participants with dysmenorrhea  
6  
7 were significantly younger ( $t = -3.78$ ,  $p < 0.001$ ), were more frequently unmarried  
8  
9 (77.78%,  $\chi^2 = 20.03$ ,  $p < 0.001$ ) and without a history of childbirth (83.16%,  $\chi^2 =$   
10  
11 19.38,  $p < 0.001$ ), and more often demonstrated an age at menarche of less than 12  
12  
13 years (15.49%,  $\chi^2 = 4.70$ ,  $p = 0.03$ ); moreover, a higher percentage of participants  
14  
15 with dysmenorrhea worked a three-shift rotation (91.25%,  $\chi^2 = 6.06$ ,  $p = 0.014$ ). The  
16  
17 other variables showed no significant differences between the two groups (Table 1).  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



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 $\chi^2$	p-value
	n	%	n	%		
Age (years) M $\pm$ SD	30.33 $\pm$ 3.61		32.04 $\pm$ 4.47		-3.78	<0.001
Age <40	292	98.32	115	93.50	6.74	<0.01
Age $\geq$ 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		
$\geq$ 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
$\leq$ 4 days	110	37.04	43	34.96		
5-6 days	157	52.86	70	56.91		
$\geq$ 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 dysmenorrhoeal and non-dysmenorrhoeal groups (continued)

Variables	Dysmenorrhoeal (n = 297)		Non-dysmenorrhoeal (n = 123)		t or $\chi^2$	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 dysmenorrhoea?					3.59	0.058
No	262	88.22	116	94.31		
Yes	35	11.78	7	5.69		
Secondary dysmenorrhoea					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 dysmenorrhoea, 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 non-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

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22

	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	

---

23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45

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.

46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56

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

---

Reference group: Age  $\geq 40$  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,<sup>5,6,16</sup> and another reported a rate of 55.9% among women aged 15–45 years,<sup>31</sup> 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

1  
2  
3 the occurrence of dysmenorrhea.<sup>35</sup> Nursing is a female-dominated occupation in  
4 Taiwan. In this study, 97% of participants were younger than 40 years old. The high  
5 prevalence rate of dysmenorrhea severely affects nurses such that they may not be  
6 able to focus on their work, thereby affecting the quality of patient care. Nurses may  
7 need to take menstrual leave, which can cause a shortage of nursing resources.  
8  
9  
10  
11  
12

13  
14 In terms of marital status, the ratio of unmarried to married women in the  
15 dysmenorrhea group was 2.74 times that of the non-dysmenorrhea group, indicating a  
16 high dysmenorrhea occurrence rate among unmarried women; after adjusting for  
17 confounding variables, it was 2.59 times higher than that among married women. This  
18 result is consistent with those of Chung (average study participant age 27 years),  
19 which reported a higher dysmenorrhea occurrence rate in single nurses than in  
20 married and divorced ones.<sup>36</sup> Many women are told by their doctors that their  
21 dysmenorrhea will improve after getting married and giving birth, which may  
22 improve menstrual blood discharge. Furthermore, women may engage in positive  
23 self-care for menstruation after getting married for childbearing reasons, which may  
24 also be a factor that indirectly relieves dysmenorrhea.<sup>11</sup> In terms of work, the  
25 dysmenorrhea occurrence rate among nurses in the dysmenorrhea group who worked  
26 three-shift rotations was 2.15 times that of nurses in the non-dysmenorrhea group;  
27 after adjusting for confounding variables, it was 2.07 times higher than among nurses  
28 who did not work three-shift rotations. This indicates that work type (e.g., rotating  
29 nightshifts) is a risk factor for dysmenorrhea in nurses. However, Chung found that  
30 rotating work shifts were not significantly related to dysmenorrhea occurrence in  
31 nurses.<sup>36</sup> Furthermore, one study among Japanese junior high school students also  
32 found that nightshift work was not significantly associated with dysmenorrhea.<sup>37</sup>  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
However, focus group interviews conducted by Chang revealed that working rotating

1  
2  
3 shifts was highly associated with menstrual discomfort.<sup>19</sup> Owing to the nature of  
4 nursing work, most nurses need to work rotating night shifts, and the graveyard shift  
5 can easily cause uncomfortable menstrual cycles or obvious irregularities.<sup>25</sup> Owing to  
6 nurses' day/night activities and sleep patterns, along with the increased pressure of  
7 working night shifts, menstrual discomfort may be more common in those with  
8 frequent rotation changes.  
9  
10  
11  
12  
13  
14

15  
16 In terms of attitudes towards menstruation, the dysmenorrhea group had  
17 significantly higher scores than the non-dysmenorrhea group in terms of considering  
18 menstruation to be a debilitating event, and significantly lower scores than the  
19 non-dysmenorrhea group in terms of denying the effects of menstruation. In the  
20 multiple logistic regression analysis of attitudes towards menstruation, the tendency to  
21 consider menstruation as a debilitating event in the dysmenorrhea group was 2.53  
22 times higher than that in the non-dysmenorrhea group; after adjusting for confounding  
23 variables, women with dysmenorrhea had a 2.72 times higher tendency to think of  
24 menstruation as a debilitating event than women who did not consider menstruation to  
25 be debilitating. The tendency to deny the effects of menstruation in the dysmenorrhea  
26 group was 2.83 times higher than in the non-dysmenorrhea group; after adjusting for  
27 confounding variables, women with dysmenorrhea had a 2.59 times higher tendency  
28 to deny the effects of menstruation. In this study, attitude towards menstruation was  
29 related to dysmenorrhea occurrence. Firat found no significant correlation between  
30 menstrual discomfort and attitude towards menstruation.<sup>38</sup> In that study,  
31 "menstruation is a debilitating event" and "anticipation and prediction of the onset of  
32 menstruation" obtained significantly higher scores from the vocational nursing  
33 students with dysmenorrhea than those who did not have dysmenorrhea. In terms of  
34 "menstruation is a bothersome event" and "menstruation is a natural event," the  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 non-dysmenorrhea group demonstrated significantly higher scores than the  
4  
5 dysmenorrhea group; no significant differences were observed between the two  
6  
7 groups in terms of “denial of any effect of menstruation”.<sup>26</sup> These results are different  
8  
9 from those of the present study. The most obvious difference between the two studies  
10  
11 is the tendency to deny the effects of menstruation. Scores in the dysmenorrhea and  
12  
13 non-dysmenorrhea groups in the present study were 23.1 and 26.8, respectively,  
14  
15 compared with 26.6 and 28.0 among adolescent nursing students in Firat’s study. In  
16  
17 other words, compared with adolescent nursing students, the nurses in the present  
18  
19 study did not deny the effects caused by menstruation and recognized that they were  
20  
21 affected by menstruation. When a nurse experiences dysmenorrhea, her work may be  
22  
23 affected. If she requests for menstrual leave, temporary work arrangements must be  
24  
25 made and patient care may be affected. Because dysmenorrhea is a periodic  
26  
27 phenomenon, taking frequent menstrual leave may affect working relationships;  
28  
29 therefore, nurses usually choose to work even when they experience dysmenorrhea.  
30  
31

32  
33 In summary, the factors influencing dysmenorrhea occurrence included age  
34  
35 under 40 years, working three-shift rotations, and marital status, and when mean was  
36  
37 used as the contact point, the tendency to consider menstruation to be a debilitating  
38  
39 event and tendency to deny the effects of menstruation. Chiou’s study of adolescent  
40  
41 nursing students revealed that menstrual regularity and health education were  
42  
43 predictive factors for dysmenorrhea.<sup>30</sup> Women who had irregular menstrual cycles and  
44  
45 had not received dysmenorrhea-related health education demonstrated higher  
46  
47 dysmenorrhea occurrence rates;<sup>9</sup> however, these two factors were not predictive  
48  
49 factors in the present study. Our participants were nurses from a wide range of age  
50  
51 groups rather than only adolescents; therefore, they had more experience with  
52  
53 dysmenorrhea and self-care. In addition, menstrual health is a part of nursing  
54  
55  
56

1  
2  
3 education; therefore, although nurses are not directly involved in health education,  
4 education is a part of their professional training. Thus, health education was not an  
5 important predictive factor in this study. This study mainly evaluated the factors  
6 influencing dysmenorrhea in hospital nurses in order to help institutions build a caring  
7 and friendly work environment for high-risk nurses. The participants were randomly  
8 selected from only two hospitals in southern Taiwan; therefore, the results might have  
9 limited generalizability to nurses in other parts of the country. In future studies, the  
10 inclusion criteria should be extended to examine any differences across regions in  
11 Taiwan. In addition, rotating night shifts are required in many other occupations  
12 besides nursing. Considering different professional backgrounds and life experiences,  
13 future studies should also include women from different occupations who work  
14 rotating shifts, to evaluate the differences in the influence of their knowledge and  
15 attitudes on the prevalence of dysmenorrhea. The variables assessed in this study  
16 included demographic characteristics, menstruation history, dysmenorrhea-related  
17 knowledge, and attitudes towards menstruation; however, lifestyle choices such as  
18 smoking, alcohol consumption, and exercising were not included. Further studies that  
19 analyze the effects of these lifestyle choices on dysmenorrhea are warranted.  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40

## 41 **CONCLUSIONS**

42  
43 We assessed the various factors influencing the occurrence of dysmenorrhea with  
44 the aim of helping nursing managers to offer appropriate assistance for high-risk  
45 groups and build a caring and friendly work environment for at-risk hospital nurses,  
46 which were as follows: (a) setting up a more accommodating working hours system  
47 that is based on the nurses' menstrual cycle; (b) creating a supportive workplace  
48 environment that allows nurses to take a break from work to apply hot compresses or  
49  
50  
51  
52  
53  
54  
55  
56

1  
2  
3 drink hot beverages; (c) allowing flexible menstrual leave or scheduling menstrual  
4  
5 leave, thereby integrating menstrual self-care into the annual occupational safety and  
6  
7 health training; (d) providing spaces at work for nurses to take short breaks and  
8  
9 offering supportive measures, such as thermotherapy, aromatherapy massage, and  
10  
11 others. Such measures will enable nurses to care for themselves at work, thus  
12  
13 improving their workplace comfort levels and increasing their work satisfaction and  
14  
15 performance.  
16

## 17 18 19 20 **ACKNOWLEDGEMENTS**

21  
22 The authors thank the participants for their participation and the nurse managers of  
23  
24 the two hospitals for their administrative assistance. We also thank Editage for their  
25  
26 professional English review of this manuscript.  
27

## 28 29 **Competing interests**

30  
31 None.  
32

## 33 34 **Funding**

35 This research received no specific grants from any funding agency in the public,  
36  
37 commercial, or not-for-profit sectors.  
38

## 39 40 **Contributors**

41 Min-Hui Chiu and Hsiu-Hung Wang designed the study, analyzed and interpreted the  
42  
43 data, and drafted the manuscript. Yi-Hsin Yang assisted in defining the statistical  
44  
45 analysis. Min-Hui Chiu and Su-Chen Hsu contributed to the data collection and  
46  
47 analysis. Hsiu-Fen Hsieh and Huei-Mein Chen assisted with drafting the manuscript.  
48  
49 All authors had full access to all data in the study and take responsibility for its  
50  
51 integrity.  
52  
53

## 54 55 **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

- 1  
2  
3 medical and dental university students in Kelantan: Prevalence and associated  
4 factors. *International Medical Journal* 2009;16(2):93-99.  
5  
6  
7 18. Lu I-C. Dysmenorrhea and related factors in Taiwanese adolescent girls.  
8  
9 *University of Texas at Austin* 2010.  
10  
11 19. Chang C, Chen FL, Chang CH, Hsu CH. A preliminary study on menstrual health  
12 and menstrual leave in the workplace in Taiwan. *Taiwan J Public Health*  
13 2011;30(5):436-50.  
14  
15  
16 20. Schluter PJ, Turner C, Huntington AD, Bain CJ, McClure RJ. Work/life balance  
17 and health: the nurses and midwives e-cohort study. *International Nursing*  
18 *Review* 2011(58):28-36.  
19  
20  
21 21. Cady RK, Diamond ML, Diamond MP, Ballard JE, Lener ME, Dorner DP, et al.  
22 Sumatriptan-naproxen sodium for menstrual migraine and dysmenorrhea:  
23 satisfaction, productivity, and functional disability outcomes. *Headache*  
24 2011;51(5):664-73.  
25  
26  
27 22. Bettendorf B, Shay S, Tu F. Dysmenorrhea: contemporary perspectives.  
28 *Obstetrical and Gynecological Survey* 2008;63(9):597-603.  
29  
30  
31 23. Perry M. Treatment options for dysmenorrhoea. *Practice Nursing* 2012;23(4):4.  
32  
33  
34 24. Ju H, Jones M, Mishra GD. Smoking and trajectories of dysmenorrhoea among  
35 young Australian women. *Tobacco control* 2016;25(2):195-202.  
36  
37  
38 25. Chiou MH, Wang HH. The relationship between dysmenorrhea and menstrual  
39 attitudes among female students in vocational nursing schools. *The Journal of*  
40 *Nursing* 2004;51(4):45-52.  
41  
42  
43 26. Parker MA, Sneddon AE, Arbon P. The menstrual disorder of teenagers (MDOT)  
44 study: determining typical menstrual patterns and menstrual disturbance in a large  
45 population-based study of Australian teenagers. *BJOG : an international journal*  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 *of obstetrics and gynaecology* 2010;117(2):185-92.
- 4  
5 27. Stubbs ML. Cultural perceptions and practices around menarche and adolescent  
6  
7 menstruation in the United States. *Annals of the New York Academy of Sciences*  
8  
9 2008;1135:58-66.
- 10  
11 28. Cheng CY, Yang K, Liou SR. Taiwanese adolescents? Gender differences in  
12  
13 knowledge and attitudes towards menstruation. *Nursing & Health Sciences*  
14  
15 2007;9(2):127-34.
- 16  
17 29. H LY. The medical utilization of chinese and western medicine in females with  
18  
19 dysmenorrhea. Kaohsiung Medical University, 2012.
- 20  
21 30. Chiou M-H, Wang H-H, Yang Y-H. Effect of systematic menstrual health  
22  
23 education on dysmenorrheic female adolescents' knowledge, attitudes, and  
24  
25 self-care behavior. *Kaohsiung J Med Sci* 2007;23(4):183-90.
- 26  
27 31. Brooks-Gunn J, Ruble D. The menstrual attitude questionnaire. *Psychosomatic*  
28  
29 *medicine* 1980;42:503-11.
- 30  
31 32. S L. Prevalence and associated factors of premenstrual syndrome among nurses in  
32  
33 Taiwan. In: Ministry of Science and Technology, R. O. C., editor, 1994.
- 34  
35 33. Morrison LA, Larkspur L, Calibuso MJ, Brown S. Women's attitudes about  
36  
37 menstruation and associated health and behavioral characteristics. *American*  
38  
39 *Journal of Health Behavior* 2010;34(1):90-100.
- 40  
41 34. Lo Sing-Kai, Lin Ching-Fen. On the use and interpretation of Cronbach's alpha.  
42  
43 *The Journal of Nursing Research* 1998;6:82-9.
- 44  
45 35. Lin YX. *When "Experts" meet the medical professionals: The women with*  
46  
47 *menstrual pain encountering western medicine*. Kaohsiung Medical University,  
48  
49 Taiwan, 2006.
- 50  
51 36. Chung F, Yao C, Wan G. The associations between menstrual function and life  
52  
53  
54  
55  
56

1  
2  
3 style/working conditions among nurses in Taiwan. *Journal of occupational health*  
4  
5 2005;47(2):149-56.  
6

7 37. Takeuchi H, Oishi T, Harada T. Morningness-eveningness preference, and mental  
8  
9 and physical symptoms during the menstrual cycle of Japanese junior high school  
10  
11 students. *Sleep and Biological Rhythms* 2003(1):245-47.  
12

13 38. Firat MZ, Kulakac O, Oncel S, Akcan A. Menstrual attitude questionnaire:  
14  
15 confirmatory and exploratory factor analysis with Turkish samples. *Journal of*  
16  
17 *advanced nursing* 2009;65(3):652-62.  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



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

	Item No	Page No	Recommendation
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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	<i>Cross-sectional study</i> —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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed
			<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed
			<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy
			(e) Describe any sensitivity analyses

Continued on next page

<b>Results</b>			
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	<i>Cross-sectional study</i> —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
<b>Discussion</b>			
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
<b>Other information</b>			
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](http://www.strobe-statement.org).