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Complete List of Authors:	Situmorang, Herbert; Universitas Indonesia Fakultas Kedokteran, Reproductive Health Division, Department of Obstetrics and Gynecology, Faculty of Medicine Universitas Indonesia - dr. Cipto Mangunkusumo General Hospital, Jakarta, Indonesia Sutanto, Reynardi Larope; Universitas Indonesia Fakultas Kedokteran, Tjoa, Kevin; Universitas Indonesia Fakultas Kedokteran Rivaldo, Rivaldo; Universitas Indonesia Fakultas Kedokteran
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Impact of primary dysmenorrhea on quality of life, mental health, and academic performance among medical students in Indonesia

Herbert Situmorang[1*], Reynardi Larope Sutanto[2], Kevin Tjoa[2], Rivaldo[2]

[1] Reproductive Health Division, Department of Obstetrics and Gynecology, Faculty of Medicine Universitas Indonesia - dr. Cipto Mangunkusumo General Hospital, Jakarta, Indonesia

[2] Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

* Corresponding Author:

Herbert Situmorang, MD, PhD

E-mail: datadrherbert@gmail.com (HS)

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Abstract

Objectives This study aims to investigate the impact of dysmenorrhea on the quality of life, mental health, and academic performance of medical students in Indonesia.

Design This study employed a cross-sectional design through an online survey targeting medical students across Indonesia based on several inclusion criteria. Associations between dysmenorrhea – occurrence and severity – and affected areas of life (quality of life, mental health, and academic performance) were examined using Chi-square and t-tests, where appropriate. Variables with significant p-values (< 0.05) were included as dependent variables in multivariate linear or logistic regression models. The effects of dysmenorrhea occurrence and severity were assessed alongside other potential independent variables, including age, region, stage of study, and parental income.

Setting and participants Indonesia (June – July 2021: n = 630 female medical students).

Outcomes The primary outcomes are the effects of dysmenorrhea occurrence, defined as the presence of painful menstruation without a prior diagnosis of pelvic pathology, dysmenorrhea severity, categorized as mild and moderate-to-severe pain levels using the Verbal Multidimensional Scoring System (VMSS), towards academic performance (measured by concentration and activity disruption, absenteeism, and cum laude GPA), quality of life (measured by the Quality of Life Scale), and mental health conditions (measured depression and stress through DASS-42 scores) among Indonesian medical students.

Results Dysmenorrhea were found to significantly affect aspects of quality of life, mental health, and academic performance of Indonesian medical students. After adjusting for potential

confounders, multivariate analyses confirm statistically significant mean differences and odds ratios between the variables.

Conclusions Our study highlights the significant impact of primary dysmenorrhea on the quality of life, mental health, and academic performance of Indonesian medical students. Addressing these implications can better support medical students and potentially enhance their overall well-being and academic outcomes.

Keywords: primary dysmenorrhea, quality of life, mental health, academic performance, medical students

Strengths and limitations of this study

- This study offers valuable insights into the impact of primary dysmenorrhea on the quality of life, mental health, and academic performance of medical students, providing data that can guide interventions to improve student well-being.
- Multivariate binary logistic regression analysis enables the control of potential confounders, such as age, region, stage of study, and parental income, thereby enhancing the validity of the findings related to the effects of dysmenorrhea.
- The cross-sectional design limits the ability to establish causal relationships between dysmenorrhea and the observed outcomes.
- The reliance on self-reported data may introduce bias, as participants' perceptions of dysmenorrhea severity and its impact could vary, potentially affecting the accuracy of the findings.
- The study's focus on a specific population of Indonesian medical students may limit the generalizability of the findings to other populations or regions, indicating the need for further research in more diverse settings to validate these results.

Introduction

Dysmenorrhea, or menstrual pain, refers to recurrent lower abdominal pain associated with uterine contractions during menstruation.[1,2] Dysmenorrhea is classified by its pathophysiology into two types: primary dysmenorrhea, where there is no identifiable underlying organic disease, and secondary dysmenorrhea, which is clearly caused by identifiable disease. It is the most common gynecological problem in women across all age ranges and races worldwide.[3,4] Among other types of chronic pelvic pain, dysmenorrhea is the most prevalent, with an incidence of 16.8-81%, compared to dyspareunia with an incidence of 8-21.8%, and non-cyclical pain with an incidence of 2.1-24%. A World Health Organization systematic review shows dysmenorrhea prevalence reaches 94% in hospitalized women aged 10-20 years and 8.8% in those aged 18-41 years. Another study from England shows that dysmenorrhea prevalence in community and hospitalized women reaches 45-97% and 41-62%, respectively.[5] It is also estimated that 2-28% of the female population suffers from severe dysmenorrhea.[6]

It is well known that dysmenorrhea has various consequences throughout a woman's life. A study among 21,573 women concludes that dysmenorrhea causes increased absenteeism from school or university (20.1%), decreased concentration and academic performance during episodes of dysmenorrhea (40.6%), and less participation in school activities (29.6%).[3] There is also a significant disparity in healthcare burden among the dysmenorrhea population. Women with primary dysmenorrhea experience a 2.2-fold increase in healthcare service costs, whereas women with secondary dysmenorrhea experience a higher increase (2.9 times) than the general female population.[7] Screening for mental disorders in women with dysmenorrhea indicates that dysmenorrhea increases the risk of depressive and anxiety symptoms.[8] Primary dysmenorrhea raises the risk of significant depressive disorder by more than 70%.[9]

However, there is a scarcity of data regarding the impact of dysmenorrhea in low or middle-income countries, especially Indonesia. Several studies in India, Malaysia, Iran, and Nigeria have attempted to investigate the matter, but the scale of the studies remains small and regional.[3] Data corresponding to the magnitude of dysmenorrhea's impact on quality of life, stress, and academic performance on a national scale is urgently needed for stakeholders to raise awareness surrounding dysmenorrhea. Medical students are believed to have better knowledge and attitudes towards dysmenorrhea and fall into the category of women at a younger, productive age, hence aiding the process of collecting information for this study. This study aims to investigate the impact of dysmenorrhea on the quality of life, mental health, and academic performance of medical students on a nationwide scale.

Methods

This study is part of the research project "Primary Dysmenorrhea: Prevalence, Perception, Behavior, and Quality of Life among Medical Students in Indonesia" conducted by the Faculty of Medicine, Universitas Indonesia. The broader project seeks to investigate the impact of primary dysmenorrhea on medical students, covering its prevalence, students' perceptions and behaviors, and the overall influence on their life. This particular study concentrates on examining how dysmenorrhea affects the academic performance and daily lives of medical students. Ethical approval was given by the Health Research Ethics Committee, Faculty of Medicine, Universitas Indonesia and Cipto Mangunkusumo National General Hospital (344/UN2.F1/ETIK/PPM.00.02/2021) in accordance with good clinical practice and the Declaration of Helsinki.

Study design and participants

This study is conducted with a cross-sectional design. Data were collected using an online questionnaire, Google Forms (docs.google.com/forms), from 17 June to 31 July 2021. The target population involved all female undergraduate medical students across Indonesia, which were recruited through a snowball sampling method in social media and medical student organizations. The inclusion criteria were medical students who consent, menstruate, of Indonesian nationality, reside in Indonesia during the survey period, and without prior diagnosis of pelvic pathology. Consent to participate in this research was obtained by answering a yes-no question on the first page of the online form.

The minimum required sample size was determined using an online sample size calculator from Raosoft, Inc. (Seattle, WA).[10] Due to the unavailability of the exact number of female undergraduate medical students in Indonesia, the population size was estimated to be

around 31,250 based on previous studies.[11] To achieve a 5% margin of error and a 95% confidence level, a minimum of 380 participants was needed for this study.

Measurement tool and data management

Participants' academic performance – including concentration and activity disruption, absenteeism, and *cum laude* GPA (≥3.50/4.00) – were measured with a validated questionnaire in Bahasa Indonesia employed in a similar yet small-scale research on dysemenorrhea among Jakartan students by Derdameisya and Affandi (2014).[12] We also adapted their translation of Quality of Life Scale[13] to measure participants' quality of life as well as the Verbal Multidimensional Scoring System (VMSS)[14] to measure severity of menstrual pain. VMSS severity was then dichotomously categorized into mild and moderate-to-severe pain levels. Mental health conditions were measured through the Damanik Bahasa Indonesia translation of the Depression Anxiety Stress Scales (DASS 42)[15] and include the conditions of depression and stress. We also gathered sociodemographic information on age, body mass index (BMI), region of domicile, stage of study, and parental income, as well as information on participants' menstrual history, including age of menarche, cycle regularity and length, and menstrual duration (Table 1).

Statistical analysis

Google Forms responses were imported into MS Excel® for Office 365 (Microsoft Corporation, Redmond, WA) for data cleaning and coding. The cleaned dataset was then analyzed using STATA version 18.0 (StataCorp LLC, College Station, TX). Dichotomous data were presented as frequencies and proportions, while continuous data were presented as mean ± standard deviation (SD). The associations between independent variables – dysmenorrhea occurrence and severity – and affected areas of life – quality of life, mental health, and academic performance – were examined using Chi-square and t-test, depending on the variable measurement (Table 2). Variables with significant p-values (< 0.05) were then included as

dependent variables in multivariate linear or logistic regression models, where appropriate (Table 3). The effects of dysmenorrhea occurrence and severity were assessed in conjunction with other potential independent variables, namely age, region, stage of study, and parental income.[16]

Patient and public involvement:

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Results

Characteristics of study participants

A total of 676 respondents filled our questionnaire. However, due to incomplete data from some respondents, only 630 valid participants were included in the analysis. The majority of respondents were in their preclinical years (85.87%) and aged between 20-24 years (66.35%). A significant portion of respondents resided in Java (57.78%), which is to be expected as it is Indonesia's most populous and developed island. In regard to the dysmenorrhea status, an overwhelming majority described themselves as having primary dysmenorrhea (91.27%), where a slight plurality (47.78%) describing moderate-to-severe pain.

Table 1. Sociodemographic and menstrual status

Variable		Frequency	Percentage (%)
Age	Less than 20	212	33.65
	20-24	418	66.35
BMI	Less than 18.5	111	17.62
	18.5-23.4	326	51.75

	23.5-25	87	13.81
	25-29.9	75	11.90
	More than 30	31	4.92
Region	Java	364	57.78
	Outside Java	266	42.22
Stage of study	Preclinical	541	85.87
	Clinical	89	14.13
Parental income	≤ IDR 1,000,000	15	2.38
	IDR 1,000,000 - 5,000,000	131	20.79
	IDR 5,000,000 - 10,000,000	182	28.89
	IDR 10,000,000 - 15,000,000	104	16.51
	≥ IDR 15,000,000	198	31.43
Age of menarche	9-11	168	26.67
	12-14	422	66.98
	15-17	40	6.35
Cycle Regularity	Regular	519	82.38
	Irregular	111	17.62
Cycle Length	Normal (21 – 35 days)	426	67.62
	Abnormal (<21 or >35 days)	204	32.38
Menstrual duration	Normal (< 7 days)	508	80.63
	Abnormal (≥ 8 days)	122	19.37
Dysmenorrhea status	Without dysmenorrhea	55	8.73
	Mild dysmenorrhea	274	43.49
	Moderate-severe dysmenorrhea	301	47.78

168 *IDR* Indonesian Rupiah

Effects of dysmenorrhea on Indonesian medical students

Quality of life

Quality of life was found to be affected by dysmenorrhea occurrence and severity. After adjusting for confounders (Table 3), we discovered that students with dysmenorrhea had a –1.82 [95% CI –2.63, –1.02; p < 0.001] lowered Quality of Life score compared to students without dysmenorrhea. Moreover, in students with dysmenorrhea, having moderate-to-severe pain is associated with a reduction of – 2.09 [95% CI –2.54, –1.63; p < 0.001].

Mental health

Out of all the participants, 373 (59.21%) were found to exhibit symptoms of depression of varying degrees whereas stress was found among 436 (69.21%) participants, where it was more predominant among students with dysmenorrhea (Table 2). Multivariate logistic regression (Table 3) found significant association of both dysmenorrhea occurrence (OR 2.16 [95% CI: 1.23–3.81]; p = 0.007) and severity (OR 2.07 [95% CI: 1.47–2.92]; p = < 0.001) towards depression. However, only dysmenorrhea severity was found to be significantly associated towards occurrence of stress (OR 1.82 [95% CI: 1.26–2.62]; p = < 0.001).

Academic performance

Four different measures of academic performance were used in our study, namely disruption of concentration, activities, absenteeism, and *cum laude* GPA. Dysmenorrhea occurrence and severity were found to significantly affect (Table 2) three of the variables – disruption of concentration, activities, and absenteeism – while not affecting *cum laude* GPA (p value 0.941 and 0.606, respectively). These associations were also found even after adjusting for confounders (Table 3).

191 **Table 2.** Proportion of dysmenorrhea occurrence and severity on affected areas of life with univariate measures of association

Affected area of life		Dysmenorrhea occurrence		p value	Dysmenorrhea severity		p value
		No	Yes		Mild	Moderate-Severe	
		N (%)	N (%)		N (%)	N (%)	
Quality of life[a] (Mean; SD)		8.89; SD 2.60	7.04; SD 2.94	< 0.001[b]	8.16; SD 2.[illegible]	6.03; SD 3.13	< 0.001[b]
Mental health	Stress occurrence	34 (7.80)	402 (92.20)	0.214	174 (43.28)	228 (56.72)	0.001[b]
	Depression occurrence	23 (6.17)	350 (93.83)	0.006[b]	142 (40.57)	208 (59.43)	< 0.001[b]
Academic	Concentration disruption	9 (2.15)	410 (97.85)	< 0.001[b]	142 (34.63)	268 (65.37)	< 0.001[b]
performance	Activity disruption	1 (0.45)	220 (99.55)	< 0.001[b]	45 (20.45)	175 (79.55)	< 0.001[b]
	Absenteeism	1 (0.89)	111 (99.11)	0.001[b]	19 (17.12)	92 (82.88)	< 0.001[b]
	GPA – *cum laude*	20 (8.62)	212 (91.38)	0.941	104 (49.06)	108 (50.94)	0.606

192 Chi-square test was used in analysis, unless otherwise stated. [a]t-test was used instead of chi-square [b]indicating significant p value < 0.05. *SD*

193 standard deviation, *CI* confidence interval, *GPA* grade point average, *cum laude* GPA > 3.50

Table 3. Multivariate analysis

Affected area of life		Dysmenorrhea occurrence		Dysmenorrhea severity	
		OR [95% CI]	p value	OR [95% CI]	p value
Quality of life[a]		-1.82 [-2.63, -1.02]	< 0.001[b]	-2.09 [-2.54, -1.63]	< 0.001[b]
Mental health	Stress occurrence			1.82 [1.26, 2.62]	< 0.001[b]
	Depression occurrence	2.16 [1.23, 3.81]	0.007[b]	2.07 [1.47, 2.92]	< 0.001[b]
Academic performance	Concentration disruption	12.92 [6.14, 27.22]	< 0.001[b]	7.24 [4.68, 11.19]	< 0.001[b]
	Activity disruption	34.95 [4.77, 256.16]	< 0.001[b]	6.92 [4.63, 10.36]	< 0.001[b]
	Absenteeism	12.10 [1.65, 88.83]	0.014[b]	4.65 [3.32, 9.63]	< 0.001[b]

Multivariate logistic regression was used in analysis, unless otherwise stated. [a]linear regression was used instead of logistic regression

[b]indicating significant p value < 0.05. *OR* odds ratio, *CI* confidence interval,

Discussion

With a high prevalence of primary dysmenorrhea (91.27%) among Indonesian medical students, efforts to elucidate its impact on many aspects of daily life are necessary. Our study found evidence that dysmenorrhea can affect the quality of life, mental health, and academic performance of medical students. Quality of life is significantly affected by both the presence and severity of dysmenorrhea. Since pain is a disturbing event that causes numerous distractions in daily activities, quality of life impairment is expected. Quality of life comprises several aspects (physical, psychological, social, etc.) and is assessed differently across studies, either qualitatively[17] or quantitatively, as in our study. We used the Quality of Life scale by the American Chronic Pain Association due to its simplicity (maximum score of 10 without segmentation into several domains), while other studies used more complex scoring systems: the WHO QoL scale (4 domains) or EuroQoL-5D (5 domains), both with a maximum score of 100. A study in Japan showed significantly lower quality of life (WHO QoL) with more severe dysmenorrhea, yet no significant differences in the social domain.[18] Meanwhile, a study on the Spanish population revealed a slightly different trend. Although the overall quality of life (EuroQoL-5D) was significantly lower in women with dysmenorrhea, no differences across degrees of dysmenorrhea severity were observed (overall and within the 5 domains).[19] These previous studies revealed that not all aspects of quality of life are impaired similarly by dysmenorrhea. Furthermore, cultural background and subjective perceptions of pain play important roles in determining the degree of quality of life impairment. Future studies on the willingness to pay for the complete cure of dysmenorrhea are valuable, especially in the Asian population, since the available evidence is often limited to the Western population.[20]

Our study revealed that increasing dysmenorrhea severity significantly increased the risk of depressive symptoms. This finding aligns with the results of a Saudi Arabian study that examined the relationship between dysmenorrhea and depressive symptoms among female

university students. The study reported a significant positive correlation ($r = 0.401$, $p < 0.010$) between quantified dysmenorrhea severity scores (working ability, location, intensity, days of pain, and WaLIDD score) and Patient Health Questionnaire (PHQ-9) scores, a depression screening scale.[21] Another single-center study reported that 80.8% of its medical students (n=435) with dysmenorrhea-related symptoms experienced depressed mood. A meta-analysis of 10 studies incorporating 4,691 participants reported similar results (RR = 1.72, 95% CI: 1.44-2.0, $P < 0.001$).[9] We hypothesized that the high prevalence of depressive symptoms among medical students with dysmenorrhea could be attributed to their low resilience due to the recurrent pain. It is known that resilience is a determining factor in whether patients develop depression. Students with low resilience have an increased risk of developing depression.[22]

Our study also found that stress levels increased as dysmenorrhea severity advanced (OR 1.82, 95% CI: 1.26-2.62, p=0.001). Maryam et al. reported that severe menstrual cramps, assessed using the Wong-Baker scale and the Numeric Rating Scale among fourth-year medical students, were significantly associated (OR 3.69, 95% CI: 1.06–12.8, p=0.033) with moderate to severe psychological stress measured by the Depression Anxiety Stress Scale (DASS-42).[23] Multiple regression analysis conducted in Tokyo revealed a significant relationship between dysmenorrhea severity and psychological distress ($p < 0.001$).[24] Wang et al. also demonstrated that the inverse association between stress and dysmenorrhea is significant; women with higher perceived stress had an increased risk of dysmenorrhea compared to women with lower perceived stress in the preceding menstrual cycle (OR = 2.4; 95% CI: 1.4-4.3, $p<0.01$).[25] Several attempts have been made to bridge the gap between chronic pain, such as dysmenorrhea, and overall stress levels. These findings support the fact that chronic pain serves as a predictor of stress in medical students. Stress found in this study was mostly related to the disabling features of dysmenorrhea, which severely impact women's mobility and participation.[26]

Academic performance is another aspect of daily life affected by dysmenorrhea. This finding should raise concerns, as class performance may affect grades. Medicine is a stressful and competitive field, and losing top positions and receiving lower grades due to disruptive pain can increase stress levels, thus exacerbating previously discussed effects of dysmenorrhea on mental health and quality of life.[27] Students' concentration was found to be more disrupted among those with dysmenorrhea, especially with moderate-to-severe pain. Our finding is consistent with results from a systematic review involving 83 studies with more than 36,000 participants, which showed that at least 44.2% of participants experienced impaired concentration.[28] A previous meta-analysis involving 21,000 participants reported a slightly lower percentage of impaired concentration (40.9%).[3] Concentration in class is also related to active participation during classes. While many factors contribute to concentration during classes, whether external (lecturer or environmental aspects) or internal (students' conditions), there is a lack of studies specifically addressing menstrual pain in female students.[29,30] Compared to the significantly higher odds of reduced concentration found in our study (7.24-12.92 times adjusted odds ratio), a study in Riyadh found much lower odds (aOR 3.68-4.62).[31]

Students with dysmenorrhea were also found to experience more disruptions in their school-related activities. This finding is in accordance with a 2005 study which determined that 98.6% of women with severe menstrual pain were unable to attend social activities.[32] Later studies also found that higher severity of dysmenorrhea is associated with impaired social relationships (aOR 3.07).[31] Besides social activities, physical activities were also found to be impaired by dysmenorrhea according to previous studies. Physical activity and dysmenorrhea are interrelated to and complexly influence one another. A study at a university in Iran showed a 1% reduction in the incidence of dysmenorrhea per unit increase in physical activity score.[33]

Another factor that is highly influenced by dysmenorrhea is absenteeism from university classes. Our study found that 99.11% of Indonesian medical students with

dysmenorrhea need to take at least a day off from medical school because of their condition. This is the highest number of absenteeism experiences compared to previous studies, which is estimated to be 20.1% (N = 19, n = 11,226, 95% CI 14.9–26.7) as compiled in a meta-analysis by Armour et al.[3] There are three explanations to this phenomenon. Firstly, differences in questions asked might lead to different results. A Swedish study showed that absenteeism, when considered to be at least one day off in life, affects more people (59%) compared to absenteeism, when considered to be a monthly disturbance (14%).[4] As our question is of the former, this might be the reason of a significantly higher result. Secondly, our population of medical students might experience different types of stresses than other populations. Other studies conducted on medical students, namely in Saudi Arabia[34] (28.3%) and Nepal[35] (29.45%), also show a higher percentage of absenteeism compared to the average of 20.1%, albeit not as high as ours. Finally, Armour et al. found that low and middle income countries, such as Indonesia, have a higher percentage of absenteeism (26%) compared to high income ones (12.1%). Women in low and middle income countries might lack necessary access or knowledge to sanitary products and treatments during menstruation, thus affecting their morbidity and increase absenteeism.[3]

GPA is the only marker of academic performance that was found not to be associated with the presence or severity of dysmenorrhea. We used GPA as a proxy for academic performance, similar to the approach of Tadese et al., who also found a similar result. However, we used a specific cutoff of 3.50/4.00 GPA to check for cum laude status, whereas Tadese et al. used a continuous value of GPA. Tadese et al. found a lower GPA (– 0.04) in students who experienced dysmenorrhea.[36] Our contrasting findings may be explained by the reality that the association between dysmenorrhea and GPA might be dynamic, GPA is a cumulative value affected by various variables. It should also be noted that there is a higher prevalence of dysmenorrhea in our setting. Moreover, other studies that found significant associations

between academic performance and dysmenorrhea defined academic performance in terms of class absenteeism, reduced concentration and focus, falling asleep during lectures, reduced physical activities, or incomplete homework submission.[3]

Limitations of study

While this study is the first to investigate dysmenorrhea prevalence nationwide in Indonesia, it has some inherent limitations. The cross-sectional design limits our ability to establish causal relationships between dysmenorrhea and its impacts. Additionally, despite having a large sample size, we did not use a randomized sampling method. Instead, we relied on snowball sampling, which resulted in a higher concentration of participants from Java, though still reflecting the distribution of medical schools in Indonesia (45 out of 89 schools). Our focus on medical students, who have a higher baseline knowledge and interest in the subject, also necessitates caution when generalizing to the broader Indonesian population. Moreover, the use of self-reported questionnaires makes it difficult to definitively classify individuals with primary or secondary dysmenorrhea, as additional diagnostic tools are required to identify underlying pathology.

Despite these limitations, our study is crucial for raising awareness about dysmenorrhea and its impacts. As the first nationwide prevalence study on primary dysmenorrhea among Indonesians, we aim to highlight this significant gynecological issue and its considerable burden on medical students across the country. We recommend further health education initiatives to promote menstrual health literacy and ensure a comprehensive understanding of dysmenorrhea assessment and management to mitigate its impacts. Further studies are also needed to better elucidate the impact of dysmenorrhea among wider populations in the country.

Conclusion

Our study highlights the significant impact of primary dysmenorrhea on the quality of life, mental health, and academic performance of Indonesian medical students. Despite inherent limitations such as the cross-sectional design, non-randomized sampling, and reliance on self-reported data, our findings show that increased awareness and health initiatives are needed to alleviate the impact. By addressing the severe implications of dysmenorrhea, we can better support medical students and potentially improve their overall well-being and academic outcomes.

Footnotes

Contributors:

HS, RLS, KT, and R contributed to the article. HS conceived the proposal, designed the cross-sectional survey, interpret the analyses, and prepared the manuscript. RLS contributed to data collection, performed analyses, assisted with drafting the manuscript, and supervised the overall steps of the study. KT contributed to data collection, performed analyses, and assisted with drafting the manuscript. R contributed to data collection and assisted with drafting the manuscript. All authors read and approved the final manuscript. The guarantor of the study is HS; accepts full responsibility for the finished work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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Data are available on reasonable request. The original raw data analyzed are available from the corresponding author and can be presented on reasonable request.

References

1. ACOG Committee Opinion. Dysmenorrhea and endometriosis in the adolescent. Washington, D.C.: American College of Obstetricians and Gynecologists; 2018.

2. Bernardi M, Lazzeri L, Perelli F, Reis FM, Petraglia F. Dysmenorrhea and related disorders. F1000Research. 2017;6:1645.

3. Armour M, Parry K, Manohar N, Holmes K, Ferfolja T, Curry C, et al. The Prevalence and Academic Impact of Dysmenorrhea in 21,573 Young Women: A Systematic Review and Meta-Analysis. J Womens Health. 2019;28:1161–71.

4. Söderman L, Edlund M, Marions L. Prevalence and impact of dysmenorrhea in Swedish adolescents. Acta Obstet Gynecol Scand. 2019;98:215–21.

5. Latthe P, Latthe M, Say L, Gülmezoglu M, Khan KS. WHO systematic review of prevalence of chronic pelvic pain: a neglected reproductive health morbidity. BMC Public Health. 2006;6:177.

6. Ju H, Jones M, Mishra G. The prevalence and risk factors of dysmenorrhea. Epidemiol Rev. 2014;36:104–13.

7. Akiyama S, Tanaka E, Cristeau O, Onishi Y, Osuga Y. Evaluation of the treatment patterns and economic burden of dysmenorrhea in Japanese women, using a claims database. Clin Outcomes Res CEOR. 2017;9:295–306.

8. Gagua T, Tkeshelashvili B, Gagua D, McHedlishvili N. Assessment of anxiety and depression in adolescents with primary dysmenorrhea: a case-control study. J Pediatr Adolesc Gynecol. 2013;26:350–4.

9. Zhao S, Wu W, Kang R, Wang X. Significant Increase in Depression in Women With Primary Dysmenorrhea: A Systematic Review and Cumulative Analysis. Front Psychiatry. 2021;12:686514.

10. Raosoft sample size calculator [Internet]. Seattle: Raosoft, Inc; 2023. Available from: http://www.raosoft.com/samplesize.html

11. Lazarus G, Findyartini A, Putera AM, Gamalliel N, Nugraha D, Adli I, et al. Willingness to volunteer and readiness to practice of undergraduate medical students during the COVID-19 pandemic: a cross-sectional survey in Indonesia. BMC Med Educ. 2021;21:138.

12. Derdameisya D, Affandi B. The Relation of Primary Dysmenorrhea with High School Students' Menstrual Characteristic and Study Process. [Jakarta]: Universitas Indonesia; 2014.

13. Keller N, Cowan P. Quality of life scale. American Chronic Pain Association; 2003.

14. Andersch B, Milsom I. An epidemiologic study of young women with dysmenorrhea. Am J Obstet Gynecol. 1982;144:655–60.

15. Damanik ED. The Measurement of Reliability, Validity, Items Analysis and Normative Data of Depression Anxiety Stress Scale [Internet]. Sydney: University of New South Wales; Available from: https://www2.psy.unsw.edu.au/groups/dass/Indonesian/Damanik.htm

16. Mofatteh M. Risk factors associated with stress, anxiety, and depression among university undergraduate students. AIMS Public Health. 2020;8:36–65.

17. Esan DT, Ariyo SA, Akinlolu EF, Akingbade O, Olabisi OI, Olawade DB, et al. Prevalence of dysmenorrhea and its effect on the quality of life of female undergraduate students in Nigeria. J Endometr Uterine Disord. 2024;5:100059.

18. Mizuta R, Maeda N, Tashiro T, Suzuki Y, Oda S, Komiya M, et al. Quality of life by dysmenorrhea severity in young and adult Japanese females: A web-based cross-sectional study. PLOS ONE. 2023;18:e0283130.

19. Fernández-Martínez E, Onieva-Zafra MD, Parra-Fernández ML. The Impact of Dysmenorrhea on Quality of Life among Spanish Female University Students. Int J Environ Res Public Health. 2019;16:713.

20. MacGregor B, Allaire C, Bedaiwy MA, Yong PJ, Bougie O. Disease Burden of Dysmenorrhea: Impact on Life Course Potential. Int J Womens Health. 2023;15:499–509.

21. Alateeq D, Binsuwaidan L, Alazwari L, Algarni M, Al Hussain M, Alzahrani R, et al. Dysmenorrhea and depressive symptoms among female university students: a descriptive study from Saudi Arabia. Egypt J Neurol Psychiatry Neurosurg. 2022;58:106.

22. Dai Q, Smith GD. Resilience to depression: Implication for psychological vaccination. Front Psychiatry. 2023;14:1071859.

23. Maryam M, Ritonga MA, Istriati I. Relationship between Menstrual Profile and Psychological Stress with Dysmenorrhea. Althea Med J. 2016;3:382–7.

24. Matsumura K, Tsuno K, Okamoto M, Takahashi A, Kurokawa A, Watanabe Y, et al. The Association between the Severity of Dysmenorrhea and Psychological Distress of Women Working in Central Tokyo—A Preliminary Study. Int J Environ Res Public Health. 2023;20:7021.

25. Wang L, Wang X, Wang W, Chen C, Ronnennberg AG, Guang W, et al. Stress and dysmenorrhoea: a population based prospective study. Occup Environ Med. 2004;61:1021–6.

26. Brito dos Santos L, Ferreira CWS, Gonçalves CG, de Oliveira Xavier MA, Dantas JH, Barbosa IR, et al. Association among dysmenorrhea and activity limitation and participation restrictions in adult women: a cross-sectional study, Brazil -2017. Arch Public Health. 2021;79:194.

27. Bergmann C, Muth T, Loerbroks A. Medical students' perceptions of stress due to academic studies and its interrelationships with other domains of life: a qualitative study. Med Educ Online. 2019;24:1603526.

28. Munro AK, Hunter EC, Hossain SZ, Keep M. A systematic review of the menstrual experiences of university students and the impacts on their education: A global perspective. PLOS ONE. 2021;16:e0257333.

29. Rahiminia E, Yazdani S, Rahiminia H. Factors Affecting Concentration and Attendance in the Classroom from Students' Point of View in Qom University of Medical Sciences (2018). Educ Res Med Sci [Internet]. 2019 [cited 2024 Jul 19];8. Available from: https://brieflands.com/articles/erms-93075#abstract

30. Grimby-Ekman A, Åberg M, Torén K, Brisman J, Hagberg M, Kim JL. Pain could negatively affect school grades - Swedish middle school students with low school grades most affected. PLoS ONE. 2018;13:e0208435.

31. Dahlawi H, Bukhari I, Alshammari F, Althaqib G, Alhawasawi M, Bashiri R, et al. Effect of dysmenorrhea on the academic performance among students studying in Princess Nourah Bint Abdulrahman University, Riyadh. Int J Med Dev Ctries. 2021;5:588–588.

32. El-Gilany AH, Badawi K, El-Fedawy S. Epidemiology of dysmenorrhoea among adolescent students in Mansoura, Egypt. East Mediterr Health J Rev Sante Mediterr Orient Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit. 2005;11:155–63.

33. Abadi Bavil D, Dolatian M, Mahmoodi Z, Akbarzadeh Baghban A. A comparison of physical activity and nutrition in young women with and without primary dysmenorrhea. F1000Research. 2018;7:59.

34. Ibrahim NK, AlGhamdi MS, Al-Shaibani AN, AlAmri FA, Alharbi HA, Al-Jadani AK, et al. Dysmenorrhea among female medical students in King Abdulaziz University: Prevalence, Predictors and outcome. Pak J Med Sci. 2015;31:1312–7.

35. Katwal PC, Karki NR, Sharma P, Tamrakar SR. Dysmenorrhea and Stress among the Nepalese Medical Students. Kathmandu Univ Med J KUMJ. 2016;14:318–21.

36. Tadese M, Kassa A, Muluneh AA, Altaye G. Prevalence of dysmenorrhoea, associated risk factors and its relationship with academic performance among graduating female university students in Ethiopia: a cross-sectional study. BMJ Open. 2021;11:e043814.

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Association between Primary Dysmenorrhea on Quality of Life, Mental Health, and Academic Performance among Medical Students in Indonesia: A Cross-Sectional Study

Herbert Situmorang[1*], Reynardi Larope Sutanto[2], Kevin Tjoa[2], Rivaldo[2]

[1] Reproductive Health Division, Department of Obstetrics and Gynecology, Faculty of Medicine Universitas Indonesia - dr. Cipto Mangunkusumo General Hospital, Jakarta, Indonesia

[2] Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

* Corresponding Author:

Herbert Situmorang, MD, PhD

E-mail: datadrherbert@gmail.com (HS)

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Abstract

Objectives To investigate the association between primary dysmenorrhea and quality of life, mental health, and academic performance among medical students in Indonesia.

Design A cross-sectional study using an online survey was carried out among Indonesian medical students. Primary dysmenorrhea occurrence and severity, as well as their associations with quality of life, mental health, and academic performance were assessed using validated questionnaires. The associations of dysmenorrhea occurrence and severity were assessed alongside other potential independent variables, including age, region, stage of study, and parental income. Statistical analyses included chi-square tests, t-tests, and multiple regression models to adjust for confounders ($p < 0.05$).

Setting and participants Indonesia (June – July 2021: n = 630 medical students).

Outcomes The primary outcomes were quality of life, mental health, and academic performance, assessed as dependent variables**.** Quality of life was measured using the Quality of Life Scale, mental health through depression and stress scores from the DASS-42, and academic performance through concentration and activity disruption, absenteeism, and cum laude GPA. The independent variables were primary dysmenorrhea occurrence and severity, categorized as mild or moderate-to-severe using the Verbal Multidimensional Scoring System.

Results Primary dysmenorrhea was significantly associated with reduced quality of life, mental health challenges, and academic disruptions. Students with dysmenorrhea had a significantly lower Quality of Life score (–1.82, 95% CI: –2.63 to –1.02; $p < 0.001$), with moderate-to-severe pain linked to an even more significant reduction (–2.09, 95% CI: –2.54 to –1.63; $p <$

0.001). Dysmenorrhea occurrence was significantly associated with depression (OR 2.16, 95% CI: 1.23–3.81; p = 0.007) and severity with both depression (OR 2.07, 95% CI: 1.47–2.92; p < 0.001) and stress (OR 1.82, 95% CI: 1.26–2.62; p < 0.001). Dysmenorrhea occurrence and severity significantly disrupted concentration (OR 12.92, 95% CI: 6.14–27.22; p < 0.001 and OR 7.24, 95% CI: 4.68–11.19; p < 0.001, respectively), activities (OR 34.95, 95% CI: 4.77–256.16; p < 0.001 and OR 6.92, 95% CI: 4.63–10.36; p < 0.001), and absenteeism (OR 12.10, 95% CI: 1.65–88.83; p = 0.014 and OR 5.65, 95% CI: 3.32–9.63; p < 0.001). Cum laude GPA was not significantly associated.

Conclusions Primary dysmenorrhea is significantly associated with the quality of life, mental health, and academic performance of medical students in Indonesia. Addressing its implications can enhance student well-being and academic outcomes.

Keywords: Primary dysmenorrhea, quality of life, mental health, academic performance, medical students

Strengths and limitations of this study

- Primary dysmenorrhea is significantly associated with the quality of life, mental health, and academic performance of Indonesian medical students.
- Multiple binary logistic regression analysis enables the control of potential confounders, such as age, region, stage of study, and parental income.
- The cross-sectional nature of the study does not allow for the establishment of causality from dysmenorrhea to the observed outcomes.
- The reliance on self-reported data may introduce bias due to possible variations among participants' perceptions of dysmenorrhea severity.
- The results might not be generalizable beyond a specific population of Indonesian medical students.

Introduction

Dysmenorrhea is a condition characterised by recurring lower abdomen pain linked to uterine contractions during menstruation.[1,2] It is the most common gynecological problem in women across all age ranges and races worldwide. A meta-analysis estimates that 71.1% of all women had dysmenorrhea, irrespective of the economic status of their country of origin.[3,4] Based on its pathophysiology, dysmenorrhea is divided into two types: primary dysmenorrhea, where there is no identifiable underlying organic disease, and secondary dysmenorrhea, which is caused by other identifiable diseases. Primary dysmenorrhea is particularly prevalent among young females, often starting within 6 to 24 months after menarche. The pain often follows a clear cyclic pattern, being most intense on the first day of menstruation and lasting up to 72 hours.[2,5] Despite its high prevalence, primary dysmenorrhea is often inadequately managed, as many women perceive it as a normal part of menstruation and hesitate to seek medical advice due to social taboos and embarrassment. This stigma and reluctance to seek proper care for menstrual issues hinders early detection of underlying diseases and diagnosis of secondary dysmenorrhea, which further complicates the differentiation between primary and secondary dysmenorrhea, particularly in settings with limited diagnostic resources.[2,6]

Dysmenorrhea has well-documented consequences throughout a woman's life. A study involving 21,573 women found that dysmenorrhea significantly contributes to absenteeism from school or university (20.1%), reduced concentration and academic performance during episodes (40.6%), and decreased participation in school activities (29.6%).[3] Moreover, it creates a notable disparity in healthcare burdens where women with either primary (2.2 times) or secondary dysmenorrhea (2.9 times) incur higher healthcare service costs compared to the general female population.[7] Another study also mentioned the higher prevalence of depression, anxiety, and stress-related disorders among women with dysmenorrhea.[8] Primary

dysmenorrhea, in particular, raises the likelihood of major depressive disorder by over 70%.[9] Despite these extensive findings, public awareness of dysmenorrhea, either primary or secondary, remains relatively low.

Part of the reason behind the limited public awareness surrounding dysmenorrhea may be the absence of large-scale, comprehensive research highlighting the burden in low- and middle-income countries, particularly Indonesia. While studies from countries such as India, Malaysia, Iran, and Nigeria have shed some light on the issue, these investigations have been limited in scale and regional in focus.[3] Comprehensive national data on the associations between dysmenorrhea, especially primary dysmenorrhea due to its common prevalence, and disruptions to the daily life of many women are urgently needed to inform stakeholders and raise public awareness about this condition.

Medical students were chosen as the study population because they represent younger, productive-aged women, a demographic where disruptions to daily life caused by dysmenorrhea can significantly impact academic performance and future career prospects. This group is also most affected by primary dysmenorrhea, which tends to be most prevalent during adolescence and early adulthood.[2,3] Additionally, their background in medicine allows for more accurate self-reporting of symptoms, which could improve the quality of data collection. Furthermore, our focus aligns with similar studies[10–13] conducted in other countries, which enables more direct comparisons between studies. Finally, involving medical students in dysmenorrhea research might enhance their awareness of the condition as prospective physicians.

This study aims to investigate the associations between primary dysmenorrhea and quality of life, mental health, and academic performance among medical students across Indonesia.

Methods

As part of the research project "Primary Dysmenorrhea: Prevalence, Perception, Behavior, and Quality of Life among Medical Students in Indonesia" conducted by the Faculty of Medicine, Universitas Indonesia, this study aimed to investigate the association between primary dysmenorrhea and quality of life, mental health, and academic performance among medical students in Indonesia. The Faculty of Medicine, Universitas Indonesia and Cipto Mangunkusumo National General Hospital Health Research Ethics Committee has approved the research protocol in accordance with good clinical practice and the Declaration of Helsinki (Reference No. 344/UN2.F1/ETIK/PPM.00.02/2021).

Study design and participants

This study employed a cross-sectional design. Data were collected using an online questionnaire via Google Forms (docs.google.com/forms) from 17 June to 31 July 2021. The survey link was distributed through social media platforms (e.g., WhatsApp, Instagram, and LINE) and shared within medical student organizations. Representatives from all 89 medical schools in Indonesia, including both public and private institutions, were contacted and asked to distribute the survey to their peers. While the exact number of students who received the survey is unknown, 676 responses were collected, and 630 valid responses were included in the analysis. The inclusion criteria were female medical students who consented, menstruated, were of Indonesian nationality, resided in Indonesia at the time of answering the survey, and had no previous pelvic pathology diagnosis. Consent to participate was obtained by answering a yes-no question on the first page of the online form.

We acknowledge that aspects such as school type (public vs. private) and geographic location may represent potential confounding factors. However, our sample reflects the national distribution of medical schools across Indonesia. The minimum sample size was

established with an online Raosoft, Inc. (Seattle, WA) sample size calculator.[14] We used a prior study to estimate the population of female undergraduate medical students in Indonesia (±31,250).[15] The calculation assumed a 5% margin of error, a 95% confidence level, and a response distribution of 50% to maximize variability. Using these parameters, the minimum required sample size was determined to be 380 participants. Ultimately, 676 responses were collected, with 630 valid responses included in the analysis.

Measurement tool and data management

Participants' academic performance – including concentration and activity disruption, absenteeism, and *cum laude* GPA (≥3.50/4.00) – were measured with a validated questionnaire in Bahasa Indonesia employed in a similar yet small-scale research on dysemenorrhea among Jakartan students by Derdameisya and Affandi (2014).[16] We also adapted their translation of Quality of Life Scale[17] to measure participants' quality of life as well as the Verbal Multidimensional Scoring System (VMSS)[18] to measure severity of dysmenorrhea. Severity was then categorized into dichotomous pain levels of mild and moderate-to-severe. Mental health conditions were measured through the Damanik Bahasa Indonesia translation of the Depression Anxiety Stress Scales (DASS 42)[19] and include the conditions of depression and stress. We also gathered sociodemographic information on age, body mass index (BMI), region of domicile, stage of study, and parental income, as well as information on participants' menstrual history, including age of menarche, cycle regularity and length, and menstrual duration (Table 1).

Statistical analysis

Responses from Google Forms were imported into MS Excel® for Office 365 (Microsoft Corporation, Redmond, WA) for data cleaning and coding. The data cleaning process involved the following steps: first, incomplete responses were identified and excluded

(e.g., participants who did not complete the questionnaire). Next, duplicate entries were checked and removed to ensure each participant was represented only once. Finally, categorical variables were reviewed for consistency (e.g., ensuring uniformity in coding for demographic categories), and continuous variables were checked for outliers or implausible values using descriptive statistics.

The cleaned dataset was then analyzed using STATA version 18.0 (StataCorp LLC, College Station, TX). Dichotomous data were presented as frequencies and proportions, while continuous data were presented as mean ± standard deviation (SD). The associations between independent variables – primary dysmenorrhea occurrence and severity – and affected areas of daily life – quality of life, mental health, and academic performance – were examined using Chi-square and t-test, depending on the variable measurement (Table 2). Variables with significant p-values (< 0.05) were then included as dependent variables in multiple linear or logistic regression models, where appropriate (Table 3). The independent variables of primary dysmenorrhea occurrence and severity were assessed in conjunction with other potential confounders, namely age, region, stage of study, and parental income.[20]

Patient and public involvement:

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Results

Descriptive attributes of study participants

A total of 676 participants completed the questionnaire, with 630 valid respondents included in the analysis due to incomplete data from 46 participants. Most respondents were in their preclinical years (85.87%) and aged 20–24 years (66.35%). A significant proportion

resided in Java (57.78%), Indonesia's most populous and developed island, which is home to more than half of the national population. Detailed sociodemographic and menstrual characteristics are presented in Table 1.

Table 1. Sociodemographic and menstrual status

Variable		Frequency	Percentage (%)
Age	Less than 20	212	33.65
	20-24	418	66.35
BMI	Less than 18.5	111	17.62
	18.5-23.4	326	51.75
	23.5-25	87	13.81
	25-29.9	75	11.90
	More than 30	31	4.92
Region	Java	364	57.78
	Outside Java	266	42.22
Stage of study	Preclinical	541	85.87
	Clinical	89	14.13
Parental income	≤ IDR 1,000,000	15	2.38
	IDR 1,000,000 - 5,000,000	131	20.79
	IDR 5,000,000 - 10,000,000	182	28.89
	IDR 10,000,000 - 15,000,000	104	16.51
	≥ IDR 15,000,000	198	31.43
Age of menarche	9-11	168	26.67
	12-14	422	66.98
	15-17	40	6.35

Cycle Regularity	Regular	519	82.38
	Irregular	111	17.62
Cycle Length	Normal (21 – 35 days)	426	67.62
	Abnormal (<21 or >35 days)	204	32.38
Menstrual duration	Normal (< 7 days)	508	80.63
	Abnormal (≥ 8 days)	122	19.37
Dysmenorrhea status	Without dysmenorrhea	55	8.73
	Mild dysmenorrhea	274	43.49
	Moderate-severe dysmenorrhea	301	47.78

IDR Indonesian Rupiah

Associations between Primary Dysmenorrhea and Quality of Life, Mental Health, and Academic Performance among Indonesian Medical Students

Quality of life

Quality of life was found to have significant association with primary dysmenorrhea occurrence and severity. After adjusting for confounders (Table 3), it was found that students with primary dysmenorrhea had a –1.82 [95% CI –2.63, –1.02; $p < 0.001$] lowered Quality of Life score compared to students without. Moreover, in students with primary dysmenorrhea, having moderate-to-severe pain was associated with a reduction of – 2.09 [95% CI –2.54, –1.63; $p < 0.001$].

Mental health

Out of all the participants, 373 (59.21%) were found to exhibit symptoms of depression of varying degrees whereas stress was found among 436 (69.21%) participants, where it was more predominant (Table 2). Multiple logistic regression (Table 3) found significant associations of both primary dysmenorrhea occurrence (OR 2.16 [95% CI: 1.23–3.81]; p =

0.007) and severity (OR 2.07 [95% CI: 1.47–2.92]; p = < 0.001) with depression. However, only dysmenorrhea severity was found to be significantly associated with the occurrence of stress (OR 1.82 [95% CI: 1.26–2.62]; p = < 0.001).

Academic performance

Four different measures of academic performance were used in our study, namely disruption of concentration, activities, absenteeism, and *cum laude* GPA. Primary dysmenorrhea occurrence and severity were found to have significant associations (Table 2) with three of the variables – disruption of concentration, activities, and absenteeism – with the exception of *cum laude* GPA (p-value 0.941 and 0.606, respectively). These associations were also found even after adjusting for confounders (Table 3).

222 **Table 2.** Proportion of primary dysmenorrhea occurrence and severity on areas of life with unadjusted estimates

Affected area of life		Dysmenorrhea occurrence		p-value	Dysmenorrhea severity		p-value
		No	Yes		Mild	Moderate-Severe	
		N (%)	N (%)		N (%)	N (%)	
Quality of life[a] (Mean; SD)		8.89; SD 2.60	7.04; SD 2.94	< 0.001[b]	8.16; SD 2.[illegible]	6.03; SD 3.13	< 0.001[b]
Mental health	Stress occurrence	34 (7.80)	402 (92.20)	0.214	174 (43.28)	228 (56.72)	0.001[b]
	Depression occurrence	23 (6.17)	350 (93.83)	0.006[b]	142 (40.57)	208 (59.43)	< 0.001[b]
Academic	Concentration disruption	9 (2.15)	410 (97.85)	< 0.001[b]	142 (34.63)	268 (65.37)	< 0.001[b]
performance	Activity disruption	1 (0.45)	220 (99.55)	< 0.001[b]	45 (20.45)	175 (79.55)	< 0.001[b]
	Absenteeism	1 (0.89)	111 (99.11)	0.001[b]	19 (17.12)	92 (82.88)	< 0.001[b]
	GPA – *cum laude*	20 (8.62)	212 (91.38)	0.941	104 (49.06)	108 (50.94)	0.606

223 Chi-square test was used in analysis, unless otherwise stated. [a]t-test was used instead of chi-square [b]indicating significant p-value < 0.05. *SD*

224 standard deviation, *CI* confidence interval, *GPA* grade point average, *cum laude* GPA > 3.50

225 **Table 3.** Multiple logistic and linear regression analyses with confounder adjusted estimates

226

Affected area of life		Dysmenorrhea occurrence		Dysmenorrhea severity	
		OR [95% CI]	p-value	OR [95% CI]	p-value
Quality of life[a]		-1.82 [-2.63, -1.02]	< 0.001[b]	-2.09 [-2.54, -1.63]	< 0.001[b]
Mental health	Stress occurrence			1.82 [1.26, 2.62]	< 0.001[b]
	Depression occurrence	2.16 [1.23, 3.81]	0.007[b]	2.07 [1.47, 2.92]	< 0.001[b]
Academic performance	Concentration disruption	12.92 [6.14, 27.22]	< 0.001[b]	7.24 [4.68, 11.19]	< 0.001[b]
	Activity disruption	34.95 [4.77, 256.16]	< 0.001[b]	6.92 [4.63, 10.36]	< 0.001[b]
	Absenteeism	12.10 [1.65, 88.83]	0.014[b]	4.65 [3.32, 9.63]	< 0.001[b]

227 Multiple logistic regression was used in analysis, unless otherwise stated. [a]linear regression was used instead of logistic regression [b]indicating

228 significant p-value < 0.05. *OR* odds ratio, *CI* confidence interval,

Discussion

Our study found evidence that primary dysmenorrhea is associated with disturbance in the quality of life, mental health, and academic performance of medical students. Quality of life is significantly associated with both the presence and severity of primary dysmenorrhea. Since pain is a disturbing event that causes numerous distractions in daily activities, quality of life impairment is expected. Quality of life comprises several aspects (physical, psychological, social, etc.) and is assessed differently across studies, either qualitatively[21] or quantitatively, as in our study. We used the Quality of Life scale by the American Chronic Pain Association[17] due to its simplicity (maximum score of 10 without segmentation into several domains) and prior use in a similar study in Indonesia,[16] while other studies used more complex scoring systems: the WHO QoL scale (4 domains) or EuroQoL-5D (5 domains), both with a maximum score of 100. Never the less, our study corresponds to prior findings which utilize different scores. For example, a study in Japan showed significantly lower quality of life (WHO QoL) with more severe dysmenorrhea.[22] Meanwhile, a study on the Spanish population revealed a slightly different trend where, although the overall quality of life (EuroQoL-5D) was significantly lower in women with dysmenorrhea, no differences across degrees of dysmenorrhea severity were observed (overall and within the 5 domains).[23] These previous studies revealed that not all aspects of quality of life are impaired similarly by dysmenorrhea. Furthermore, cultural background and subjective perceptions of pain play essential roles in determining the degree of quality of life impairment.[8]

In terms of mental health, our study revealed that increasing primary dysmenorrhea severity is associated with an increased risk of depressive symptoms. This finding aligns with the results of a Saudi Arabian study that examined the association between dysmenorrhea and depressive symptoms among female university students.[24] The study reported a significant positive correlation between quantified dysmenorrhea severity scores (the WaLIDD score) and

Patient Health Questionnaire scores, a depression screening scale.[24] A 2021 meta-analysis of 10 studies incorporating 4,691 participants with primary dysmenorrhea reported similar significant results.[9] Our study also found that stress levels, another critical aspect of mental health, are also positively associated with primary dysmenorrhea severity. Maryam et al. reported that severe menstrual cramps were significantly associated with moderate-to-severe psychological stress among fourth-year medical students.[25] Similarly, a multiple regression analysis conducted in Tokyo revealed a significant relationship between dysmenorrhea severity and psychological distress.[26] In addition, Wang et al. demonstrated that women with higher perceived stress had an increased risk of dysmenorrhea compared to those with lower perceived stress in the preceding menstrual cycle.[27]

The etiology of the association between primary dysmenorrhea and mental health issues is not yet fully established, but several mechanisms have been proposed. Chronic and recurrent menstrual pain, as is the case with other chronic pain conditions, acts as a persistent stressor that exacerbates depressive symptoms and stress levels.[9,28] Furthermore, hormonal fluctuations during the menstrual cycle may also play a role. Primary dysmenorrhea is associated with the production of uterine prostaglandins, which are influenced by both estrogen and progesterone. Both hormones have been implicated in depressive symptomatology through their effects on serotonin pathways and neurotransmitter regulation.[24,29] Pro-inflammatory cytokines during menstruation may also contribute to serotonin deficits and depressive symptoms.[9] Finally, social and academic disruptions, such as absenteeism and decreased productivity, could add to the stress and raise the risk for depression to occur.[30]

Academic performance is another aspect of daily life which is significantly associated with primary dysmenorrhea. This finding should raise concerns, as class performance may affect grades. Medicine is a stressful and competitive field, and losing top positions and receiving lower grades due to disruptive pain can increase stress levels, thus exacerbating

previously discussed associations between primary dysmenorrhea, mental health, and quality of life.[31] Students' concentration was found to be more disrupted among those with primary dysmenorrhea, especially with moderate-to-severe pain. Our finding is consistent with results from a systematic review involving 83 studies with more than 36,000 participants, which showed that at least 44.2% of participants experienced impaired concentration.[32] A previous meta-analysis involving 21,000 participants reported a slightly lower percentage of impaired concentration (40.9%).[3] Concentration in class is also related to active participation during classes. While many factors contribute to concentration during classes, whether external (lecturer or environmental aspects) or internal (students' conditions), there is a lack of studies specifically addressing menstrual pain in female students.[12,33] Compared to the significantly higher odds of reduced concentration found in our study, a study in Riyadh found much lower odds.[34]

Students with primary dysmenorrhea were also found to experience more disruptions in their school-related activities. This finding is in accordance with a 2005 study which determined that 98.6% of women with severe menstrual pain were unable to attend social activities.[35] Later studies also found that higher pain severity is associated with impaired social relationships.[34] A study in Ethiopia found that 31.7% of college students with primary dysmenorrhea experienced limitations in going out with friends.[13] Besides social activities, physical activities were also found to be impaired by primary dysmenorrhea according to previous studies. Physical activity and primary dysmenorrhea are interrelated and complexly influence one another. A study at a university in Iran showed a 1% reduction in the incidence of primary dysmenorrhea per unit increase in physical activity score.[36] Similarly, another study among Ethiopian college students reported that 37.8% experienced limitations in sports participation due to primary dysmenorrhea.[13]

Another factor that is highly influenced by primary dysmenorrhea is absenteeism from university classes. Our study found that 99.11% of Indonesian medical students with primary dysmenorrhea need to take at least a day off from medical school because of their condition. This is the highest number of absenteeism experiences compared to previous studies, which is estimated to be 20.1% as compiled in a meta-analysis by Armour et al.[3] There are three explanations to this phenomenon. Firstly, differences in questions asked might lead to different results. A Swedish study showed that absenteeism, when considered to be at least one day off in life, affects more people (59%) compared to absenteeism, when considered to be a monthly disturbance (14%).[4] As our question is of the former, this might be the reason of a significantly higher result. Secondly, our population of medical students might experience different types of stress than other populations. Other studies conducted on medical students, namely in Saudi Arabia[10] (28.3%) and Nepal[11] (29.45%), also show a higher percentage of absenteeism compared to the average of 20.1%, albeit lower than ours. Finally, Armour et al. found that low and middle income countries, such as Indonesia, have a higher percentage of absenteeism (26%) compared to high income ones (12.1%). Women in low and middle income countries might lack necessary access or knowledge to sanitary products and treatments during menstruation, thus affecting their morbidity and increase absenteeism.[3]

GPA is the only marker of academic performance that was found not to be associated with the presence or severity of dysmenorrhea. We used GPA as a proxy for academic performance, similar to the approach of Tadese et al., who also found a similar result. However, we used a specific cutoff of 3.50/4.00 GPA to check for cum laude status, whereas Tadese et al. used a continuous value of GPA. Tadese et al. found a lower GPA in students who experienced dysmenorrhea, without specifying primary or secondary dysmenorrhea.[37] Our contrasting findings may be explained by the reality that the association between dysmenorrhea, both primary or secondary, and GPA might be dynamic where GPA is a

cumulative value affected by various variables. It should also be noted that there is a higher prevalence of primary dysmenorrhea in our setting. Moreover, other studies that found significant associations between academic performance and primary dysmenorrhea defined academic performance in terms of class absenteeism, reduced concentration and focus, falling asleep during lectures, reduced physical activities, or incomplete homework submission.[3]

Limitations and future directions

While this study is the first to investigate dysmenorrhea and its associations with disruptions in the daily life of female medical students in Indonesia, it has some inherent limitations. The cross-sectional design restricts our capacity to determine causal effects of primary dysmenorrhea towards disturbances in area of life. Furthermore, although the sample size was large, we did not employ a randomised sampling technique. Instead, we employed snowball sampling, which lead to a higher concentration of participants from Java, though this distribution remains representative of the spread of Indonesian medical schools (45 out of 89 schools are in Java). Our focus on medical students, who generally possess a higher baseline understanding and interest in the subject, also necessitates caution when generalizing findings to the broader Indonesian population.

This study was conducted in 2021, prior to the adoption of the updated FIGO criteria for normal menstrual cycle length (24–38 days). At the time, the questionnaire used the previously accepted range of 21–35 days.[38] While this does not affect the study's primary outcomes, it may influence comparability with future studies using the updated criteria. Furthermore, the use of self-reported questionnaires limits the ability to definitively classify respondents with primary or secondary dysmenorrhea, as further diagnostic methods are required to identify underlying diseases. Many similar studies do not attempt this differentiation, which may make comparisons with their findings more complex. While we excluded participants with previously diagnosed pelvic pathology, it is important to consider

that some individuals reporting persistent or severe dysmenorrhea, even when classified as "primary," may harbor previously undiagnosed secondary conditions such as endometriosis. This is particularly relevant because primary dysmenorrhea is generally expected to improve by the early 20s.[6] Thus, its persistence among this age group shows the need for greater awareness and thorough evaluation to ensure early diagnosis of potential secondary causes.

Despite these limitations, this study is crucial in raising awareness about primary dysmenorrhea and its associations with disruptions in daily life. As the first nationwide prevalence study on primary dysmenorrhea among Indonesian medical students, it highlights a significant gynecological issue and its considerable burden on this demographic. We recommend further health education initiatives to improve awareness of menstrual health and mitigate its potential impacts. Future research should also investigate the prevalence of undiagnosed secondary dysmenorrhea within populations reporting primary dysmenorrhea. Longitudinal studies using more accurate diagnostic measurements could thus provide a clearer understanding of the overlap between these conditions and provide a more comprehensive understanding of dysmenorrhea in Indonesia. Finally, Further studies are also needed to better elucidate the impact of primary dysmenorrhea among wider populations in the country.

Conclusion

Our study highlights the significant associations of primary dysmenorrhea with the quality of life, mental health, and academic performance of Indonesian medical students. Despite inherent limitations such as the cross-sectional design, non-randomized sampling, and reliance on self-reported data, our findings show the burden of primary dysmenorrhea and the need for increased awareness and future research on the topic. By addressing the problem, we can better support medical students and improve their overall well-being and academic outcomes.

Footnotes

Contributors:

HS, RLS, KT, and R contributed to the article. HS conceived the proposal, designed the cross-sectional survey, interpret the analyses, and prepared the manuscript. RLS contributed to data collection, performed analyses, assisted with drafting the manuscript, and supervised the overall steps of the study. KT contributed to data collection, performed analyses, and assisted with drafting the manuscript. R contributed to data collection and assisted with drafting the manuscript. All authors read and approved the final manuscript. The guarantor of the study is HS; accepts full responsibility for the finished work and the conduct of the study, had access to the data, and controlled the decision to publish.

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References

1. ACOG Committee Opinion. Dysmenorrhea and endometriosis in the adolescent. Washington, D.C.: American College of Obstetricians and Gynecologists; 2018.

2. Itani R, Soubra L, Karout S, Rahme D, Karout L, Khojah HMJ. Primary Dysmenorrhea: Pathophysiology, Diagnosis, and Treatment Updates. Korean J Fam Med. 2022;43:101–8.

3. Armour M, Parry K, Manohar N, Holmes K, Ferfolja T, Curry C, et al. The Prevalence and Academic Impact of Dysmenorrhea in 21,573 Young Women: A Systematic Review and Meta-Analysis. J Womens Health. 2019;28:1161–71.

4. Söderman L, Edlund M, Marions L. Prevalence and impact of dysmenorrhea in Swedish adolescents. Acta Obstet Gynecol Scand. 2019;98:215–21.

5. Aouad P, Bui M, Sarraf S, Donnelly T, Chen Y, Jaaniste T, et al. Primary dysmenorrhoea in adolescents and young women: A twin family study of maternal transmission, genetic influence and associations. Aust N Z J Obstet Gynaecol. 2022;62:725–31.

6. Iacovides S, Avidon I, Baker FC. What we know about primary dysmenorrhea today: a critical review. Hum Reprod Update. 2015;21:762–78.

7. Akiyama S, Tanaka E, Cristeau O, Onishi Y, Osuga Y. Evaluation of the treatment patterns and economic burden of dysmenorrhea in Japanese women, using a claims database. Clin Outcomes Res CEOR. 2017;9:295–306.

8. MacGregor B, Allaire C, Bedaiwy MA, Yong PJ, Bougie O. Disease Burden of Dysmenorrhea: Impact on Life Course Potential. Int J Womens Health. 2023;15:499–509.

9. Zhao S, Wu W, Kang R, Wang X. Significant Increase in Depression in Women With Primary Dysmenorrhea: A Systematic Review and Cumulative Analysis. Front Psychiatry. 2021;12:686514.

10. Ibrahim NK, AlGhamdi MS, Al-Shaibani AN, AlAmri FA, Alharbi HA, Al-Jadani AK, et al. Dysmenorrhea among female medical students in King Abdulaziz University: Prevalence, Predictors and outcome. Pak J Med Sci. 2015;31:1312–7.

11. Katwal PC, Karki NR, Sharma P, Tamrakar SR. Dysmenorrhea and Stress among the Nepalese Medical Students. Kathmandu Univ Med J KUMJ. 2016;14:318–21.

12. Rahiminia E, Yazdani S, Rahiminia H. Factors Affecting Concentration and Attendance in the Classroom from Students' Point of View in Qom University of Medical Sciences (2018). Educ Res Med Sci [Internet]. 2019 [cited 2024 Jul 19];8. Available from: https://brieflands.com/articles/erms-93075#abstract

13. Hailemeskel S, Demissie A, Assefa N. Primary dysmenorrhea magnitude, associated risk factors, and its effect on academic performance: evidence from female university students in Ethiopia. Int J Womens Health. 2016;8:489–96.

14. Raosoft sample size calculator [Internet]. Seattle: Raosoft, Inc; 2023. Available from: http://www.raosoft.com/samplesize.html

15. Lazarus G, Findyartini A, Putera AM, Gamalliel N, Nugraha D, Adli I, et al. Willingness to volunteer and readiness to practice of undergraduate medical students during the COVID-19 pandemic: a cross-sectional survey in Indonesia. BMC Med Educ. 2021;21:138.

16. Derdameisya D, Affandi B. The Relation of Primary Dysmenorrhea with High School Students' Menstrual Characteristic and Study Process. [Jakarta]: Universitas Indonesia; 2014.

17. Keller N, Cowan P. Quality of life scale. American Chronic Pain Association; 2003.

18. Andersch B, Milsom I. An epidemiologic study of young women with dysmenorrhea. Am J Obstet Gynecol. 1982;144:655–60.

19. Damanik ED. The Measurement of Reliability, Validity, Items Analysis and Normative Data of Depression Anxiety Stress Scale [Internet]. Sydney: University of New South Wales; Available from: https://www2.psy.unsw.edu.au/groups/dass/Indonesian/Damanik.htm

20. Mofatteh M. Risk factors associated with stress, anxiety, and depression among university undergraduate students. AIMS Public Health. 2020;8:36–65.

21. Esan DT, Ariyo SA, Akinlolu EF, Akingbade O, Olabisi OI, Olawade DB, et al. Prevalence of dysmenorrhea and its effect on the quality of life of female undergraduate students in Nigeria. J Endometr Uterine Disord. 2024;5:100059.

22. Mizuta R, Maeda N, Tashiro T, Suzuki Y, Oda S, Komiya M, et al. Quality of life by dysmenorrhea severity in young and adult Japanese females: A web-based cross-sectional study. PLOS ONE. 2023;18:e0283130.

23. Fernández-Martínez E, Onieva-Zafra MD, Parra-Fernández ML. The Impact of Dysmenorrhea on Quality of Life among Spanish Female University Students. Int J Environ Res Public Health. 2019;16:713.

24. Alateeq D, Binsuwaidan L, Alazwari L, Algarni M, Al Hussain M, Alzahrani R, et al. Dysmenorrhea and depressive symptoms among female university students: a descriptive study from Saudi Arabia. Egypt J Neurol Psychiatry Neurosurg. 2022;58:106.

25. Maryam M, Ritonga MA, Istriati I. Relationship between Menstrual Profile and Psychological Stress with Dysmenorrhea. Althea Med J. 2016;3:382–7.

26. Matsumura K, Tsuno K, Okamoto M, Takahashi A, Kurokawa A, Watanabe Y, et al. The Association between the Severity of Dysmenorrhea and Psychological Distress of Women Working in Central Tokyo—A Preliminary Study. Int J Environ Res Public Health. 2023;20:7021.

27. Wang L, Wang X, Wang W, Chen C, Ronnennberg AG, Guang W, et al. Stress and dysmenorrhoea: a population based prospective study. Occup Environ Med. 2004;61:1021–6.

28. Rogers AH, Garey L, Bakhshaie J, Viana AG, Ditre JW, Zvolensky MJ. Anxiety, Depression, and Opioid Misuse Among Adults With Chronic Pain: The Role of Anxiety Sensitivity. Clin J Pain. 2020;36:862–7.

29. Barcikowska Z, Rajkowska-Labon E, Grzybowska ME, Hansdorfer-Korzon R, Zorena K. Inflammatory Markers in Dysmenorrhea and Therapeutic Options. Int J Environ Res Public Health. 2020;17:1191.

30. Brito dos Santos L, Ferreira CWS, Gonçalves CG, de Oliveira Xavier MA, Dantas JH, Barbosa IR, et al. Association among dysmenorrhea and activity limitation and participation restrictions in adult women: a cross-sectional study, Brazil -2017. Arch Public Health. 2021;79:194.

31. Bergmann C, Muth T, Loerbroks A. Medical students' perceptions of stress due to academic studies and its interrelationships with other domains of life: a qualitative study. Med Educ Online. 2019;24:1603526.

32. Munro AK, Hunter EC, Hossain SZ, Keep M. A systematic review of the menstrual experiences of university students and the impacts on their education: A global perspective. PLOS ONE. 2021;16:e0257333.

33. Grimby-Ekman A, Åberg M, Torén K, Brisman J, Hagberg M, Kim JL. Pain could negatively affect school grades - Swedish middle school students with low school grades most affected. PLoS ONE. 2018;13:e0208435.

34. Dahlawi H, Bukhari I, Alshammari F, Althaqib G, Alhawasawi M, Bashiri R, et al. Effect of dysmenorrhea on the academic performance among students studying in Princess Nourah Bint Abdulrahman University, Riyadh. Int J Med Dev Ctries. 2021;5:588–588.

35. El-Gilany AH, Badawi K, El-Fedawy S. Epidemiology of dysmenorrhoea among adolescent students in Mansoura, Egypt. East Mediterr Health J Rev Sante Mediterr Orient Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit. 2005;11:155–63.

36. Abadi Bavil D, Dolatian M, Mahmoodi Z, Akbarzadeh Baghban A. A comparison of physical activity and nutrition in young women with and without primary dysmenorrhea. F1000Research. 2018;7:59.

37. Tadese M, Kassa A, Muluneh AA, Altaye G. Prevalence of dysmenorrhoea, associated risk factors and its relationship with academic performance among graduating female university students in Ethiopia: a cross-sectional study. BMJ Open. 2021;11:e043814.

38. Munro MG, Balen AH, Cho S, Critchley HOD, Díaz I, Ferriani R, et al. The FIGO ovulatory disorders classification system. Int J Gynaecol Obstet. 2022;159:1–20.