Population-based Comparison Study on the Costs of Stroke Care for Women with Dysmenorrhea

Ya-Wen Lin

China Medical University

Fung-Chang Sung

China Medical University Hospital

Ming-Hung Lin

Tajen University

Chih-Hsin Mou

China Medical University Hospital

Yu-Kuei Teng

China Medical University

Ya-Ling Tzeng (✉ wen5001@mail.cmu.edu.tw)

China Medical University

Research article

Keywords: cost of stroke care, dysmenorrhea, menstrual cycle, type of stroke, young women

Posted Date: March 2nd, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-279491/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background

No study has investigated costs of stroke care for women with dysmenorrhea and stroke. This study compared types of stroke and costs of stroke care between women with and without dysmenorrhea, using the National Health Insurance Research Database of Taiwan.

Methods

From the insurance claims data, we identified women aged 15–44 to establish study cohorts with and without dysmenorrhea, frequency matched by age, with same sample size of 66048. Incidence of stroke and costs by stroke subtype were compared between the two cohorts at the end of follow-up.

Results

The incidence of stroke was 1.3-fold greater in the dysmenorrhea cohort than in comparisons. Proportionally, hemorrhagic stroke (HS) decreased with age, whereas ischemic stroke (IS) increased with age in both cohorts. Compared to comparisons, dysmenorrhea women had lower proportions of both HS (16.6% vs. 21.3%) and IS (19.8 vs. 20.1%), whereas dysmenorrhea women had higher proportion of transient cerebral ischemia (TIA) (31.3 vs. 24.2%). The average HS care and IS care cost ratios were 4.1 (3254/789, USD) for dysmenorrhea women, and 3.3-fold (3870/1171, USD) for comparisons. Hospitalization rate was lower in the dysmenorrhea than in comparisons (18.0 vs. 23.4%). Dysmenorrhea was associated with an increased risk of HS hospitalized (adjusted odds ratio (aOR) = 1.26, 95% confidence interval (CI) 0.71–2.23), but a lowered risk for IS (aOR = 0.48, 95% CI 0.21–0.69). Average costs for inpatient care, intensive care units, emergency and outpatient visits for dysmenorrheal women were all less than that for comparisons, but not significant.

Conclusion

The overall incidence of stroke was higher in dysmenorrheal women than in comparisons due to a higher proportion of TIA, but not HS and IS. However, costs for stroke care were slightly lower for dysmenorrhea women than for comparisons.

Introduction

Dysmenorrhea and stroke are prevalent disorders in women [1–5]. Dysmenorrhea, characterized by abdominal pain, cramps, nausea, headaches, and diarrhea, occurs during menstruation. Dysmenorrhea can be categorized as primary and secondary, based on onset and persistence [4, 5]. Primary dysmenorrhea, occurring 3 years after the first menstrual cycle, affecting young women (15–25 years of

age) is the more prevalent and widely studied form of dysmenorrhea [5–8]. The secondary dysmenorrhea is associated with a specific underlying cause of reproductive organ. The global prevalence of dysmenorrhea ranges from 28–87.4% [4–9].

Stroke is one of the leading causes of deaths, after cardiovascular diseases and cancer [1]. Persky et al. reported that each year, approximately 55,000 more women than men suffer from strokes, including recurrent strokes. If the current trend continues, it has been estimated that 60% of all stroke cases will be women by 2030 [10]. In 2012, the proportional mortality associated with stroke was estimated at 7.2%, which results in an economic burden of roughly US\$75 million annually. In Taiwan, stroke is the third-leading cause of deaths [2].

Among subtypes of stroke, ischemic stroke (IS) is the most common type, referring to a blockage of blood flow to the brain, which may account for approximately 75% of all stroke cases [11–13]. Causing by a leakage of blood in the brain, hemorrhagic stroke (HS) has been associated with high blood pressure and aneurysms [14, 15]. Transient ischemic attack (TIA) is a warning sign of future major stroke events. TIA is characterized as a blockage of blood flow to the brain for a short period of time, commonly less than five minutes [16].

Women face a high risk of stroke, and this risk appears to be growing. In Taiwan, nearly 74% of all stroke cases are IS, a much greater proportion than cases of HS (19.1%) and TIA (6.7%) [12]. It should be noted that dysmenorrhea in women is associated with mutual comorbidities of stroke, including cardiovascular disorders and thyroid diseases [17–19]. In the recent Chinese Project ELEFANT, Xu et al. found that young women with dysmenorrhea are at an increased risk of hypertension, and the estimated risk increases as the duration of menstrual bleeding increases [17]. A recent study using the Mayo Clinic's Spontaneous Coronary Artery Dissection (SCAD) registry data found that chest pain is prevalent in women prior to menstruation [18]. A New Delhi study found that women with menstrual disorders are prevalent with thyroid disorders, 14% of these disorders being diagnosed with hypothyroidism and 8% being diagnosed with hyperthyroidism [19].

Although stroke and dysmenorrhea are related to mutual risk factors, few researchers have investigated the association between the two conditions. A recent case-control study using insurance-claims data of women with dysmenorrhea in Taiwan suggested that stroke-related disorders are more prevalent in stroke cases than in non-stroke controls [20]. The disorders included hypertension (adjusted odds ratio [aOR] 4.53 [95% confidence interval (CI) 3.46–5.92]), hyperlipidemia (aOR 1.60 [95% CI 1.19–2.15]), arrhythmia (aOR 1.80 [95% CI 1.31–2.46]), and thyroid disease (aOR 1.56 [95% CI 1.20–2.02]). HS is more prevalent than IS in younger women suffering from dysmenorrhea.

Stroke can result in physical disability and dependence on others, both of which impose high economic costs [2]. Stroke costs an estimated \$34 billion each year in the United States [21]. The pain and psychological distress caused by dysmenorrhea also prevent many individuals from performing daily activities, resulting in a loss of work hours. It should, however, be noted that it remains unclear how the occurrence of stroke among women with dysmenorrhea affects the cost of care. Limited study has

evaluated whether the stroke types and costs in women with dysmenorrhea differ from those in women without dysmenorrhea [20]. The occurrence of dysmenorrhea and stroke vary by age [3]. In this study, we adopted a follow-up approach to conduct a retrospective cohort study to compare the occurrence of stroke and costs for care by stroke type between women with and without dysmenorrhea using insurance-claims data. The design made it possible for follow-up with the women in order to determine outcomes of stroke, including costs by the type of stroke [22].

Materials And Methods

Study Design and Study Population

The study population was selected from the Health and Welfare Data Science Center of the Ministry of Health and Welfare, which contained claims data released by the Taiwan National Health Research Institutes, documenting for 1 million beneficiaries listed in the 2000 Registry of Beneficiaries. The database contained details of care provided to the insured population from 1996 to 2013, including demographic characteristics, inpatient and outpatient care, medications, relevant surgical procedure codes and examinations, and costs of cares. The Research Ethics Committee of the China Medical University and Hospital approved the use of insurance-claims data for this study (CMUH-104-REC2-115).

Study cohorts with and without Dysmenorrhea

From the claims data, we identified 80661 females with diagnosed dysmenorrhea (ICD-9-CM: 625.3) for at least twice from 1997 to 2013. To avoid the potential impacts of premenopause and early menopause on stroke, women aged 45–49 were not considered in this study. After excluding those aged < 15 or > 44 years and those with the history of hysterectomy or ovariectomy (Procedure Code 68 and 65, respectively), or stroke, 66048 women were included in the dysmenorrhea cohort (Fig. 1). From women without the diagnosis of dysmenorrhea, we identified a comparison cohort aged 15–44 years, frequency matched by age and index year against the dysmenorrhea cohort, after excluding those with the history of hysterectomy, ovariectomy, or stroke. Both cohorts were followed until the end of 2013 to identify cases with incident stroke.

Data Analysis

Data analysis first compared the proportional distributions of subtypes of stroke by age between the 2 cohorts: HS (ICD-9 codes 430–432), IS (ICD-9 code 434), TIA (ICD-9 code 435) and other acute and other ill-defined cerebrovascular diseases (OCD, ICD-9 code 436 and 437). We used logistic regression analysis to calculate the odds ratio (OR) and 95% confidence interval (CI) of hospitalization by subtype of stroke for the dysmenorrheal cohort relative to comparisons. Average costs by subtype of stroke were compared between the 2 cohorts. Overall days and costs of hospitalization, costs for care in intensive care unit (ICU), costs for emergency room uses and costs for outpatient visits were also compared between the 2 cohorts. We estimated and plotted by age the average total costs and average costs for outpatient care

and inpatient care within 30 days of stroke. The t-test was used to examine the significance level between means.

Results

The incidence of stroke was 1.3-fold greater in the dysmenorrheal cohort than in the comparisons without dysmenorrhea (8.9 vs. 6.8 per 1000, Fig 1). Women who developed stroke were younger in the dysmenorrheal cohort than in the comparison cohort (Table 1). The proportion of hemorrhagic stroke declined with age, while the proportion of ischemic stroke increased with age. The overall proportion of hemorrhagic stroke was 1.28-fold higher in the comparison cohort than in the dysmenorrheal cohort (21.3% vs. 16.6%), whereas the proportions of IS were approximately similar. Additionally, the dysmenorrheal cohort had a higher proportion of TIA (31.3 vs. 24.2%).

Table 2 compares the risk of hospitalization by stroke subtype. Compared to the cohort without dysmenorrhea, the dysmenorrhea cohort showed a higher risk of hospitalization for hemorrhagic stroke (adjusted OR = 1.26 (0.71-2.23), but a significant lower risk for ischemic stroke (adjusted OR = 0.48 (0.21-0.69).

Table 3 shows that the estimated average costs of cares by stroke subtype were generally lower for cases in the dysmenorrheal cohort than those in comparisons. However, none of the differences were significant. The average HS cost to IS cost ratios were nearly 4.1 in dysmenorrheal women (US\$ 3254/789) and 3.3 in comparisons (US\$ 3870/1171). The cost of care for TIA was the least. The overall average cost for stroke cases was thus moderately lower in the dysmenorrheal cohort.

The dysmenorrheal cohort were less likely hospitalized and cared at ICU. Costs for hospitalization cares, ICU cares, emergency cares and outpatient cares were all less for the dysmenorrheal cohort than for the non-dysmenorrheal cohort, but not at a significant level (Table 4).

Fig 2 shows the overall average costs of stroke care for inpatient care, outpatient care and total costs within 30 days post stroke, respectively, by age, between the dysmenorrheal cohort and comparisons. The average total costs for the stroke cares among the 3 age groups were all lower for women with dysmenorrhea than for women without dysmenorrhea, with a greater gap between the 35-44 years groups. These differences were mainly associated with the costs of inpatient cares.

Discussion

The type of stroke and costs for stroke cares may vary by population, sex, age, and other factors such as comorbidity [23, 24]. A systemic assessment examined one-year costs of stroke care in children in the US ranged US\$15,000-140,000 depending on stroke type [23]. An early study in Taiwan found that the mean inpatient care costs for stroke decreased with age, 1.8-fold greater for children than for adults [24]. This is because the proportional incidence of hemorrhagic stroke is more than 3-fold higher in children than in adults. Our study compared strokes between young women with and without dysmenorrhea, focusing on

the costs of stroke care by the patient age and stroke subtype. Subtypes differed by age, and costs differed by subtype and age.

In general, compared to the non-dysmenorrheal cohort, women with a dysmenorrheal history had a higher proportion of TIA, but lower proportions of HS, IS and OCD. TIA is a transient ministroke, self-resolving and causing no permanent impairment [25–26]. The cost of TIA treatment in this study was substantially lower than all other types of stroke, with a mean cost of approximately 20% of the cost of IS treatment, or 4.8% of the cost of HS treatment for women with dysmenorrhea. These differences in treatment costs between TIA and IS, or HS could also be seen in the comparison women. A Malaysian study also observed higher cost for HS care [27]. Interestingly, in our study, the average costs of caring for most types of stroke were somewhat greater for women in comparisons than in the dysmenorrheal cohort, although the differences were not significant.

We infer that the dysmenorrheal women may have received more frequent medical attention than the women in the comparison cohort because they were troubled by their dysmenorrhea or other disorders. Therefore, the cases of stroke in the dysmenorrheal women were somewhat less severe, with less severity meaning less care required, which in turn means lower cost. Our data show that dysmenorrheal women have a lower hospitalization rate and a lower ICU care rate for stroke than the comparison group. A lower hospitalization and ICU care rates may explain the lower overall cost for stroke care in dysmenorrheal women.

Among outpatients, we reported no obvious age-dependent difference in costs existed between the two cohorts. We also failed to observe difference in the total costs of stroke care for younger women between the two cohorts. However, the difference in inpatient costs of stroke care existed between women with and without dysmenorrhea for only those aged 35–44 years. This is because the average cost of inpatient care for the non-dysmenorrheal cohort peaked in those aged 35–44. This explains that the total cost gap between the 2 cohorts was larger in those 35–44 years old than in younger. There was a decline in both inpatient care cost and total cost for the older in the dysmenorrheal cohort, whereas there was an ascent in the comparisons to near the costs for the youngest group. The cost of stroke care among women without dysmenorrhea seems to be affected by both age and the type of stroke.

A study carried out using the MarketScan Commercial Claims and Encounter inpatient database of 97,374 hospitalizations in the US also showed a higher cost of stroke care for younger patients than for older patients [28]. The mean cost is 1.7-fold higher for patients with HS stroke than those with IS and younger patients are more prevalent with HS. However, unlike our study, the MarketScan study considered only two age groups (above and below 45 years) [28]. Age is an important factor associated with the proportional distribution among subtypes of stroke. In our study population, HS is more prevalent in younger women than in older women. Higher portions of HS were observed in all ages in comparisons than in the dysmenorrhea cohort.

Strength and study limitation

In general, stroke is relatively rare in the younger population. The present study is strengthened by using large population-based data to compare stroke risk in women aged 15–44 with and without dysmenorrhea. The findings regarding the hospitalization of stroke patients with and without dysmenorrhea are particularly unique to this study. To our best knowledge, no prior study has explored how dysmenorrhea affects the odds of hospitalization among patients with different types of stroke. This study therefore is one of the first articles on this topic. However, it should be noted that our study does not detail the factors associated with hospitalization among stroke patients. Hence, it is important for future researchers to further assess factors associated with hospitalization among stroke patients in addition to stroke subtype. We recommend a focus on stroke-related comorbidity and socio-demographic status of study population. Our findings on the costs of stroke care for women with and without dysmenorrhea can be verified in other population research. Another study limitation needs to address is that women with minor aches during menstruation were likely not included in the dysmenorrhea cohort. Some of these women might be selected into the comparison cohort. Furthermore, information on lifestyle, such as drinking and smoking, was unavailable in the claims data. The impact was likely not existing because few women in Taiwan drink or smoke [29].

Conclusions

In this study, we found no age-dependent difference in outpatient care costs between women with and without dysmenorrhea, but a lower average inpatient cost of stroke care for women with dysmenorrhea among those aged 35–44 years old. However, the overall mean cost of stroke care is moderately lower in women with dysmenorrhea. Nonetheless, costs are different among stroke types, which may vary by age since stroke types vary by age. The cost of stroke care for individual women with and without dysmenorrhea is associated with stroke type. Those with HS require more expensive care than those with IS and TIA. Based on our findings, strategies need to be put into place to help younger women in both cohorts and older women in comparisons, particularly for those suffer from HS, so that they can cope with the higher cost of stroke care. More research is required to further explore why the hemorrhagic stroke risk is greater in younger women, since near 35% of cases were HS in 15–24 years old. It is also important to conduct further research to determine factors apart from age and stroke type that influence the cost of stroke care.

Abbreviations

HS: hemorrhagic stroke

IS: ischemic stroke

TIA: transient cerebral ischemia

CI: confidence interval

aOR : adjusted odds ratio

LHID: Longitudinal Health Insurance Database

ICD-9-CM: International Classification of Diseases, 9th Revision, Clinical Modification

Declarations

- **Funding:** This study is supported in part by Taiwan Ministry of Health and Welfare Clinical Trial Center (MOHW109-TDU-B-212-114004), MOST Clinical Trial Consortium for Stroke (MOST Clinical Trial Consortium for Stroke (MOST 109-2321-B-039-002), Tseng-Lien Lin Foundation, Taichung, Taiwan.
- **Conflicts of interest/Competing interests:** The authors declare no conflict of interest.
- **Ethics approval**

The Research Ethics Committee of the China Medical University and Hospital approved the use of insurance-claims data for this study (CMUH-104-REC2-115).

- **Consent to participate**

The National Health Research Institutes changed all personal identifications into surrogate numbers before releasing the database to researchers to protect the privacy of the insured people. This study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The NHIRD encrypts patient personal information to protect privacy and provides researchers with anonymous identification numbers 3 associated with relevant claims information, including sex, date of birth, medical services received, and prescriptions. Therefore, patient consent is not required to access the NHIRD.

- **Consent for publication**

Not applicable

- **Availability of data and material (data transparency):** We accessed the database of the Taiwan National Health Research Institutes. We are not eligible to duplicate and disseminate the database. For further access to the database, please contact the Ministry of Health and Welfare (Email: stcarolwu@mohw.gov.tw) for assistance. Taiwan Ministry of Health and Welfare Address: No.488, Sec. 6, Zhongxiao E. Rd., Nangang Dist., Taipei City 115, Taiwan (R.O.C.). Phone: +886-2-8590-6848.)
- **Code availability (software application or custom code)**

Not applicable

- **Authors' contributions:** Conceptualization: Ya-Wen Lin, Ming-Hung Lin; Data curation: Chih-Hsin Mou, Fung-Chang Sung; Investigation: All authors; Methodology: All authors; Validation: Ya-Ling Tzeng, Fung-Chang Sung, Ya-Wen Lin, Yu-Kuei Teng; Resources: Fung-Chang Sung, Ya-Ling Tzeng;

Supervision: Ya-Ling Tzeng, Yu-Kuei Teng; Writing – original draft: Ya-Wen Lin, Ming-Hung Lin;
Writing – review & editing: All authors.

Acknowledgements: None

References

1. Persky RW, Turtzo LC, McCullough LD. Stroke in women: disparities and outcomes. *Curr Cardiol Rep* 2010;12(1): 6-13. PMID:
2. Hsieh FI, Chiou HY. Stroke: morbidity, risk factors, and care in Taiwan. *J Stroke* 2014;16: 59-64.
3. Chiu MH, Hsieh HF, Yang YH, Chen HM, Hsu SC, Wang HH. Influencing factors of dysmenorrhoea among hospital nurses: a questionnaire survey in Taiwan. *BMJ Open* 2017;7: e017615.
4. Osayande AS, Mehulic S. Diagnosis and initial management of dysmenorrhea. *Am Fam Physician* 2014;89: 341-346.
5. Smith RP. The clinical classification and causes of dysmenorrhea. In *Dysmenorrhea and Menorrhagia*. Springer: Cham, Switzerland; 2018. pp. 55-64.
6. Santina T, Wehbe N, Ziade F. Exploring dysmenorrhoea and menstrual experiences among Lebanese female adolescents. *East Mediterr Health J* 2012;18: 857-63.
7. Agarwal AK, Agarwal A. A study of dysmenorrhea during menstruation in adolescent girls. *Indian J Community Med* 2010;35: 159.
8. Unsal A, Ayranci U, Tozun M, Arslan G, Calik E. Prevalence of dysmenorrhea and its effect on quality of life among a group of female university students. *Ups J Med Sci* 2010;115: 138-145.
9. Chiou MH, Wang HH. Predictors of dysmenorrhea and self-care behavior among vocational nursing school female students. *J Nurs Res* 2008;16: 17–25.
10. Reeves MJ, Bushnell CD, Howard G, Gargano JW, Duncan PW, Lynch G, et al. Sex differences in stroke: epidemiology, clinical presentation, medical care, and outcomes. *Lancet Neurol* 2008;7: 915-926.
11. Centers for Disease Prevention and Control. Know the Facts About Stroke. 2014. Available online: https://www.cdc.gov/stroke/docs/ConsumerEd_Stroke.pdf.
12. Hsieh FI, Lien LM, Chen ST, Bai CH, Sun MC, Tseng HP et al. Get with the guidelines-stroke performance indicators: surveillance of stroke care in the Taiwan stroke registry: Get with the guidelines-stroke in Taiwan. *Circulation* 2010;122: 1116-1123.
13. Shiber JR, Fontane E, Adewale A. Stroke registry: Hemorrhagic vs ischemic strokes. *Am J Emerg Med* 2010;28: 331-333.
14. Chen JH, Jiang H, Wu L, Liao X, Lu Y, Tao XQ, Deng PF, et al. Association of ischemic and hemorrhagic strokes hospital admission with extreme temperature in Nanchang, China-A case-crossover study. *J Clin Neurosci* 2017;43: 89-93.

15. Gathier CS, Bergh WM, Jagt M, Verweij BH, Dankbaar, JW, Müller MC, et al. Induced hypertension for delayed cerebral ischemia after aneurysmal subarachnoid hemorrhage: a randomized clinical trial. *Stroke* 2018;49: 76-83.
16. Béjot Y, Daubail B, Giroud M. Epidemiology of stroke and transient ischemic attacks: current knowledge and perspectives. *Rev Neurol* 2016;172: 59-68.
17. Xu H, Li PH, Barrow TM, Colicino E, Li C, Song R, et al. Obesity as an effect modifier of the association between menstrual abnormalities and hypertension in young adult women: results from Project ELEFANT. *PLoS ONE*. 2018;13: e0207929. doi: 10.1371/journal.pone.0207929.
18. Tweet MS, Codsi E, Best PJM, Gulati R, Rose CH, Hayes SN. Menstrual chest pain in women with history of spontaneous coronary artery dissection. *J Am Coll Cardiol* 2017;70: 2308-2309.
19. Ajmani NS, Sarbhai V, Yadav N, Paul M, Ahmad A, Ajmani AK. Role of thyroid dysfunction in patients with menstrual disorders in tertiary care center of walled city of Delhi. *J Obstet Gynaecol India* 2016;66: 115-119.
20. Lin MH, Yeh CH, Mou CH, Lin YW, Chen PC, Chang YY, et al. Stroke risks in women with dysmenorrhea by age and stroke subtype. *Plos ONE*. 2019;14: e0225221. doi: 10.1371/journal.pone.0225221.
21. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R, et al. Heart disease and stroke statistics—2017 update: A report from the American Heart Association. *Circulation* 2017;135: e229-e445.
22. Song JW, Chung KC. Observational studies: Cohort and case-control studies. *Plast Reconstr Surg* 2010;126: 2234.
23. Ellis C, McGrattan K, Mauldin P, Ovbiagele B. Costs of pediatric stroke care in the United States: a systematic and contemporary review. *Expert Rev Pharmacoecon Outcomes Res* 2014;14: 643-50.
24. Chen PC, Chien KL, Chang CW, Su TC, Jeng JS, Lee YT, et al. More hemorrhagic and severe events cause higher hospitalization care cost for childhood stroke in Taiwan. *J Pediatr* 2008;152: 388-93.
25. Amort M, Fluri F, Schäfer J, Weisskopf F, Katan M, Burow A, et al. Transient ischemic attack versus transient ischemic attack mimics: frequency, clinical characteristics and outcome. *Cerebrovasc Dis* 2011;32: 57–64.
26. Mohan KM, Wolfe CDA, Rudd AG, Heuschmann PU, Kolominsky-Rabas PL, Grieve AP. Risk and cumulative risk of stroke recurrence: a systematic review and meta-analysis. *Stroke* 2011;42: 1489–1494.
27. Hejazi SM, Mazlan M, Abdullah SJ, Engkanan JP. Cost of post-stroke outpatient care in Malaysia. *Singapore Med J* 2015;56: 116-119.
28. Wang G, Zhang Z, Ayala C, Dunet DO, Fang J, George MG. Costs of hospitalization for stroke patients aged 18-64 years in the United States. *J Stroke Cerebrovasc Dis* 2014; 23:861-868.
29. Yang JJ, Yu D, Wen W, Shu XO, Saito E, Rahman S, et al. Tobacco Smoking and Mortality in Asia: A Pooled Meta-analysis. *JAMA Netw Open*. 2019;2(3): e191474. PMID: 30924901;

Tables

Table 1. Stroke types by age compared between women with and without dysmenorrhea.

Dysmenorrhea	Stroke type									
Age, years	HS		IS		TIA		Other		Total	
Yes	n	%	n	%	n	%	n	%	N	%
15-24	43	34.1	19	15.1	28	22.2	36	28.6	126	21.5
25-34	20	12.7	29	18.4	56	35.4	53	33.5	158	27.0
35-44	34	11.3	68	22.6	99	32.9	100	33.2	301	51.5
Total	97	16.6	116	19.8	183	31.3	189	32.3	585	100.0
No										
15-24	30	36.6	13	15.9	15	18.3	24	29.3	82	18.3
25-34	24	19.1	27	21.4	28	22.2	47	37.3	126	28.2
35-44	41	17.2	50	20.9	65	27.2	83	34.7	239	53.5
Total	95	21.3	90	20.1	108	24.2	154	34.5	447	100.0

HS, hemorrhagic stroke; IS, ischemic stroke; TIA, transient cerebral ischemia;

Other, other acute and other ill-defined cerebrovascular disease.

Table 2. Estimated risk of hospitalization for stroke in dysmenorrheal women compared to women without dysmenorrhea by subtype of stroke.

		Hospitalization		Odds ratio (95% Confidence interval)	
Stroke type	Cohort	Yes	No	Crude	Adjusted
HS					
	Dysmenorrhea	51	46	1.23 (0.70-2.17)	1.26 (0.71-2.23)
	Comparison	45	50	Reference	Reference
IS					
	Dysmenorrhea	27	89	0.38 (0.21-0.69)	0.48 (0.21-0.69)
	Comparison	40	50	Reference	Reference
TIA					
	Dysmenorrhea	16	167	0.70 (0.32-1.52)	0.69 (0.32-1.50)
	Comparison	13	95	Reference	Reference
Other					
	Dysmenorrhea	11	178	1.31 (0.49-3.46)	1.30 (0.49-3.44)
	Comparison	7	148	Reference	Reference

HS, hemorrhagic stroke; IS, ischemic stroke; TIA, transient cerebral ischemia;

Other, other acute and other ill-defined cerebrovascular disease.

Note: Use comparison as reference; Adjusted CI, controlling for age.

Table 3. Comparison of average cost of stroke care (USD) between women with and without dysmenorrhea by stroke subtype.

Dysmenorrhea								
Yes				No				
Stroke type	N (%)	Mean	SD	N (%)	Mean	SD	Difference	p
HS	97(16.6)	3254	4890	95(21.2)	3870	8000	-616	0.52
IS	116(19.8)	789	2382	90(20.2)	1171	2924	-382	0.30
TIA	183(31.3)	157	254	108(24.1)	183	267	-26	0.41
Other	189(32.3)	255	954	155(34.6)	324	1426	-69	0.59
Total	585(100)	827	2566	448(100)	1212	4232	-385	0.07

HS, hemorrhagic stroke; IS, ischemic stroke; TIA, transient cerebral ischemia;

Other, other acute and other ill-defined cerebrovascular disease;

SD, standard deviation.

Table 4. Cost of hospitalization, uses of intensive care unit, emergency room and outpatient visit for stroke patients compared between women with and without dysmenorrhea.

	Dysmenorrhea		
	Yes	No	<i>p</i> -value
	N=585	N=448	
Hospitalization (included ICU)			
Yes, n (%)	105 (18.0)	105 (23.4)	0.03
Mean days ± SD	19.9 ± 27.5	20.2 ± 34.2	0.94
Means cost ± SD	3822.5 ± 4817.0	4557.0 ± 7716.9	0.41
ICU care received			
Yes, n (%)	46 (7.86)	52 (11.6)	0.04
Means cost ± SD	1680.3 ± 1396.3	2648.9 ± 3279.0	0.06
OPD (included ER)			
Means cost ± SD	148.7 ± 155.2	157.3 ± 190.9	0.46
ER			
Means cost ± SD	300.5 ± 215.3	326.9 ± 250.8	0.42

SD, standard deviation. ICU, intensive care unit; OPD, outpatient department; ER, emergency room.

Note: n, number of persons hospitalized in each group. Mean days and SD are calculated only for those hospitalized.

Figures

Figure 1

Flowchart showing the process of sample selection

Figure 2

Average costs of stroke care estimated within 30 days post stroke for inpatient department (IPD) care, outpatient department (OPD) care and total costs by age compared between women with and without dysmenorrhea.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AuthorInformation.docx](#)