Prevalence and impact of dysmenorrhea among University students in Ireland

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Disclosures: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors have no conflicts of interest to declare.

Abstract

Objective: Primary dysmenorrhea (PD), or painful menstruation, is a common gynaecological condition that can cause intense pain and functional disability in women of reproductive age. As a non-malignant condition, PD is relatively under-studied and poorly managed. The purpose of this study was to estimate the prevalence and impact of PD among third-level students in Ireland.

Design: Cross-sectional observational study.

Methods: Students (N = 892; age range = 18–45) completed an online survey on menstrual pain characteristics, pain management strategies, pain interference, and pain catastrophizing.

Results: The prevalence of PD was 91.5% (95% Confidence Interval = 89.67–93.33). Non-pharmacological management strategies were most popular (95.1%); of these, heat application (79%), rest (60.4%), hot shower/bath (40.9%), and exercise (25.7%) were most common. Perceived effectiveness of these methods varied between participants. Analgesic use was also common (79.5%); of these, paracetamol was most used (60.5%) despite limited perceived effectiveness. Pain catastrophizing was a significant predictor of variance in both pain intensity and pain interference scores such that those with higher pain catastrophizing scores reported more intense pain and greater interference with daily activities and academic demands.

Conclusions: This article presents the first investigation into PD among third-level students in Ireland. Poorly managed menstrual pain may impact functional ability across several domains. Future research should focus on improving menstrual pain management education and support, and promoting menstrual health literacy for women affected by PD.

Keywords: dysmenorrhea; menstrual pain; menstruation; pain catastrophizing; anxiety

Introduction

Primary dysmenorrhea (PD) is defined as painful menstrual cramps of uterine origin in the absence of pelvic pathology (1). It is often characterised by congestive (deep, dull ache) and/or spasmodic (sharp spasms) pain, and associated with a number of additional symptoms including fatigue, headache, backache, moodiness, irritability, constipation, and painful urination (2, 3). PD is known to negatively affect quality of life and can result in absenteeism from school and work (4). Despite this, given the non-malignant nature of the condition, PD is generally under-studied and poorly managed.

PD is the most common gynaecological condition among women of reproductive age (5). It affects an estimated 45–95% of menstruating women globally (1); however, prevalence estimates vary widely, in part due to methodological differences, but also cultural differences that may limit the generalisability of international estimates. Clinical risk factors for PD include younger age at menarche, irregular menstruation, and heavy menstrual flow (6, 7). Women with PD report significantly lower quality of life during their menstruation phase in comparison to their pain-free follicular phases and compared to those without pain during menstruation (1). PD can also lead to significant interference with daily activities (8-11). Importantly, for those in the critical developmental phases of adolescence and emerging adulthood, which typically coincide with secondary school and higher education, PD may negatively impact educational attainment through absenteeism and/or presenteeism, whereby people who menstruate may not be able to perform academically due to interference with concentration and performance during their period (2, 12-14).

Secondary dysmenorrhea, defined as menstrual pain resulting from anatomic or macroscopic pelvic pathology, is typically caused by a gynaecologic disorder such as endometriosis, adenomyosis, fibroids, or by congenital anomalies of the pelvic reproductive organs. Such conditions, particularly endometriosis, are not uncommon in young people (15, 16); however,

diagnoses are often delayed (17). This may be in part due to low healthcare consultation rates for people with dysmenorrhea (18, 19). Reasons for not seeking care for dysmenorrhea identified by Chen et al. (20) include assuming symptoms are normal, thinking providers would not offer help, being unaware of treatment options, and feeling embarrassed or afraid to seek care. In addition to the risk of underlying medical causes of menstrual pain going undetected, underutilisation of healthcare for dysmenorrhea may contribute to sub-optimal self-management through lack of awareness and underuse of effective strategies.

Pain catastrophizing, characterised by a tendency to magnify the threat value, to feel helpless in the context of pain, and by a relative inability to inhibit pain-related thoughts (21), may represent an important risk factor for adverse menstrual pain-related outcomes, such as pain intensity and disability. Females have been found to be more likely to engage in specific problematic coping strategies such as catastrophizing than males (22). Indeed, pain catastrophizing has been shown to mediate the relationship between sex and pain for adolescents with chronic pain (22). Relatively few studies (23, 24) have examined relationships between pain catastrophizing and dysmenorrhea to date, and these have typically focused on chronic pain samples. Research into the relationship between pain catastrophizing and dysmenorrhea-related outcomes in community samples is lacking.

The aim of the current study was to estimate the prevalence of dysmenorrhea among University students living in Ireland, and to explore the predictive value of pain catastrophizing scores in explaining variance in pain intensity and pain interference.

Methods

Design

This study utilised a cross-sectional (observational) quantitative online survey design.

Participants

Third-level students in Ireland who menstruate were invited to self-select into a study about their menstruation. Inclusion criteria were being a student in a third-level educational institution in Ireland (e.g., University, College, Institute of Technology), aged 18 years or older, who has reached menarche and is premenopausal (i.e., has not reached perimenopause or menopause; *note:* those on contraception who might use menstrual suppression were not specifically excluded). All who met these criteria were eligible to participate, regardless of how they identified in terms of gender.

Sample Size

A power calculation with finite population correction, assuming 5% precision, a conservative expected proportion of 50% based on the existing international literature, a large population to draw upon (i.e., over 120,000 females of reproductive age enrolled in higher education in Ireland) (25), and a 95% confidence interval, suggested a target sample of $N = 385$ would be sufficient to allow for estimation of the prevalence of PD in the general University population (26).

Measures

A copy of the survey tool is available via the Open Science Framework (27). The survey was pilot tested with two students who met the eligibility criteria and changes were made based on their feedback. The feedback related to the length of the questionnaire and the clarity of response options for certain items. Participants were asked to self-report basic demographic information as well as information about their menstrual cycle, menstrual pain experience, strategies they used to manage pain, and their perceived effectiveness of these. Prompts were used to elicit information about pain management strategies as well as any diagnosed gynaecological conditions that may have been associated with menstrual pain. In responding to these items, participants selected from a list devised from previous research as many

response options as were relevant to them. These lists also included an 'other' option, in which participants could enter via a free text box any responses not listed on the survey. Effectiveness of pain management strategies was rated on a 5-point Likert scale ranging from 0 'not at all effective' to 4 'very effective.' To protect participant anonymity, only age ranges were recorded. Participants were also asked to complete the following measures:

Numerical Rating Scale (NRS). Pain intensity was measured using the NRS, a scale consisting of whole number scores between 0–10, with higher scores indicating a greater pain intensity. Across many different chronic pain conditions, the NRS has shown to be highly correlated with the visual analog scale (28). This scale is a reliable and valid subjective measure of menstrual pain intensity (29, 30).

Patient-Reported Outcomes Measurement Information System (PROMIS). Pain interference was assessed using the PROMIS Short Form v1.0 – Pain Interference 8a for adults (31). This scale assessed self-reported impact of pain on aspects of the individual's life (social, cognitive, physical, recreational, and emotional). The prompt given at the start of the scale was modified from 'In the past 7 days…' to 'When you have menstrual pain…' in order to measure PD interference specifically. Participants responded on a 5-point Likert scale from 1 'Not at all' to 5 'Very much'. The total raw score was calculated by summing the response values to each question, with a possible range between 8–40. Additional specific questions relating to academic absenteeism and performance were also included. In the current study the Cronbach's alpha coefficient for the PROMIS scale was .95, suggesting very good internal consistency.

Pain Catastrophizing Scale (PCS). Pain catastrophizing was measured using the PCS (32), a 13 item self-report measure which assesses three dimensions of pain catastrophizing (rumination, magnification, and helplessness). Participants indicated the extent to which they agree with statements on a 5-point Likert scale ranging from 0 'Not at all' to 4 'All the time'.

The rank score for the statements was summed to find to total catastrophizing score ranging from 0-52. The scale has shown good internal consistency (α=.87) (32). In the current sample the Cronbach's alpha coefficient was .94, suggesting very good internal consistency.

Procedure

Ethical approval was obtained from the School of Psychology Research Ethics Committee at NUI Galway. Potential participants were invited to complete the survey via Institutional mailing lists, whereby each Institution shared the study information with registered students via email on one occasion, and social media posts on Facebook, Twitter, and Instagram. Due to resource limitations, we could not pay for targeted social media advertising. Posts were made public and could be shared by other social media users. Participants were given information about the purpose and protocol of the study, and informed consent was obtained prior to data collection. Data collection ran from January to March 2020. Participants filled in the online questionnaire through the LimeSurvey platform on their smart phones, laptops, or personal computers in their own time. The survey took between five and ten minutes to complete. Upon completion, participants were debriefed about the purpose of the study.

Statistical Analyses

Data were analysed using SPSS v.25.0 (33). A listwise deletion approach to handling missing data was taken, such that the current analyses include only participants with complete data on the variables of interest. Listwise deletion was chosen due to the small and random nature of the missing data (< 1% missing), and the large sample size (34). Descriptive statistics were computed for demographics, pain and menstruation characteristics listed above. Correlation coefficients (i.e., Pearson correlation coefficients [r] for two continuous variables, and point-biserial correlation coefficients [r_{pb}] for one continuous and one binary variable) and hierarchical multiple linear regression were used to examine associations between predictor

variables (i.e., clinical characteristics such as age at menarche, having an irregular menstrual cycle, having a heavy flow, and pain catastrophizing) and criterion variables (i.e., pain intensity and pain interference).

Results

Results are reported in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) Statement (35). A STROBE checklist is provided in Appendix A.

Sample Characteristics

A sample of 899 University students in Ireland who menstruate initiated the online survey. Of these, 7 did not complete the survey, leaving a sample of 892 participants for analysis following listwise deletion. The majority (85.1%) were aged between 18–24 years, and most (81.5%) were undergraduate students. Demographic characteristics are presented in Table 1.

[Table 1 around here]

The mean age of menarche was 12.54 years (range = 5–17[i]). For most of the sample (87.6%), menstruation was regular (i.e., period occurs approximately every 28 days, between 21–35 days). The median menstrual frequency of those with irregular periods was 40 days (interquartile range = 24; total range = 6–180). Additional detail on menstrual patterns of the sample is provided in Table 2. Beyond those listed on the survey, other related symptoms reported in a free-text box include nausea (1.6%), skin blemishes, pins and needles, mouth ulcers, heavy dreams, flatulence, ringing of the ears, and dermatographia (all < 1%).

[i] One participant reported the age at which they had their first period as 5 years old. While this may have been erroneous, it may be the case that this participant experienced precocious puberty (i.e., onset of puberty before the age of 8 years in girls). We therefore have not excluded this participant from these analyses. For information, the mean age of menarche in the sample with this participant excluded from the calculation is 12.55 years (standard deviation = 1.40), the median is 12 (interquartile range = 1) and the range of responses is 8–17 years.

[Table 2 around here]

Prevalence and Characteristics of Menstrual Pain

Menstrual pain occurred in 96.9% of respondents. Of these, 5.4% were diagnosed with a gynaecological condition (i.e., may be more appropriately classed as having secondary dysmenorrhea): 2.7% had a diagnosis of endometriosis; 1.7% had polycystic ovary syndrome; and less than 1% reported another diagnosis (uterine fibroids, adenomyosis, or pelvic inflammatory disease). Therefore, the prevalence of PD in this sample was 91.5% (95% Confidence Interval = 89.67–93.33). Of these, most respondents experienced pain with every period (52.2%) or most periods (27.3%). The mean menstrual pain rating was 5.45 on average (standard deviation = 1.79, median = 6, interquartile range = 3, range = 1–10), and 7.41 at its most severe (standard deviation = 1.73, median = 8, interquartile range = 3, range = 1–10). Only 37.2% had ever visited healthcare professional regarding menstrual pain; those who did reported higher pain intensity on average (t = -9.61, p < .001) and at its most severe (t = -11.10, p < .001). Beyond those listed on the survey (see Table 3, below), other pain areas identified by participants included the lower legs (1.8%), the upper back, vagina, anus, shoulders, neck, chest, pelvis, and the cervix (all < 1%). A full breakdown of dysmenorrhea-associated features is presented in Table 3.

[Table 3 around here]

Pain Management

Table 4, below, depicts the pain management strategies used as well as their perceived effectiveness. Non-pharmacological pain management strategies were most popular, with 95.1% of respondents reporting at least one such method; of these, direct heat application, having a hot shower or bath, rest, and exercise were most common. Though much less common, exercise was rated as more effective for managing pain than was rest. Other non-

pharmacological methods identified by participants included chocolate, lying in the foetal position, masturbation, sex, rocking back and forth, sleep, teas, transcutaneous electrical nerve stimulator (TENS) machine, prescription blood thinners, and topical essential oils (all < 1%). Analgesic use was also common (79.5%); paracetamol was most used (60.5%). Non-steroidal anti-inflammatory drugs (NSAIDs; e.g., ibuprofen, aspirin), which are the first-line treatment for menstrual pain, were less commonly used. Other drugs identified by participants include butylscopolamine, diclofenac, and mefenamic acid (all < 1%). The mean number of pain management strategies used was 4.37 (standard deviation = 2.12, range = 1–14). The number of strategies used was significantly correlated with pain intensity, such that participants who reported more intense pain used more methods ($r = .24$, $p < .001$).

[Table 4 around here]

Pain Interference

Responses to the PROMIS measure of pain interference showed considerable impact of PD on social, cognitive, physical, recreational, and emotional aspects of life. Participants reported that pain interfered 'quite a bit' or 'very much' with day-to-day activities (36.6%); work around the home (34.1%) and household chores (30.5%); ability to participate in (42.4%) and enjoy social activities (47.2%); things usually done for fun (39.7%) and enjoyment of life (37.1%); and family life (19.6%).

Table 5, below, presents PD interference with academic demands. For those who reported they had missed lectures due to PD ($n = 513$), the median number of lecture hours missed during the previous menstruation was 3 (interquartile range = 2; total range = 1–48).

[Table 5 around here]

Inferential Analyses

Table 6 presents means, standard deviations and correlation coefficients between predictor and criterion variables. Analyses of predictors of having PD were not undertaken given the degree of small-sample bias (i.e., the small number of participants that did *not* report PD) in this case (36). No strong relationships were observed between predictor variables ($r/r_{pb} < .7$). Variance inflation factor (< 2) and tolerance values (> .1) for all predictor values were also adequate, thereby demonstrating that there was no issue with multicollinearity in the data. All factors were significantly correlated with pain intensity and pain interference bar having an irregular menstrual cycle, which was not included in any further analyses. All assumptions of hierarchical linear regression were met.

[Table 6 around here]

The first hierarchical multiple linear regression explored the impact of predictor variables on average pain intensity. Clinical variables (i.e., age at menarche and having a heavy menstrual flow) were entered into the first block, followed by pain catastrophizing in the second block. The overall model significantly predicted pain intensity ($F_{(3, 782)} = 81.50$, $p < .001$), accounting for 23.5% of the variance in pain intensity scores. In block one, having a heavy flow was associated with greater pain intensity. In block two, menstrual pain catastrophizing contributed significantly to the model, explaining an additional 15.3% in the variance explained.

Similar results were observed for the second regression analysis, which explored the impact of predictor variables on pain intensity at its most severe. The overall model significantly predicted pain intensity ($F_{(3, 782)} = 71.72$, $p < .001$), accounting for 21.3% of the variance in pain intensity scores. In block one, younger age at menarche and having a heavy flow were associated with greater pain intensity. In the block two, menstrual pain catastrophizing contributed significantly to the model, and reduced the contribution of age at menarche to

non-significance. Pain catastrophizing made a significant contribution to the model and accounted for an additional 15.4% in the variance explained.

The above procedure was followed for criterion variable pain interference, with the addition of average pain intensity as a predictor variable in block one. The overall model significantly predicted pain interference ($F_{(4, 781)} = 187.01$, $p < .001$), accounting for 48.7% of the variance in PROMIS scores. In block one, having a heavier flow and reporting greater pain intensity was associated with greater interference. In block two, menstrual pain catastrophizing contributed significantly to the model, explaining an additional 15.8% of variance beyond clinical characteristics in block one. Results of all hierarchical regression analyses are displayed in Table 7.

[Table 7 around here]

Discussion

The current study indicates that PD is highly prevalent among third-level students in Ireland. Our data shows that 91% of students who menstruate in Ireland experience PD, with 52% having pain during every period. The majority had experienced pain since their first period. A wide variety of pharmacological and non-pharmacological pain management strategies were used, most commonly heat application, rest, paracetamol, and ibuprofen; the perceived effectiveness of these varied considerably, with many participants relying on strategies that have been shown to be less effective than others that are equally accessible in Ireland. Pain interference was common in this study; concentration during classes, ability to study and to complete assignments were most affected. Participants also reported that PD affected their enjoyment of life and impacted their ability to perform day-to-day activities. Given that the goal of pain management is not just to alleviate pain, but to maximise quality of life and functional ability, we contend that menstrual pain was poorly managed in this sample.

Symptom burden was high, with a majority of those with PD experiencing changes in mood, fatigue, bloating, tender breasts, and changes in appetite. Given that over 80% experienced changes in mood, it follows that PD may have a greater negative effect on mental health and wellbeing than has been previously understood.

This study is one of few to explore the role of pain catastrophizing in PD to date. We found that pain catastrophizing predicted both pain intensity and pain interference in this sample, after controlling for clinical variables known to predict menstrual pain (e.g., heavy flow). This is consistent with Payne, Rapkin (23), in which pain catastrophizing scores correlated with participants' menstrual pain ratings; however, this relationship was not significant for those without chronic pain. Walsh, LeBlanc (24) also found that women with higher pain catastrophizing scores reported greater disability. Similarly, Kapadi and Elander (37) found that lower physical quality of life was related to higher pain severity and catastrophizing scores. These findings indicate there may be a role for psychological intervention to improve outcomes for people with PD. Cognitive-behavioural therapy (38) or mindfulness (39) based interventions targeting pain catastrophizing may serve to reduce pain intensity and inference for people with PD. Psychological intervention may also help to promote use of adaptive cognitive and behavioural coping strategies in place of maladaptive strategies such as catastrophic thinking. With research on pain catastrophizing and PD in its relative infancy, the current findings provide an important foundation of evidence on which to base future research and practice.

Clinical and Policy Implications

The current findings have implications for the assessment and clinical management of PD. Participants in this study reported menstrual pain at a variety of sites, including the abdomen, lumbar, groin, and thighs. In addition, several gastrointestinal symptoms, such as nausea, vomiting, diarrhoea, and bloating, as well as headaches and tender breasts, were also

reported. This is consistent with previous research, which has shown that increased inflammatory prostaglandins and pain sensitization are likely to contribute to pain at multiple sites as well as gastrointestinal symptoms among women with dysmenorrhea (4, 40-43). However, this remains at odds with typical clinical practice, whereby abdominal pain intensity is often the only symptom assessed in dysmenorrhea cases (44). Future dysmenorrhea assessment should involve comprehensive evaluation of pain at different locations, gastrointestinal symptoms, as well as psychological factors such as pain catastrophizing and changes in mood, to ensure adequate clinical care and facilitate effective self-management.

Consultation rates were relatively high in the current sample, but still sub-optimal given the symptom burden reported. This is consistent with previous research (2, 45-47). Low consultation rates may also explain the low prevalence of secondary dysmenorrhea in this sample (5.4%); it is likely that some respondents classed in this study as having PD may have had undiagnosed gynaecological conditions such as endometriosis or uterine fibroids. This may also partly explain why some participants reported unusually short durations between periods (48). Low consultation rates may be in part due to enduring stigma surrounding menstruation (49) and a lack of education resulting in poor menstrual health literacy and reduced help seeking (46). It may also be due to the enduring and harmful idea that menstrual pain is something that must be tolerated as "part of being a woman" (20). Consequently, many people who menstruate choose menstrual pain management strategies without consulting a medical professional, which may result in unnecessary pain and suffering. This is evident from the data, whereby many participants relied upon less effective pain management strategies over those supported by evidence. For example, paracetamol was the most commonly used analgesic despite limited scientific evidence of clinical effectiveness for menstrual pain; NSAIDs, the first-line treatment for menstrual pain, were less commonly

used despite similar cost and ready availability in Ireland. This is in line with previous research (46), including a recent meta-analysis (50), which reported paracetamol to be the most widely used analgesic despite more than 50% of respondents reporting that it was not always effective for managing their pain. Varying perceived effectiveness ratings in this sample may indicate that what works for one individual may not work for another, particularly regarding non-pharmacological strategies. However, this may reflect that some young people who menstruate lack the necessary knowledge to allow them to self-manage menstrual pain effectively and may endure severe and debilitating symptoms without seeking medical attention and pain management support. Health education measures are needed to promote menstrual health literacy among young people and reduce stigma around menstruation. Comprehensive school- and community-based menstrual health education initiatives that are evidence-based, accessible, and inclusive can serve to increase health literacy, which in turn has positive impacts on understanding, agency and self-management, and appropriate help-seeking behaviour (46, 51, 52). In order to reduce stigma, educational initiatives should aim to normalise discussion of menstrual health issues by including boys and men in the conversation (53). Providing this education to children at a younger age (i.e., primary school age) may also promote healthy physical and emotional development into adolescence and adulthood (53).

Limitations and Recommendations for Future Research

The current study utilised a large sample of third-level students who menstruate. Recruiting participants from third-level institutions across Ireland resulted in a sample that may be more representative than in previous research focusing on single institutions. There may, however, be certain biases in the recruited sample. Due to resource limitations in terms of both time and funding, this study used a non-probability sampling approach, whereby students were invited to self-select into the study. Non-representative sampling limits the validity of the

conclusions we can draw regarding prevalence of PD based on this sample. People who experience menstrual pain may be more inclined to opt into such a study in comparison to those without. This could have contributed to the high prevalence of PD observed. Furthermore, students may not be representative of young adults in the community (54) as well as adolescent schoolchildren who also experience PD. PD may affect these groups in different ways, for example in terms of their development or the economic impact of missing work. Socioeconomic and occupational factors may also play a role in menstrual pain experiences. High levels of job strain, exhaustion, and stress related to working conditions have been associated with gynaecological pain (55-57). Additionally, access to gynaecological healthcare, analgesic medications, and certain self-management supports may be more difficult for people with fewer economic resources. Finally, limitations of online surveys as regards sampling and access issues have been well documented (58-60) and must be considered when interpreting the current findings. Given advertisements were shared by social media users, it is not known how many eligible students saw the study invitation and therefore it is not possible to calculate response rates. That said, given the reduced response time, relatively low cost, flexibility, acceptability, and constant advances in survey technology and household connectivity to the Internet (61), online surveys such as this can provide useful information on research topics that have been historically deprioritised and under-funded. Future research should utilise probability sampling and a variety of data collection methods to obtain diverse clinical and community-based samples of people who menstruate, as well as school-based samples of menstruating adolescents, in order to validate the current prevalence estimate.

There are certain measurement limitations to consider. First, it is not possible to make a diagnosis of secondary dysmenorrhea without a gynaecological exam. Reliance on self-report of gynaecological health in a sample wherein consultation rates are low is therefore likely to

underestimate the prevalence of secondary dysmenorrhea relative to estimates from clinical research. Second, we were limited in our ability to assess academic impact. For example, students may attend lectures but find their concentration in class negatively affected by pain. Previous research has shown that students are less likely to miss lectures because of pain when the lectures are mandatory (11). Also, self-reported data on missed lectures may be subject to recall bias. Future research should use objective measures of lecture attendance in conjunction with other relevant indicators of academic performance that may be impacted by pain. Third, participants were not asked to report what phase of menstruation they were in at the time of participation. This may have affected pain intensity scores through both response and recall biases, given the cyclical nature of PD. Pain catastrophizing has also been demonstrated to fluctuate during the menstrual cycle (62), which is consistent with the growing literature on situational versus dispositional catastrophizing (63, 64). Future cross-sectional research should assess participants' menstrual phase at the time of responding, and indeed aim to target phases during which pain is more likely (i.e., menstruation and ovulation phases). Longitudinal research may also provide important insight into the pain experience and its management. Fourth, the PROMIS pain interference measure has not been validated in dysmenorrhea and so results should be interpreted with caution. Fifth, in an effort to keep survey completion time to a minimum in order to achieve a sufficiently large sample, several factors thought to affect menstrual pain experiences were not assessed in this study; notably, modifiable and behavioural factors associated with increased risk of PD such as body mass index and smoking were not included. Importantly, there are likely other psychological factors beyond pain catastrophizing that play a role in menstrual pain experiences (e.g., pain acceptance) (37); in particular, only 23.5% and 21.3% of variance in pain intensity was predicted by our model, versus 48.7% variance in pain interference. Future research should explore the predictive value of pain catastrophizing relative to other theoretically and

empirically informed predictors. Finally, this study did not address other factors that may be associated with the effectiveness of pain management strategies, particularly dosage of analgesic drugs and timing of administration. Future research should attend to these variables to advance the science and practice of menstrual pain management.

Conclusions

Limitations notwithstanding, the current study provides important data on the prevalence and impact of PD among third-level students in Ireland. Based on these findings, we conclude that menstrual pain is highly prevalent and poorly managed. This has the potential to impact women's functional ability across personal and academic domains. The relationship between pain catastrophizing and pain intensity and interference warrants further investigation, given its implications for pain management and risk of pain-related disability. Further clinical research and health education measures are needed to promote menstrual health literacy and reduce stigma around menstruation in order to ensure adequate menstrual pain assessment and management.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors have no other conflicts of interest to declare. The authors would like to acknowledge and thank the participants who took part in the study.

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Table Legend

Table 1: *Participant demographics*

Table 2: *Cycle and menstruation characteristics*

Table 3: *Menstrual pain characteristics*

Table 4: *Pain management strategies used by participants with PD (N = 816)*

Table 5: *Menstrual pain interference with academic demands*

Table 6: *Descriptive statistics and correlations between predictor and criterion variables*

Table 7: *Hierarchical regression analyses of the contribution of pain catastrophizing to pain intensity and interference*

Table 1

Participant demographics

		n	%
Age groups	18-24	759	85.1
	25-34	109	12.2
	35-44	22	2.5
	45-54	2	0.2
Year of study	1	282	31.6
	2	168	18.9
	3	197	22.1
	4	79	8.9
	Postgraduate	165	18.5

Table 2

Cycle and menstruation characteristics

		n	%
Period duration	1-2 days	12	1.5
	3-4 days	269	33
	5-6 days	443	54.3
	7 or more days	92	11.3
Menstrual flow	Light	62	7.6
	Moderate	492	60.3
	Heavy	262	32.1
Experienced related symptom(s)	Yes	811	99.4
	No	5	0.6
Related symptoms	Mood change	692	85.3
	Fatigue	655	80.8
	Bloating	632	77.9
	Tender breasts	491	60.5
	Appetite change	440	54.3
	Headache	352	43.4
	Diarrhoea	351	43.3
	Sweating	262	32.3
	Dizziness	215	26.5
	Constipation	211	26
	Vomiting	95	11.7
	Fainting	68	8.4
	Other	21	2.6

Note: Participants could choose more than one option; therefore, columns may add up to greater than 100%

Table 3

Menstrual pain characteristics

Variable		*n*	%
Menstrual pain	Yes (PD)	816	91.5
	Yes (SD)	48	5.4
	No pain	28	3.1
Frequency of pain	Every period	426	52.2
	Most periods	223	27.3
	Some periods	167	20.5
Stage at which pain occurs	Pre-menstrual period	300	37.5
	Beginning of period	699	87.5
	Middle of period	191	23.9
	End of period	36	4.5
Pain duration	Less than 1 day	61	7.6
	1 day	143	17.9
	2 days	361	45.2
	3 days	161	20.2
	4 or more days	73	9.1
Pain site	Abdominal region	733	91.7
	Lumbar	428	53.6
	Groin	228	28.5
	Thigh(s)	85	10.6
	Other	19	2.4
Consulted doctor for menstrual pain	Yes	297	37.2
	No	502	62.8

Note: Participants could choose more than one option; therefore, columns may add up to greater than 100%

Table 4
Pain management strategies used by participants with PD (N = 816)

Type	Prevalence of use *n* (%)	Perceived effectiveness				
		Very effective	Somewhat effective	A little effective	Not very effective	Not at all effective
Analgesics	**649 (79.5%)**					
Ibuprofen	410 (50.2%)	93 (22%)	230 (56.1%)	63 (15.4%)	18 (4.4%)	6 (1.5%)
Aspirin	39 (4.8%)	4 (10.5%)	18 (47.4%)	6 (15.8%)	9 (23.7%)	1 (2.6%)
Paracetamol	494 (60.5%)	67 (13.6%)	242 (49%)	117 (23.7%)	51 (10.3%)	17 (3.4%)
Codeine	167 (20.5%)	75 (44.9%)	81 (48.5%)	10 (6%)	1 (0.6%)	0 (0%)
Prescription Analgesic	77 (9.4%)	30 (39%)	33 (42.9%)	8 (10.4%)	5 (6.5%)	1 (1.3%)
Other	8 (1%)	5 (62.5%)	3 (37.5%)	0 (0%)	0 (0%)	0 (0%)
Contraceptives	**255 (31.3%)**					
OCP, patch, ring	228 (27.9%)	78 (34.2%)	101 (44.3%)	26 (11.4%)	18 (7.9%)	5 (2.2%)
LARC	29 (3.6%)	8 (27.6%)	12 (41.4%)	6 (20.7%)	1 (3.4%)	2 (6.9%)
Non-Pharmacological	**776 (95.1%)**					
Heat application	645 (79.0%)	182 (28.2%)	293 (45.4%)	145 (22.5%)	25 (3.9%)	0 (0%)
Hot shower/bath	334 (40.9%)	47 (14.1%)	164 (49.1%)	94 (28.1%)	29 (8.7%)	0 (0%)
Cold shower/bath	12 (1.5%)	1 (8.3%)	4 (33.3%)	4 (33.3%)	3 (25%)	0 (0%)
Exercise	210 (25.7%)	48 (22.9%)	106 (50.5%)	50 (23.8%)	6 (2.9%)	0 (0%)
Yoga	39 (4.8%)	9 (23.1%)	15 (38.5%)	11 (28.2%)	4 (10.3%)	0 (0%)
Rest	493 (60.4%)	96 (19.5%)	200 (40.6%)	133 (27%)	62 (12.6%)	2 (0.4%)
Relaxation techniques	53 (6.5%)	6 (11.3%)	24 (45.3%)	19 (35.8%)	3 (5.7%)	1 (1.9%)
Meditation	26 (3.2%)	2 (7.7%)	14 (53.8%)	9 (34.6%)	1 (3.8%)	0 (0%)
Massage	94 (11.5%)	9 (9.6%)	41 (43.6%)	35 (37.2%)	9 (9.6%)	0 (0%)
Acupuncture	9 (1.1%)	3 (33.3%)	4 (44.4%)	1 (11.1%)	1 (11.1%)	0 (0%)
Diet change	49 (6%)	8 (16.3%)	20 (40.8%)	13 (26.5%)	8 (16.3%)	0 (0%)
Dietary supplements	45 (5.5%)	3 (6.7%)	15 (33.3%)	14 (31.1%)	12 (26.7%)	1 (2.2%)
Homeopathy	7 (0.9%)	0 (0%)	3 (42.9%)	3 (42.9%)	1 (14.3%)	0 (0%)
Herbs	36 (4.4%)	4 (11.1%)	18 (50%)	9 (25%)	4 (11.1%)	1 (2.8%)
Cannabis	23 (2.8%)	9 (39.1%)	14 (60.9%)	0 (0%)	0 (0%)	0 (0%)
CBD products	12 (1.5%)	3 (25%)	6 (50%)	2 (16.7%)	1 (8.3%)	0 (0%)
Alcohol	16 (2%)	4 (25%)	5 (31.3%)	4 (25%)	3 (18.8%)	0 (0%)
Other	20 (2.5%)	3 (15%)	13 (65%)	2 (10%)	2 (10%)	0 (0%)

Note: OCP = oral contraceptive pill; LARC = long-acting reversible contraception

Table 5

Menstrual pain interference with academic demands

Academic demand	Level of interference				
	Very much *n* (%)	Quite a bit *n* (%)	Somewhat *n* (%)	A little bit *n* (%)	Not at all *n* (%)
Lecture attendance	62 (8.2%)	167 (22.1%)	184 (24.3%)	176 (23.3%)	167 (22.1%)
Exam study	90 (11.9%)	220 (29.1%)	195 (25.8%)	179 (23.7%)	72 (9.5%)
Assignment completion	46 (6.1%)	158 (20.9%)	200 (26.5%)	206 (27.2%)	146 (19.3%)
Concentration	146 (19.3%)	237 (31.3%)	175 (23.1%)	157 (20.8%)	41 (5.4%)

Table 6

Descriptive statistics and correlations between predictor and criterion variables

Variable		*M* (*SD*)	*n* (%)	1	2	3	4	5	6	7
1	Age at menarche	12.54 (1.42)		–						
2	Irregular menstruation		115 (12.9)	-.06	–					
3	Heavy flow		295 (33.1)	-.07*	-.07*	–				
4	Pain catastrophizing	16.78 (11.72)		-.14***	-.08*	.20***	–			
5	Pain intensity (on average)	5.51 (1.80)		-.11**	.03	.28***	.45***	–		
6	Pain intensity (most severe)	7.47 (1.73)		-.14***	.01	.22***	.44***	.75***	–	
7	Pain interference	24.93 (8.01)		-.11**	-.05	.27***	.62***	.57***	.54***	–

Note: * = $p < .05$; ** = $p < .01$; *** = $p < .001$. Variables 2 and 3 were coded as binary variables, whereby 0 = regular menstruation, 1 = irregular menstruation, and 0 = light/normal flow, 1 = heavy flow, respectively.

Table 7

Hierarchical regression analyses of the contribution of pain catastrophizing to pain intensity and interference

	Adj. R^2	Adj. ΔR^2	ΔF	β
Pain intensity (on average)				
Block 1	.08	.08	35.88***	
Age at menarche				-.04
Heavy flow				.19***
Block 2	.24	.15	158.32***	
Pain catastrophizing				.40***
Pain intensity (most severe)				
Block 1	.06	.06	25.50***	
Age at menarche				-.07*
Heavy flow				.13***
Block 2	.21	.15	154.17***	
Pain catastrophizing				.41***
Pain interference				
Block 1	.33	.33	129.53***	
Age at menarche				.00
Heavy flow				.08**
Pain intensity				.34***
Block 2	.49	.16	240.46***	
Pain catastrophizing				.45***

Note: * = $p < .05$; ** = $p < .01$; *** = $p < .001$

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

	Item No.	Recommendation	Page # where this item is located:
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-7
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	n/a
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	5-7

Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-12
		(*b*) Describe any methods used to examine subgroups and interactions	7-12
		(*c*) Explain how missing data were addressed	7
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	8
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	n/a
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	n/a
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	n/a
		Cross-sectional study—Report numbers of outcome events or summary measures	8-12

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-12
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-12
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15-18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-18
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a