


Confidence to manage menstruation among university students in Australia: Evidence from a cross-sectional survey

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Abstract

Objectives: There has been increased attention to university students' experiences of menstrual disorders, and access to menstrual products, in high-income countries. Less attention has been directed to other aspects of their menstrual experience, including confidence for menstrual management. This study aimed to understand the factors affecting university students' confidence to manage menstruation at university.

Methods: An online survey was completed by 410 participants (age range: 16–46 years, mean = 20.1 years) who menstruate and study at an Australian university. Participants reported demographic characteristics, confidence to manage menstruation at university, and personal, physical and environmental factors. A Mann–Whitney U-test analysed differences in confidence between groups of students. Pearson's correlation coefficient and bivariate linear regressions determined associations between factors and confidence. Statistically significant associations were inputted into a multiple linear regression model. P-values less than 0.05 were considered significant.

Results: A minority of students (16.2%) felt completely confident to manage their menstruation at university. Menstrual knowledge, positive perceptions of menstruation and comfort to discuss menstruation with others positively predicted confidence. Physical menstrual symptoms, negative perceptions of menstruation, perceived stigma and using a menstrual cup or period underwear predicted lower confidence. In multiple regression, private and clean and sanitary university bathroom facilities, changing menstrual products at university, perceived stigma and negative perceptions of menstruation remained significant predictors.

Conclusion: Most students did not have complete confidence to manage their menstruation at university. Several personal, physical and environmental factors were related to students' confidence to manage menstruation. Assessment of these factors in future research with university students is recommended to enable a comprehensive understanding of their menstrual needs, and inform interventions aimed at improving their menstrual management confidence at university.

Keywords

education, menstrual health, menstrual hygiene management, quantitative, universities, women's health

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Introduction

A growing body of research has highlighted that those who menstruate face many challenges managing their menstruation in the spaces they live, learn or work.^{1,2} Most of this evidence was initially focused on adolescent school girls.^{3,4} However, the global discourse has since acknowledged the importance of addressing menstruation to improve the health and well-being, education and employment prospects

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of women, girls and all people who menstruate and to advance gender equality.⁵

University education is linked to numerous individual benefits including job security, higher lifetime earnings, safe living conditions, improved quality of life, increased civic participation and improved perceptions of health.^{6,7} However, university students' experiences of menstruation can negatively impact their academic performance, educational engagement and class attendance.⁸ Addressing university students' menstrual needs is therefore important for ensuring they remain engaged at university and complete their studies.

A recent systematic review of university students' menstrual experiences globally found that most of the research conducted with this cohort explored their experiences of disordered menstruation, predominantly dysmenorrhea.⁸ This may explain why current menstrual health interventions with university students predominantly target reductions in menstrual pain or irregular menstruation.^{9–12}

In Australia and abroad, there has also been a rise in anecdotal evidence of 'period poverty' – a term describing how menstruating individuals may lack access to menstrual materials (menstrual products) to manage menstruation due to socioeconomic disadvantage.^{13–15} In response to widespread advocacy and campaigning, the Scottish Government has provided free menstrual products in all schools, colleges and universities since 2018.¹⁶ The French Government also committed to making menstrual products freely available to university students in 2021.¹⁷ Students in Australia and the United States have urged their universities to provide free products in student bathrooms after organizing their own distributions.^{18–21}

Despite efforts to address university students' menstrual disorders or experience of 'period poverty', less attention has been paid to other aspects of their menstrual experience such as their menstrual practices, access to suitable sanitation facilities for menstrual management, experiences of stigma, available social support and their confidence to manage menstrual bleeding.⁸ However, these have been documented as shaping positive and negative experiences of menstruation, and overall well-being, in qualitative research with women and girls.^{1,2} For example, Spanish nursing students with low confidence to manage heavy and unexpected menstrual periods were distracted by constant concerns of leaking menstrual blood on their clothes while attending class.²² Conversely, girls with confidence to manage their menstruation felt comfortable to engage in other activities without being preoccupied with fears of menstrual leaks.^{23–25} Investigating factors affecting university students' confidence to manage menstruation is important as it can highlight other aspects of their menstrual experience that are currently unaddressed in research studies and menstrual health programmes.

Qualitative research with women and girls suggests that many factors can impact their perceptions of their ability

to manage menstruation. These include the following: experiences of disordered menstruation and adverse menstrual symptoms;^{26–29} holding positive or negative perceptions of menstruation;^{26,30} perceived menstrual stigma;^{31–33} comfort to discuss menstruation or menstrual-related concerns with others;^{28,34} knowledge of menstruation and menstrual management;^{23,35} characteristics of water, sanitation and hygiene facilities;^{23,33,36–38} and the type of menstrual material used to contain menstrual fluid.^{35,37,38} This study aims to quantitatively test the associations between these factors and confidence to manage menstruation at an Australian university.

In addition, there is a paucity of studies exploring the associations between university students' cultural and religious backgrounds and their experiences of menstruation in a multicultural environment.⁸ However, empirical research with women and girls suggests that these characteristics can influence menstrual experiences (i.e. menstrual cycle changes, menstrual management behaviours or perceptions of menstruation).^{39–42} Since Australia is becoming increasingly culturally diverse, coupled with a high intake of international university students,⁴³ such factors should be considered to ensure university-based menstrual health programmes are culturally appropriate and tailored to students' needs.⁴⁰ The secondary aim of this study is to assess whether differences in confidence to manage menstruation exist for university students based on their residency status (domestic or international student) or whether they identify as migrant or follow a specific religion.

Our study aims are captured by the following research questions:

1. How do university students rate their confidence to manage menstruation at university?
2. What differences in the level of confidence to manage menstruation at university exist between university students of different migrant status, residency status and religious beliefs?
3. What factors contribute to university students' confidence to manage menstruation at university?

Methods

Study design and setting

This study uses a cross-sectional quantitative survey design and reports on a subset of data collected from a larger cross-sectional survey study designed to assess the impact of menstruation on university students' education. The survey contained 92 items and was informed by a review of current literature on menstrual health and hygiene^{44–46} (Supplementary File 1). A metropolitan university in Sydney, Australia, was selected as the setting for this study because it had a high enrolment of students from diverse sociodemographic backgrounds. The university

has several campus locations in Sydney. Students can live on campus in student accommodation (residential colleges and residence halls) although most students live away from campus and commute to university.

Procedure

The survey was pre-tested on a sample of 12 university students, including 4 students who identified as belonging to culturally and linguistically diverse backgrounds and 1 student from the lesbian, gay, bisexual, transgender, intersex and queer (LGBTIQ) community. Questions were refined and additional questions were developed based on their feedback to enhance the acceptability of the instrument and the collection of meaningful responses. We determined a minimum sample size of 255 participants based on previous research with university students and their menstrual experiences, which was sufficient power to detect effects.⁴⁷

The survey was hosted online via Qualtrics (<https://www.qualtrics.com/au/>) between March and April 2020. All university students enrolled in an undergraduate degree who experienced menstruation were eligible to participate. Undergraduate students in the study setting are more likely to frequently visit university campus to complete their studies (and thus manage menstruation at university) in comparison with postgraduate students who are more likely to have infrequent on-campus attendance arrangements. No additional inclusion or exclusion criteria were applied. Convenience sampling was used to recruit participants. The study and survey URL were advertised through social media posts on Facebook and Instagram, flyers around campus and announcements at lectures. The median survey completion time was 8 min and 43 s. Upon completion of the survey, participants could click on a separate link to enter their email address to receive a summary of the findings and/or be placed into a prize draw for a 50 AUD voucher for an entertainment and electronics store.

Materials

Independent variables were based on factors hypothesized to predict confidence to manage menstruation derived from published qualitative research with adolescent girls and university students, but limited to variables measured in the larger cross-sectional survey. These included sociodemographic factors, menstrual knowledge and perceptions, types of people students felt comfortable to discuss menstruation with, menstrual symptoms, menstrual products used and whether they changed their menstrual products at university, and perceptions of bathroom facilities at university. The dependent variable was confidence to manage menstruation at university. Survey measures were designed to assess students' confidence to manage menstruation and

test our predictors. Predictors were grouped as personal, physical or environmental factors.

Confidence to manage menstruation at university. Students were asked to grade their confidence in their current ability to manage their menstrual period at university using one item with a 5-point response option, where 1 is 'not confident at all' and 5 is 'completely confident'. An explanatory note indicated that confidence to manage menstruation at university included 'cleaning your genitals, finding a menstrual product, changing it as much as you need to and disposing of, or appropriately washing, it after you are finished with it'.

Sociodemographic factors. Sociodemographic factors were captured by seven items. Students were asked to report their current age, age at menarche, gender, year at university, religion, migrant status (indicated as having one or both parents born overseas) and residency status (domestic or international student).

Personal factors. Personal factors consisted of knowledge of menstruation and menstrual management, perceptions towards menstruation and comfort to discuss menstruation with others.

Knowledge of menstruation and menstrual management was collected through four items that asked participants about the cause of menstruation, source of menstrual bleeding, knowledge of menstruation prior to menarche and whether they believed they possessed enough knowledge to practically manage their menstruation. Correct answers were summed, resulting in a total score between 0 and 4.

Perceptions of menstruation (positive perception, negative perceptions and perceived social stigma of menstruation) were assessed using four items. Students were asked whether they 'agree', 'disagree' or feel 'neutral' towards the statement 'menstruation is a normal and healthy part of life' (*positive perception*), 'menstruation is a curse' and 'menstruation is debilitating' (*negative perceptions*) and 'society's attitude of menstruation is that it is taboo' (*perceived social stigma of menstruation*).

Comfort to discuss menstruation with others was assessed using nine items which asked participants to indicate whether they 'agree', 'disagree' or were 'neutral' in feeling comfortable to discuss menstruation with their mother/female carer, father/male carer, sister, brother, friends, partner, health professional, employer and university lecturer or tutor. A 'not applicable' response option was available for all nine items.

Physical factors. Physical factors comprised factors relating to the physical management practices and physical health impacts of menstruation. Three items assessed *complications and/or adverse symptoms they experienced during*

menstruation, the main menstrual product they used during their last menstrual period (e.g. pad, tampon, menstrual cup, period underwear or cloth/rag) and *whether they changed their used product at university*.

Environmental factors. Environmental factors comprised factors relating to available water, sanitation and hygiene infrastructure to support menstrual management.

Perceptions of bathroom facilities on the university campus were assessed through seven items. (At Australian universities, a 'bathroom' refers to a room containing one or more toilet cubicles and washbasins. It does not often include bathing facilities (i.e. bath or shower).) Participants indicated whether the bathrooms they regularly frequent on university campus met their needs 'never', 'rarely', 'sometimes', 'most of the time' or 'always'. These items were based on checklists for monitoring menstrual health and hygiene in low- and middle-income countries and adapted to suit the Australian context (e.g. removal of reference to pit latrines or incinerators).^{48,49}

Ethical considerations

Ethical approval was granted by the University of Sydney's Human Research Ethics Committee (Project Number: 2019/754). Participants were provided with a Participant Information Sheet on the first page of the survey, informing them that their participation in the study was completely voluntary, and they could withdraw from the survey at any time. Participants indicated their consent by answering 'yes' to providing consent to participate.

Data analysis

Analyses were conducted using RStudio 1.3.1073. Descriptive analyses captured sample characteristics and students' confidence to manage menstruation at university. Data were assessed for normality using Shapiro–Wilk's test of normality. The Mann–Whitney U-test compared confidence between international and domestic students, migrant and non-migrant students, and students who identified as following a religion or not. Initially, Pearson's correlation coefficient assessed bivariate relationships between confidence to manage menstruation at university and other factors. Statistically significant relationships were then tested through bivariate linear regressions to determine the extent to which a factor predicted menstrual confidence and adjusted and unadjusted effect estimates were calculated.

We created dummy variables for categorical data (e.g. type of menstrual product) to input into our regression models. Responses to items with 'agree', 'neutral', and 'disagree' response options were recorded as 1, 0 and -1, respectively, and reverse scored were required for analysis. We similarly treated responses to each item on

perceptions of bathroom facilities with numerical data ('never' = 0, 'rarely' = 1, 'sometimes' = 2, 'most of the time' = 3, 'always' = 4) to run single linear regressions with confidence to manage menstruation as data were not normally distributed. Factors found as significantly predicting menstrual confidence in the bivariate model were inputted into a multiple regression model. Statistical significance was determined at the 5% level.

Results

Participants

A total of 553 survey responses were submitted. Of them, 143 responses were removed as participants did not provide consent ($n = 32$), were not undergraduate university students ($n = 98$) or did not experience menstruation ($n = 13$), leaving 410 survey responses available for analysis. Not all participants completed all questions. Most participants were enrolled in their first year of an undergraduate degree (40.9%), had one or both parents born overseas (68.5%), were domestic students (89.1%) and did not follow a religion (50.5%) (Table 1).

Personal factors

Most students (68.21%) received a complete knowledge score (4/4). Nearly all students (96%) expressed positive sentiments of menstruation as a normal and healthy part of life, and few (9.1%) perceived it to be a curse. The majority of students agreed they were comfortable discussing menstruation with friends (83.7%) and partners (82.2%). In contrast, few students (6.9%) agreed they felt comfortable discussing menstruation with university lecturers or tutors (Table 2).

Physical factors

Most students used a pad as their main product to manage menstruation. Over one-fifth of students (22%) indicated that they do not change their menstrual products while at university. Their most cited reason was not needing to change it (63.6%). Nearly all respondents (99.5%) indicated they experienced menstrual-related complications or adverse symptoms while menstruating. Emotional disturbances (e.g. moodiness, stress and depression) were most commonly cited (89.9%) and polycystic ovarian syndrome (PCOS) was the most prevalent diagnosis (Table 2).

Environmental factors

Less than half of the students (46.5%) reported that the bathrooms they regularly used at university always had a bin to dispose of their used menstrual products, although most (54.1%) indicated that clean running water and soap

Table 1. Sociodemographic characteristics of university students in Sydney, Australia.

Characteristics	Mean (%)	n
Current age	Mean = 20.1 (SD = 3.25)	401
Age of menarche	Mean = 12.5 (SD = 1.53)	401
Year of university		
First year	40.9	163
Second year	23.8	95
Third year	19.3	77
Fourth year or above	16.0	64
Religion		
Catholic	12.6	50
Anglican	7.3	29
Other Christian	9.1	36
Islam	7.1	28
Buddhism	2.8	11
Other (i.e. Sikhism, Hinduism)	10.6	42
No religion	50.5	200
Gender		
Female ^a	98.5	394
Male ^a	–	–
Non-binary	1.0	4
Not specified	0.5	2
Migrant status		
Both parents born in Australia	31.5	124
One parent born overseas	18.3	72
Both parents born overseas	50.2	198
Unsure	–	–
Resident status ^b		
Domestic student	89.1	351
International student	10.9	43

SD = standard deviation.

^aThese response options conflate sex with gender (i.e. woman, man). It is unclear how participants interpreted these response options. We did not use responses to this question on students' gender identity in further analyses.

^bDomestic students include Australian or New Zealand citizens, a permanent resident of Australia or a holder of a permanent Australian humanitarian visa. International students are residents or citizens of any other country.

were always available for handwashing. Around half of the students indicated that, most of the time, bathrooms had enough privacy (43.6%), functional toilets (47.4%), locks on doors (47.3%) and toilet paper (51.4%) and were clean and sanitary (43.9%) (Table 3).

Confidence to manage menstruation

A total of 353 students reported on their confidence to manage menstruation at university. On average, students rated their confidence to manage menstruation as 3.5 out of 5 (SD = 1.00). Only 16.2% of students felt completely confident to manage menstruation at university (a rating of 5), and very few (3.1%) did not feel confident at all (a rating of 1). There were no statistically significant differences in confidence in managing menstruation at university between domestic and international students, migrant and non-migrant students, and students who did and did not follow a religion (Table 4). Differences in confidence

between religious groups (e.g. Christianity, Islam, Sikhism and Buddhism) or those who did not specify their religion were unable to be analysed due to small frequencies.

Factors affecting confidence to manage menstruation

There were no significant correlations between menstrual confidence and current age, age of menarche, year of degree, religion, residency status, migrant status, menstrual symptoms and complications (painful periods, irregular or missing periods, emotional symptoms), menstrual disorder diagnosis and comfort to discuss menstruation with a father, sister, brother, friend, partner, employer or university teacher.

Statistically significant correlations were inputted into bivariate linear regression models (Table 5). Bivariate analyses found that confidence to manage menstruation was significantly positively predicted by a positive

Table 2. University students' responses to personal and physical factors affecting their menstrual experience.

	Mean (%)	SD/n
Personal factors		
<i>Knowledge of menstruation and menstrual management</i>		
Correctly identified and/or indicated:		
Hormones as cause of menstruation	98.0	351
Uterus as location where menstrual bleeding originates	85.4	327
Awareness of menstruation prior to menarche	85.2	323
They believed they had enough knowledge to manage menses	93.7	355
Knowledge score (range: 0–4)	3.64	0.58
<i>Perceived social stigma of menstruation</i>		
Society's attitude of menstruation is that it is taboo (n = 369)		
Agree	52.8	195
Disagree	19.5	72
Neutral	27.6	102
<i>Positive perception of menstruation</i>		
Menstruation is a normal and healthy part of life (n = 374)		
Agree	96.0	359
Disagree	–	–
Neutral	4.0	15
<i>Negative perception of menstruation</i>		
Menstruation is a curse (n = 374)		
Agree	9.1	34
Disagree	69.5	260
Neutral	21.4	80
Menstruation is debilitating (n = 374)		
Agree	25.1	94
Disagree	28.6	107
Neutral	46.2	173
<i>Comfort to discuss menstruation with others</i>		
Feel comfortable talking about menstruation with mother/female carer (n = 360)		
Agree	79.4	286
Disagree	8.6	31
Neutral	11.9	43
Feel comfortable taking about menstruation with father/male carer (n = 341)		
Agree	19.9	68
Disagree	56.6	193
Neutral	23.4	80
Feel comfortable taking about menstruation with sister (n = 218)		
Agree	74.8	163
Disagree	11.5	25
Neutral	13.7	30
Feel comfortable taking about menstruation with brother (n = 217)		
Agree	17.5	38
Disagree	56.2	122
Neutral	26.3	57
Feel comfortable taking about menstruation with friends (n = 361)		
Agree	83.7	302
Disagree	3.9	1445
Neutral	12.5	175
Feel comfortable taking about menstruation with partner (n = 213)		
Agree	82.2	13
Disagree	6.1	25
Neutral	11.7	266
Feel comfortable taking about menstruation with health professional (n = 345)		
Agree	77.1	22
Disagree	6.4	57
Neutral	16.5	29

(Continued)

Table 2. (Continued)

	Mean (%)	SD/n
Feel comfortable taking about menstruation with employer (n = 316)		
Agree	9.2	248
Disagree	78.5	39
Neutral	12.3	24
Not applicable		
Feel comfortable taking about menstruation with lecturer or tutor (n = 348)		
Agree	6.9	276
Disagree	79.3	48
Neutral	13.8	
Physical factors		
<i>Menstrual characteristics</i>		
Complications or adverse symptoms experienced during menstruation (n = 357):		
Painful periods	81.2	290
Irregular/missing periods	63.0	225
Heavy bleeding	59.3	211
Migraines/headaches	50.1	179
Emotional symptoms (e.g. moody, stressed or depressed)	89.9	321
Other (e.g. back pain, gastrointestinal issues, acne or suicidal thoughts)	28.6	102
I don't experience any side effects	0.6	2
Consulted a health professional about menstrual-related complications (n = 354)		
yes	46.0	163
no	54.0	191
Diagnosed with a menstrual disorder if they answered yes to consulting a health professional (n = 163)		
yes	27.6	45
no	72.4	118
Diagnosis received after consulting with a health professional (n = 45):		
Dysmenorrhea (painful periods)	24.4	11
Amenorrhea (missing periods)	8.9	4
Abnormal uterine bleeding (bleeding within periods)	4.4	2
Endometriosis	31.1	14
Polycystic ovarian syndrome	37.8	17
Other (e.g. premenstrual dysphoric disorder, adenomyosis or menorrhagia)	31.1	14
<i>Menstrual practices at last period</i>		
Main menstrual products (n = 356)		
Pad	65.2	232
Tampon	23.9	85
Menstrual cup	8.2	29
Cloth/rag	0.8	3
Period underwear	2.0	7
Other (clothing, regular underwear, nothing)	–	–
Change menstrual products at university (n = 356)		
yes	78.4	279
no	21.6	77
Proportion of students who changed their menstrual products at university broken down by type they mainly used (n = 279):		
Pad	83.6	194
Tampon	84.7	72
Menstrual cup	37.9	11
Cloth/rag	33.3	1
Period underwear	14.3	1
Reasons for not changing menstrual products at university (n = 77)		
Not required	63.6	49
Fear of being heard/seen	14.3	11
No disposal bin	2.6	2
No replacement material to use	18.2	14
Unsanitary facilities	31.2	24
Other (e.g. washing and cleaning menstrual cup discretely, not enough time between class or toilets too far away from class)	26.0	20

SD = standard deviation.

Table 3. Students' perceptions of the bathroom facilities they regularly use at university for menstrual management.

Environmental factors	n (%)
Bathrooms have enough privacy so they can change their menstrual product if they use one (n = 346)	
Always	121 (35.0)
Most of the time	151 (43.6)
Sometimes	56 (16.2)
Rarely	16 (4.6)
Never	2 (0.6)
Bathrooms have functional toilets (not clogged, able to flush, toilet seats are not broken) (n = 346)	
Always	76 (22.0)
Most of the time	164 (47.4)
Sometimes	82 (23.7)
Rarely	22 (6.4)
Never	2 (0.6)
Bathrooms are clean and sanitary (n = 346)	
Always	34 (9.8)
Most of the time	152 (43.9)
Sometimes	111 (32.1)
Rarely	43 (12.4)
Never	6 (1.7)
Bathrooms have functional locks on doors so they can use the toilet in privacy (n = 344)	
Always	92 (26.7)
Most of the time	163 (47.3)
Sometimes	76 (22.0)
Rarely	13 (3.8)
Never	0 (0)
Bathrooms have a bin in each toilet where they can dispose of their used menstrual product (n = 345)	
Always	161 (46.5)
Most of the time	135 (39)
Sometimes	40 (11.6)
Rarely	9 (2.6)
Never	0 (0)
Bathrooms have enough supply of toilet paper so they can clean/wipe their genitals (n = 343)	
Always	108 (31.4)
Most of the time	177 (51.5)
Sometimes	55 (16.0)
Rarely	3 (0.9)
Never	0 (0)
Bathrooms have clean running water and soap for handwashing (n = 345)	
Always	187 (54.1)
Most of the time	126 (36.4)
Sometimes	27 (7.8)
Rarely	5 (1.5)
Never	0 (0)

perception of menstruation ($\beta = 0.714$, 95% CI = 0.173 to 1.256); changing menstrual products at university ($\beta = 0.549$, 95% CI = 0.296 to 0.802); and access to university

bathroom facilities that were perceived as being clean and sanitary ($\beta = 0.351$, 95% CI = 0.235 to 0.467) and having adequate privacy ($\beta = 0.452$, 95% CI = 0.336 to 0.568), toilet paper ($\beta = 0.365$, 95% CI = 0.219 to 0.511), functional toilets ($\beta = 0.272$, 95% CI = 0.149 to 0.395), functional locks on doors ($\beta = 0.258$, 95% CI = 0.127 to 0.389), a disposal bin ($\beta = 0.200$, 95% CI = 0.064 to 0.336) and clean running water and soap ($\beta = 0.217$, 95% CI = 0.068 to 0.366). Having a higher menstrual knowledge score ($\beta = 0.246$, 95% CI = 0.056 to 0.436) and feeling comfortable discussing menstruation with a health professional ($\beta = 0.272$, 95% CI = 0.095 to 0.462) or mother ($\beta = 0.199$, 95% CI = 0.025 to 0.372) also significantly positively predicted confidence.

Using period underwear ($\beta = -1.063$, 95% CI = -1.819 to -0.307) or a menstrual cup ($\beta = -0.511$, 95% CI = -0.901 to -0.120) to manage menstrual bleeding significantly negatively predicted menstrual confidence in bivariate relationships. Perceived social stigma of menstruation also significantly predicted lower confidence ($\beta = -0.237$, 95% CI = -0.372 to -0.104), as did having negative perceptions of menstruation as debilitating ($\beta = -0.240$, 95% CI = -0.384 to -0.096) or a curse ($\beta = -0.355$, 95% CI = -0.512 to -0.197). Heavy menstrual bleeding ($\beta = -0.379$, 95% CI = -0.592 to -0.166) and migraines ($\beta = -0.218$, 95% CI = -0.430 to -0.006) while menstruating significantly negatively predicted confidence.

All statistically significant factors based on bivariate linear regressions were entered into an adjusted multiple linear regression model (Table 5) to determine the extent to which they affected menstrual confidence. These variables accounted for 30.8% of the explained variance in confidence to manage menstruation. Only five factors remained significant predictors of confidence. Bathroom facilities at university that offered sufficient privacy ($\beta_{\text{adj}} = 0.487$, 95% CI = 0.289 to 0.686) and were clean and sanitary ($\beta_{\text{adj}} = 0.363$, 95% CI = 0.132 to 0.594) significantly positively predicted confidence, as well as changing menstrual products at university ($\beta_{\text{adj}} = 0.142$, 95% CI = 0.049 to 0.234). Negative perceptions of menstruation (menstruation as a curse) ($\beta_{\text{adj}} = -0.125$, 95% CI = -0.244 to -0.007) and perceived social stigma of menstruation ($\beta_{\text{adj}} = -0.103$, 95% CI = -0.198 to 0.008) significantly predicted lower confidence.

Discussion

Our study found that most students do not feel completely confident to manage their menstruation at university. Several personal, physical and environmental factors independently predicted students' confidence to undertake menstrual management practices in bivariate analyses. Multivariable analysis showed that only five factors remained strong predictors of confidence to manage menstruation: negative perceptions of menstruation, perceived

Table 4. Comparison of mean ranks for confidence to manage menstruation at university between students with and without religion, and of differing migrant and residency status.

	n (%)	Mean rank ^a	SD	Mann–Whitney U	p-value
All students	353	3.5	1.00	–	–
Religious status					
Students with a religion	166 (48.1)	3.5	1.0	15190.0	0.71
Students with no religion	179 (51.9)	3.5	1.0		
Migrant status					
Migrant students	242 (68.8)	3.5	1.0	12960.0	0.68
Non-migrant students	110 (31.2)	3.4	1.0		
Residency status					
Domestic students	314 (88.9)	3.5	1.0	6250.0	0.83
International students	39 (11.1)	3.5	1.1		

^aConfidence rating range: 0–5.

social stigma of menstruation, changing menstrual products at university, and private and clean and sanitary bathroom facilities.

Predictors of confidence to manage menstruation

Personal factors. Knowledge of menstruation and menstrual management predicted confidence in managing menstruation in the bivariate analyses. However, it was not significant in the multivariable analyses. Previous qualitative research with adolescent girls suggested that education on menstrual biology and management improved their menstrual confidence because they knew what to expect from, and how to prepare for, their menstrual period.²³

Although most participants reported they felt comfortable to discuss menstruation with partners and friends, bivariate regression results indicated that only comfort to discuss menstruation with mothers or health professionals positively predicted confidence. Other studies have shown that, while friends and partners may provide emotional support to students in dealing with menstrual discomforts,^{26,28,50} mothers can be important sources of information for managing menstrual bleeding and disordered menstruation.^{51–53} This could increase students' confidence for menstrual management. Studies have also demonstrated the important role health professionals play in enhancing their patients' confidence to manage health conditions, such as chronic diseases and obesity, through education, encouragement and ongoing guidance.^{54,55} Health professionals may adopt similar approaches to support their patients in developing their confidence for menstrual self-care.

A positive perception of menstruation positively predicted confidence, whereas holding negative perceptions predicted lower confidence. Students who believed menstruation was a normal life experience may be less inclined

to feel shame from menstruating in public spaces or pressure to conceal their menstrual status, thereby increasing their confidence. In contrast, students who found menstruation debilitating or a curse may perceive a lack of control over their bodies while menstruating.^{22,26} This could undermine students' beliefs in their ability to manage menstrual bleeding. Nevertheless, confidence may also impact perceptions of menstruation, owing to the complexity of measuring relationships among latent constructs in menstrual health. For instance, it is possible that the more confident a student is to manage their menstruation, the more likely they are to perceive menstruation positively.

The perceived social stigma of menstruation negatively predicted confidence in bivariate and multivariable analyses. In qualitative research, women and girls have described how they perceived society, or those around them, considered menstruation a taboo. They then internalized this stigma and attempted to conceal their menstruation to avoid stigmatisation.¹ Our findings demonstrate how stigma is an important construct to consider in future research with menstruating university students although validated measures are currently lacking.⁵⁶ Stigma reduction interventions at university are worth contemplating, but this should be balanced against the risk of inadvertently perpetuating menstrual stigma by enhancing the visibility of menstruation.⁵⁷

Environmental factors. All characteristics of university bathroom facilities under investigation positively predicted students' confidence to manage menstruation, consistent with qualitative research with people who menstruate. Most important was access to sufficient privacy and clean and sanitary facilities which remained significant contributors in multivariable analyses. There are a few possible reasons for these associations. First, privacy may afford students reassurance that they can discretely and comfortably manage their menstruation without risks that others may discover

Table 5. Bivariate and multivariable relationships between personal, physical and environmental factors and confidence to manage menstruation at university.

Independent variable	Bivariate				Multivariable			
	n	β (95% CI)	R ² _{adj}	Multiple R ²	p-value	β_{adj} (95% CI)	p-value	
<i>Personal factors</i>								
Knowledge of menstruation and menstrual management	342	0.246 (0.056 to 0.436)	0.017	0.020	0.01*	0.152 (-0.038 to 0.341)	0.111	
Believed that society's attitude of menstruation is that it is taboo	352	-0.237 (-0.372 to -0.104)	0.032	0.034	< 0.001*	-0.103 (-0.198 to -0.008)	0.031*	
Personally, felt that menstruation is a								
Normal and healthy part of life	352	0.714 (0.173 to 1.256)	0.017	0.020	0.009*	0.138 (-0.058 to 0.333)	0.159	
Debilitating	352	-0.240 (-0.384 to -0.096)	0.028	0.031	0.001*	-0.061 (-0.165 to 0.042)	0.235	
A curse	352	-0.355 (-0.512 to -0.197)	0.052	0.055	< 0.0001*	-0.125 (-0.244 to -0.007)	0.035*	
Comfort to discuss menstruation with								
Mother	351	0.199 (0.025 to 0.372)	0.012	0.015	0.023*	0.037 (-0.085 to 0.159)	0.548	
Health professional	336	0.272 (0.095 to 0.462)	0.021	0.024	0.005*	0.121 (-0.010 to 0.252)	0.066	
<i>Physical factors</i>								
<i>Menstrual characteristics</i>								
Heavy bleeding	353	-0.379 (-0.592 to -0.166)	0.032	0.035	< 0.0005*	-0.065 (-0.139 to 0.008)	0.078	
Migraines/headaches	352	-0.218 (-0.430 to -0.006)	0.009	0.012	0.04	-0.012 (-0.086 to 0.062)	0.741	
Type of menstrual product								
Menstrual cup	352	-0.511 (-0.901 to -0.120)	0.016	0.019	0.009*	-0.068 (-0.212 to 0.077)	0.351	
Period underwear ^a	352	-1.063 (-1.819 to -0.307)	0.019	0.022	0.005*	-	-	
Changed products at university	353	0.549 (0.296 to 0.802)	0.049	0.051	< 0.0002*	0.142 (0.049 to 0.234)	0.002*	
<i>Environmental factors</i>								
<i>Perceptions of bathroom facilities on campus</i>								
Privacy	345	0.452 (0.336 to 0.568)	0.148	0.150	< 0.0001*	0.487 (0.289 to 0.686)	< 0.001*	
Functional toilets	345	0.272 (0.149 to 0.395)	0.051	0.054	< 0.0001*	-0.142 (-0.372 to 0.089)	0.220	
Clean and sanitary	345	0.351 (0.235 to 0.467)	0.094	0.096	< 0.0001*	0.363 (0.132 to 0.594)	0.002*	
Functional locks on doors	344	0.258 (0.127 to 0.389)	0.040	0.043	< 0.0001*	-0.015 (-0.226 to 0.196)	0.888	
Available bin to dispose materials	345	0.200 (0.064 to 0.336)	0.022	0.025	< 0.0036*	-0.030 (-0.246 to 0.186)	0.783	
Toilet paper	343	0.365 (0.219 to 0.511)	0.065	0.068	< 0.0001*	0.113 (-0.144 to 0.370)	0.381	
Clean running water and soap	345	0.217 (0.068 to 0.366)	0.021	0.024	< 0.0001*	-0.186 (-0.421 to 0.048)	0.113	

CI: confidence interval.

^an: refers to the number of observations included in bivariate linear regression analyses.^aNot tested in multiple linear regression as only seven participants used period underwear.

*p < 0.05.

their menstrual status.⁵⁸ Second, clean and sanitary facilities may reduce students' concerns of contracting infections or feeling discomfort from odours.^{58,59} This can lead to more comfortable experience for students where they do not feel rushed or distressed in attending to their menstrual needs.⁵⁸

An alternative explanation might be that students' confidence to manage menstruation influences their perceptions of university bathroom facilities. For instance, a student who is confident in managing their menstruation may perceive facilities as being satisfactory, but a student who is less confident may perceive facilities as being insufficient for their needs. The cross-sectional design of this study precluded assessment of the potential bidirectional relationship between confidence for menstrual management and perceptions of bathroom facilities, and we recommend this as an area for future research.

Physical factors. Experiencing heavy bleeding or migraines negatively predicted confidence. Heavy menstrual bleeding (menorrhagia) can pose many challenges to menstrual management including access to sufficient and reliable menstrual materials, and risks of menstrual leaks and staining which can cause anxiety.^{29,31} Migraines can impair cognitive abilities which may impact students' ability to navigate and solve menstrual hygiene challenges.^{60,61} Menstrual pain, irregular periods and emotional disturbances were additionally unpredictable of confidence. Our measurement for confidence to manage menstruation potentially influenced this finding as it was limited to menstrual hygiene tasks, overlooking other aspects of menstrual management (i.e. addressing disordered menstruation or menstrual cycle-related symptomatology).

Using a menstrual cup or period underwear negatively predicted confidence. Students using reusable products may require access to a sink and water supply within individual toilet cubicles to clean and reuse their products which are often unavailable in public bathrooms, including the study setting.⁶² Changing menstrual products at university predicted confidence in both bivariate and multivariable analyses. Previous studies on health behaviours have highlighted how confidence in one's ability to perform a behaviour increases the likelihood they will enact it.^{54,63} Those who are confident to change their menstrual products at university will therefore do so, reflecting reverse causation.

Confidence to manage menstruation between groups of students based on their migrant status, residency status or religious beliefs. No statistically significant differences in confidence between groups of students based on their migrant, residency or religious status emerged. Access to prestigious university education, like the study setting, is an indicator of socioeconomic advantage.⁶⁴ Therefore students, regardless of their migrant, residency or religious status, may have access to education, information and

menstrual products of their choice that enable them to feel confident in meeting their menstrual needs.

Nevertheless, it is likely that the quality of our measurement for confidence affected our findings. Hence, these sociodemographic factors should not be discounted in future studies with university students and in the design of university-based menstrual health interventions as this could exclude their unique menstrual needs. For example, many cultural and religious doctrines comprise expectations of personal hygiene.⁶⁵ Menstruating women and girls who follow Islam must perform ablution (ritual washing of genitalia with water) after using the toilet and undertake ghusl (ritual washing of the full body with water) after menstruation ends to attain purity.⁶⁶ These practices were not included in our concept definition for confidence to manage menstruation and, therefore, we do not know whether students face barriers or opportunities to confidently manage this aspect of their menstrual self-care at university in Australia. Future studies should seek to explore students' confidence to engage in a diverse range of menstrual practices than those limited to menstrual hygiene to better assess differences based on cultural and religious backgrounds.

Strengths and limitations

Our study contributes to a gap in the literature on confidence to manage menstruation in high-income countries, including Australia. Our findings also highlight the aspects of university students' menstrual experiences that have received limited consideration in menstrual health research and programmes with this population. Yet, these are necessary to contemplate for an improved understanding of their menstrual needs.

Australian border closures to all non-residents and non-citizens announced in March 2020 affected our ability to recruit, and therefore assess the menstrual experiences of, a greater sample of international students who were unable to relocate to Australia. Our decision to use a convenience sample helped overcome recruitment challenges during the COVID-19 pandemic but could be a source of selection bias, limiting the generalisability of our findings. As we did not collect information on students' degrees, it is unclear whether their area of study influenced the responses. For example, research in Ghana suggests university students studying medical or health-related degrees possess greater knowledge of menstruation and menstrual management compared to students studying other disciplines.⁶⁷ Further research with students across study disciplines is needed to improve the generalisability of our results.

As our study was cross-sectional in design, we cannot conclude causal or bidirectional relationships between confidence to manage menstruation and tested personal, physical and environmental factors. We measured confidence to manage menstruation using a single item limited

to menstrual hygiene practices. Without the use of a validated multi-item scale, it is unlikely our single item captured the full essence of this construct. Not using validated scales for menstrual perceptions (e.g. the Menstrual Attitude Questionnaire) and practices (e.g. Menstrual Practices Questionnaire) was a significant limitation.^{68,69} Our operationalization of perceptions of bathroom facilities did not consider the washing and drying requirements for students using reusable menstrual products. This prevented us from investigating how perceptions of environments differed based on menstrual product choice and how this was related to confidence. Our measurement for knowledge included an item on awareness of menstruation prior to menarche. Since most students were of post-adolescent age, their response to this question may be affected by recall bias, influencing their overall knowledge score. We recommend the development of a validated and reliable set of menstrual knowledge items to be used consistently in menstrual health research.

Conclusion

Our study found that most menstruating students surveyed at an Australian university reported not feeling completely confident in their ability to manage their menstruation at university. By investigating factors affecting students' confidence, we were able to explore other aspects of their menstrual experience that have received less attention in research and programming in the Australian context. Multiple personal, physical and environmental factors – including perceptions of menstruation, stigma, bathroom facilities and menstrual product type – were key predictors for menstrual confidence in our sample. These factors warrant further assessment to inform a comprehensive understanding of university students' menstrual needs. More research is needed to examine the directionality of relationships among menstrual confidence and these predictors, coupled with improved measures for menstrual health constructs.

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Author contributions

A.K.M. was responsible for the conceptualization, methodology, formal data analysis, investigation, data interpretation, writing – original draft and writing – review and editing. S.Z.H. and M.K. contributed to the conceptualization, methodology, data interpretation and writing – review and editing. E.C.H. contributed to the methodology, data interpretation and writing – review and editing. All authors approved the final version of this manuscript.

Data availability

The data used to support the findings of this study are publicly available from the *Women's Health* journal online site.

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Supplemental material

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