The burden and determinants of dysmenorrhoea: a population-based survey of 2262 women in Goa, India

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Objective To describe the prevalence and determinants of dysmenorrhoea, the most common menstrual complaint, in a community in India.

Design Cross-sectional survey.

Setting Catchment area of primary health centre in Goa, India.

Population Three thousand women aged 18–45 years randomly selected. A total of 2494 women consented to participate (83.1%).

Methods Eligible participants were asked standardised questions regarding menstrual complaints over the past 12 months, and socio-demographic, psychosocial and reproductive risk factors. Vaginal or urine specimens were collected for the diagnosis of reproductive tract infections.

Main outcome measures Dysmenorrhoea of moderate to severe intensity.

Results A total of 2262 women were eligible. More than half reported dysmenorrhoea; moderate to severe dysmenorrhoea was reported by 755 participants (33.4%, 95% CI 31.4–35.4). There was a linear association between severity of pain and impact (medication and taking rest) and the onset of pain (premenstrual

onset associated with more severe pain). On multivariate analyses, the risk of moderate–severe dysmenorrhoea was associated with the experience of violence (OR 2.23, 95% CI 1.5–34); other somatic complaints (OR 3.67, 95% CI 2.7–4.9 for highest somatoform symptom score category compared with the lowest); gynaecological complaints (non-menstrual lower abdominal pain: OR 1.78, 95% CI 1.3–2.3; dysuria: OR 1.98, 1.4–2.7); menorrhagia (OR 1.92, 95% CI 1.4–2.6); and illiteracy (OR 1.32, 95% CI 1.0–1.7). Having had a pregnancy (OR 0.53, 95% CI 0.4–0.7), older age of menarche (OR 0.70, 95% CI 0.5–0.9, for age >14 compared with <13 years) and older age (OR 0.43, 0.3–0.6 for age 40–50, compared with 18–24 years) were protective.

Conclusions The burden of dysmenorrhoea is greater than any other gynaecological complaint, and is associated with significant impact. Social disadvantage, co-morbidity with other somatic syndromes and reproductive factors are determinants of this complaint.

Keywords Developing countries, dysmenorrhoea, epidemiology, psychosomatic.

Introduction

Although reproductive health, in particular related to maternal health and reproductive tract infections (RTIs), is recognised as a health priority in developing countries, much less attention is paid to menstrual health and menstrual disorders.[1] A recent review of menstrual disorders in developing countries in this journal[2] revealed high rates of menstrual morbidity in population-based studies. However, much of the existing research focuses on prevalence estimates; there

is little information on the determinants and consequences of menstrual dysfunction.[1] Of all menstrual complaints, dysmenorrhoea is by far the most common and, arguably, the least understood and addressed complaint.

The aim of this paper is to describe the burden, determinants and impact of dysmenorrhoea in a population of women aged 18–45 years in Goa, India. The study was nested in a population-based cohort study of gynaecological morbidities, RTIs and psychosocial health. Findings from this study relating to the complaints of vaginal discharge and fatigue

have been published elsewhere.[3,4] In the analyses presented in this paper, we wished to describe the prevalence of dysmenorrhoea and to study whether established risk factors described in other studies were associated with the complaint, notably age and parity,[5] mental health and stress,[6] tobacco and alcohol consumption and age at menarche[5,7] and other menstrual complaints, particularly menorrhagia.[8] In addition, we wished to explore the association between gender disadvantage and the complaint. Gender influences the control men and women have over the determinants of their health, including their economic position and social status, access to resources and treatment in society.[9] Factors associated with gender disadvantage are crucial to understanding the epidemiology of health problems in poor countries, such as the rising rates of HIV/AIDS in women.[10] The impact of dysmenorrhoea on disability and use of medication was studied.

Methods

Sample

The study population comprised women aged 18–45 years living in the catchment area of the Aldona primary health centre of north Goa district ($n = 8595$). A computer program (SPSS Inc, Chicago, USA) was used to randomly select 3000 women from the sampling frame (the population registers maintained by the health department). The population registers which formed the basis for the sampling frame are updated by community health workers on the basis of door-to-door surveys; they represent the most complete record of the population in the primary health centre catchment area. Subjects were approached in two stages: First, community-level awareness programmes were held in each village and community-level consent was obtained from village leaders. Next, women who had been randomly selected were sent letters informing them of their selection; a visit to their homes was scheduled a week or so later, at which time consent to participate was requested. The eligibility criteria for recruitment at the time of the visit were age between 18 and 50 years (since the enumeration date of the registers could be as old as 4 years in some areas); residence in the area for the following 12 months; speaking one of the study languages; not suffering from cognitive impairment which would make responding to the interview and giving informed consent difficult; and not being currently pregnant. If the selected woman did not meet any of these criteria, or if the woman was no longer living in the area, then the researcher was instructed to replace her using *a priori* criteria. Recruitment took place from November 2001 to May 2003.

Data collection

The two mandatory requirements for participation were a face-to-face interview with a trained researcher, and the collection of biological samples for the diagnosis of RTI.

The study employed a semi-structured interview, which was a composite of questions eliciting data on different aspects of the participant's personal and health history, derived from a number of sources.[11–13] The composite interview was piloted with 100 women attending gynaecological outpatient clinics in the Asilo & Goa Medical College Hospitals in north Goa. For participants who consented to an optional gynaecological examination, two high vaginal (for polymerase chain reaction [PCR]) and two vaginal (for smears and culture) swabs were collected. The examinations were carried out by qualified gynaecologists who had been trained to carry out the clinical examination protocol as described in our pilot study.[12] For unmarried participants, and participants who refused the offer of a gynaecological examination, first-void urine specimens were collected in lieu of the high vaginal swabs, and self-administered vaginal swabs for smears and culture. The use of self-administered swabs had been piloted in Goa, and was shown to be a reliable method of collection of vaginal specimens for the diagnosis of endogenous infections.[12] The data collected from participants were organised in the following manner for the analyses presented in this paper.

Socio-economic risk factors

Information on age, education, religion and marital status was collected from all subjects, including those who refused to participate further in the study. In addition, data were collected from participants on the type of housing, access to safe drinking water and a toilet, household composition and income, employment status, indebtedness, and the experience of hunger in the previous 3 months.

Psychosocial factors

Two domains of psychosocial factors were measured, viz., those measuring gender disadvantage and social support, and those measuring mental health. Questions on gender disadvantage covered two domains. The first was the lifetime experience of verbal, physical and sexual violence by the spouse. The second inquired about the autonomy the woman had in making decisions regarding visiting her mother/friend's home, seeing a doctor, keeping money aside for personal use, and having time to do things for herself. The questions were derived from the National Family Health Survey[11] which found a strong association between low autonomy and other indicators of gender disadvantage, such as domestic violence. The responses were added to generate an Autonomy Score. Two measures were used for mental health. The Scale for Somatic Symptoms was used to measure somatic symptoms which are features of Somatoform Disorders. The scale, which consists of questions regarding the experience of 20 common somatic symptoms in the previous 2 weeks, has been used in India.[14] Four categories of symptoms are inquired about: pain-related symptoms such as headache and body ache;

sensory symptoms such as hot/cold sensations and tingling; nonspecific symptoms such as tiredness and tremors; and biological function symptoms such as poor sleep and constipation. Each symptom is rated on a Likert scale of 0–2 of increasing severity; the final score is a summation of the 20 item scores. The second measure was the Revised Clinical Interview Schedule (CISR), a structured interview for the measurement and diagnosis of common mental disorders (CMDs) in community and primary care settings.[15] The Konkani language version of the CISR used in the present study has been used and validated in previous studies in Goa.[16] The interview consists of 14 sections, each covering specific symptoms such as anxiety, depression, irritability, obsessions, compulsions and panic. The sum of the section scores generates a total score (range 0–57) which is a measure of non-psychotic psychiatric morbidity.

Reproductive and sexual health risk factors
All participants were asked about pregnancies; numbers of pregnancies and their outcome were recorded. Pregnancies and abortions in the previous 12 months were recorded. Participants who were sexually active in the past year were asked about their experience of difficulty in conception (infertility) in the previous 12 months and use of contraceptives (sterilisation, oral contraceptives and intrauterine contraceptive device [IUCD]). Five complaints associated with gynaecological morbidity in the previous 3 months were elicited: abnormal vaginal discharge, itching in the genital area, pain in the lower abdomen (excluding menstrual pain), pain or burning during urination and dyspareunia.[17] RTIs were diagnosed in a single laboratory, using the following tests: for chlamydial and gonococcal infection, PCR using the Roche Amplicor system (Roche Molecular Systems, Alameda, CA, USA) with internal controls, according to the manufacturer's instructions; for *Trichomonas vaginalis* infection, culture using the InPouch TV Culture Kit (Biomed Diagnostic, San Jose, CA, USA) incubated at 37°C for up to 5 days and examined daily for motile trichomonads; for bacterial vaginosis, the reading of Gram-stained slides based on Nugent's score;[18] and for candidiasis, the reading of Gram-stained slides using a rating of the density of yeast cells seen per high-power field. Slides were read by trained laboratory technologists. These tests are the most sensitive and specific available for the diagnosis of RTIs.[19] All positive Neisseria gonorrhoeae (NG) and Chlamydia trachomatis (CT) results were confirmed by repeating the test, first with a duplicate of the original specimen and, if this was equivocal, with a back-up specimen. Quality control for the laboratory tests consists of independent verification of 10% of slides (for bacterial vaginosis and *Candida*) by an independent microbiologist. The laboratory participated in the Quality Control for Molecular Diagnostics annual quality control tests, and achieved 100% correct results for the CT and NG panels in 2003/4.

Menstrual data
Participants who had had a hysterectomy, who were postmenopausal, and who had been pregnant or were breastfeeding and had not had a menstrual period at least twice in the previous 12 months were not asked questions regarding their current (i.e. in the past 12 months) menstrual health. Questions on menstrual health covered four domains of menstrual dysfunction: menorrhagia (bleeding or spotting for more than 10 days or heavy bleeding requiring change of sanitary protection in less than 1 hour); polymenorrhoea (irregular menstrual cycles whose shortest period between the start of a cycle and the start of the next was less than 3 weeks); amenorrhoea (no menstrual period in the previous 3 months); and dysmenorrhoea. Dysmenorrhoea was defined on the basis of the question 'Do you usually experience menstrual cramps, abdominal pain or backache when you have menstrual period?' Participants who responded affirmatively were asked four questions on the nature of the dysmenorrhoea: the severity of the pain (mild, moderate, severe); the timing of the pain relative to the menstrual period (before, during, after); whether analgesics were used; and whether the pain was so severe that the woman needed to lie down or stop her usual activities as a consequence. We also inquired regarding any culturally defined restrictions women experienced in their daily lives while they were menstruating. All these questions were derived from recent guidelines on eliciting menstrual history,[17] and had been locally tested as part of the piloting procedure.

Ethical considerations
The study proposal received ethical approval from the ethical committee of the London School of Hygiene & Tropical Medicine, and from the Independent Ethics Commission, Mumbai (India). All participants were offered free care by the study gynaecologists and psychologists, as appropriate.

Statistical analysis
Dysmenorrhoea was coded as a binary outcome (absent/present). We first examined the association of severity of dysmenorrhoea with impact and found that mild dysmenorrhoea was associated with relatively low levels of disability and distress (Table 1). We therefore chose to use dysmenorrhoea rated as moderate or severe as our primary outcome for the analyses of determinants. We first determined the univariate association with each socio-economic factor; all factors whose association reached significance at $P \leq 0.05$ were included in a multivariate model. Factors which were statistically significantly associated with dysmenorrhoea were then combined in a multivariate model and those which remained significantly associated with dysmenorrhoea were retained for the next step of analysis. We then estimated the univariate associations of psychosocial and reproductive and sexual health factors with dysmenorrhoea; adjustments for socio-economic factors were then carried out. Finally, we carried out multiple logistic

Table 1. Severity of dysmenorrhoea and association with impact and onset (*n* = 2262)

	Prevalence, *n* (%, 95% CI)	Use analgesic	Miss activities/take rest	Premenstrual onset
Mild	482 (21.3, 19.6–23.0)	26 (5.4%)	172 (35.7%)	**145 (30.1%)**
Moderate	340 (15.0, 13.6–16.6)	48 (14.1%)	187 (55.5%)	**109 (32.1%)**
Severe	415 (18.3, 16.8–20.0)	100 (24.1%)	291 (70.1%)	**168 (40.5%)**
χ^2, *df*, *P*	**n/a**	**64.52, 2, <0.001**	**107.2, 2, <0.001**	**11.6, 2, 0.003**

n/a, not applicable.

regression analyses including variables which were significantly associated with dysmenorrhoea from all domains. We repeated these analyses separately for women with report of any dysmenorrhoea, for women with dysmenorrhoea which was premenstrual in onset, and for women whose dysmenorrhoea began during or after the menstrual period to ascertain whether there were any key variations in risk factors. Continuous factors, such as age, autonomy, CISR and somatoform symptom scores, were categorised based on the distribution of scores. All variables were initially fitted as categorical variables, and tests for non-linearity were carried out as appropriate. If there was no evidence of non-linearity, a *P*-value for trend is shown; otherwise, the *P*-value shows significance of the categorical variable. Odds ratios and 95% confidence intervals are presented for the main associations.

Results

Of the 3000 randomly selected women, 2494 (83.1%) consented to participate in the study. Details of the study population have been published previously.[4] Briefly, the most common reasons for refusal were that the woman did not have time to participate (52.4%) or that a family member had not given permission (18.8%). Women who consented differed significantly from those who refused. Refusers were more likely to be ethnic Goans (9.9 versus 1.6%, *P* < 0.001), Christian (39.7 versus 22.2%, *P* < 0.001), unmarried (41.4 versus 26.7%, *P* < 0.001), younger in age (mean 31.3 versus 32.3 years, *P* = 0.01) and to have completed more years of education (10.2 versus 8.4 years, *P* < 0.001). About half the interviews were conducted in the woman's home, the remainder being conducted in the field research centre. The majority of participants were Hindu (74.6%); most of the remainder were Christian (22.2%). Three hundred and fifty-six (14.3%) participants were illiterate. The majority of participants were homemakers (66.7%). The average household income per month, based on the average income in the previous 3 months, was Rs 4575 (approximately 100 US$). Over one-third of participants (36.1%) had no toilet facility of any kind. A third of households (33.3%) were currently in debt but the experience of hunger in the recent 3 months was uncommon (5.2%).

Menstrual health

Of the 2494 participants, 42 (1.68%) had had a hysterectomy; the average age of these participants was 42.9 years (95% CI 41.3–44.5). Of the remaining 2452 participants, 135 (5.5%) were postmenopausal; the average age of these participants was 44.7 years (95% CI 44.1–45.3). Fifty-five participants had had a pregnancy within the past 12 months and/or were breastfeeding and had not had at least two periods in the past 12 months. Thus, 2262 participants were asked questions regarding their menstrual health in the past 12 months. The mean age of menarche was 13.4 years (95% CI 13.4–13.5). Most women (1665, 73.6%) reported restrictions in their daily activities during the menstrual period. Menorrhagia was reported by 219 participants (9.7%, 95% CI 8.5–10.9). Polymenorrhoea was reported by 128 participants (5.7%, 95% CI 4.7–6.7). Amenorrhoea was reported by 118 participants (5.2%, 95% CI 4.3–6.2).

Table 1 reports the prevalence of dysmenorrhoea according to the reported severity of pain and its association with the timing of onset and impact. There is a linear association between severity and impact and the timing of onset of pain (premenstrual onset being associated with more severe pain). The majority of participants with dysmenorrhoea of any severity had either used analgesics (14.1%, 174/1237) or taken rest and been unable to complete their regular activities (52.5%, 650/1237) as a result of their pain. Moderate to severe dysmenorrhoea (the primary outcome for the analyses presented below) was reported by 755 participants (33.4%, 95% CI 31.4–35.4). There was no difference in reports of dysmenorrhoea between interviews carried out at home and interviews carried out in the field clinic.

Association with socio-demographic factors

A number of socio-demographic factors were significantly associated with moderate–severe dysmenorrhoea (Table 2). In summary, younger, single participants who had a relatively deprived socio-economic status (migrants, illiterate, facing economic difficulties) were at greater risk to complain of moderate–severe dysmenorrhoea. However, many of these univariate associations were confounded by age; on multivariate analyses, only age, being illiterate and participant replacement status (as compared with random status) were significantly associated in this model.

Table 2. Association of baseline socio-economic characteristics with moderate–severe dysmenorrhoea (n = 2262 unless otherwise specified)

Factors	Dysmenorrhoea	Univariate OR (95% CI)	P-value	Multivariate OR (95% CI)*	P-value
Demographic factors					
Age (years)					
18–24	226 (45.6%)	1		1	
25–29	172 (38.9%)	0.76 (0.6–0.98)		0.76 (0.6–0.9)	
30–34	143 (30.0%)	0.51 (0.4–0.7)		0.50 (0.4–0.6)	
34–40	116 (25.7%)	0.41 (0.3–0.5)		0.40 (0.3–0.5)	
40–50	98 (24.7%)	0.39 (0.3–0.5)	<0.001**	0.38 (0.3–0.5)	<0.001**
Subject type					
Random	407 (29.9%)	1		1	
Replacement	348 (38.6%)	1.47 (1.2–1.8)	<0.001	1.33 (1.1–1.6)	0.002
Language					
Konkani	611 (32.7%)	1			
English	110 (34.4%)	1.08 (0.8–1.4)	0.5		
Other	34 (46.6%)	1.79 (1.1–2.9)	0.01		
Education (years)					
None	71 (37.6%)	1			
1–9	293 (32.8%)	0.81 (0.6–1.1)			
10–14	308 (33.3%)	0.83 (0.6–1.1)			
15–23	83 (32.3%)	0.79 (0.5–1.2)	0.4**		
Literate (read and write)					
Yes	642 (32.5%)	1		1	
No	113 (39.4%)	1.35 (1.0–1.7)	0.02	1.62 (1.2–2.1)	<0.001
Ethnicity					
Goan	659 (32.3%)	1			
Migrant	96 (42.7%)	1.56 (1.2–2.0)	0.002		
Religion					
Hindu	557 (32.9%)	1			
Christian	162 (32.5%)	0.98 (0.8–1.2)	0.86		
Muslim	36 (49.3%)	1.98 (1.2–3.2)	0.004		
Occupation					
Homemaker	459 (30.9%)	1			
Employed	190 (38.5%)	1.39 (1.1–1.7)	0.002		
Other	106 (37.2%)	1.32 (1.0–1.7)	0.04		
Marital status					
Single	282 (42.6%)	1			
Married	456 (29.6%)	0.56 (0.5–0.7)	<0.001		
Divorced/widowed/separated	17 (29.3%)	0.56 (0.3–1.0)	0.05		
Household size					
1–3	134 (36.7%)	1			
4–5	404 (33.0%)	0.85 (0.7–1.1)			
6–9	192 (32.4%)	0.83 (0.6–1.1)			
10–17	25 (30.5%)	0.76 (0.4–1.3)	0.2**		
Number of children <18 years in the household					
0	234 (39.6%)	1			
1	188 (33.5%)	0.77 (0.6–0.97)			
2	204 (29.3%)	0.63 (0.5–0.8)			
3+	129 (31.2%)	0.69 (0.5–0.9)	0.001**		
Economic factors					
Housing					
Own home	651 (32.4%)	1			
Not owned	104 (41.3%)	1.47 (1.1–1.9)	0.005		

(continued)

Table 2. (*Continued*)

Factors	Dysmenorrhoea	Univariate OR (95% CI)	*P*-value	Multivariate OR (95% CI)*	*P*-value
Toilet access					
Yes	298 (32.4%)	1			
No	457 (34.1%)	1.08 (0.9–1.3)	0.4		
Tap water in house					
Yes	340 (33.7%)	1			
No	415 (33.1%)	0.97 (0.8–1.1)	0.7		
Household income (monthly rupees)					
<2000	260 (34.0%)	1			
2000–2999	125 (31.97%)	0.91 (0.7–1.2)			
3000–4999	189 (33.6%)	0.98 (0.8–1.2)			
5000–9999	128 (34.8%)	1.03 (0.8–1.3)			
≥10 000	52 (29.7%)	0.82 (0.6–1.2)	0.7**		
Family in debt (*n* = 2215)					
No	475 (32.2%)	1			
Yes	255 (34.5%)	1.11 (0.9–1.3)	0.3		
Hunger in the past 3 months					
No	707 (32.96%)	1			
Yes	48 (41.0%)	1.41 (0.96–2.1)	0.07		
Managing to make ends meet					
Yes	494 (31.99%)	1			
No	261 (36.3%)	1.21 (1.0–1.5)	0.04		

*Associations reported only for variables which were associated with dysmenorrhoea at *P* < 0.05 after adjustment for other socio-demographic variables.
**P*-value for trend.

Association with psychosocial and reproductive factors

Factors associated with gender disadvantage, notably younger age at marriage, spousal sexual violence, violence from others and lack of autonomy were associated with moderate–severe dysmenorrhoea; associations with sexual violence and violence from others remained significant after adjustment (Table 3). Significant associations with poor mental health were found; these remained significant after adjustment. Linear associations were found between the severity of menstrual pain (three categories of mild, moderate and severe) and CISR scores (F = 14.4, *df* = 2, *P* < 0.001) and somatoform symptom scores (F = 25.8, *df* = 2, *P* < 0.001).

On adjustment for the three main mental health exposures, viz., depression and anxiety, somatoform symptoms, and alcohol consumption, the strongest associations were with somatoform symptoms (highest score category compared with the lowest: OR 3.85, 95% CI 2.7–5.4, *P* < 0.001). The association with depression and anxiety was considerably attenuated (highest CISR score category compared with the lowest: OR 1.39, 95% CI 1.0–2.0, *P* = 0.07), while the association with alcohol consumption was no longer significant.

Apart from the findings of an association between past history of pregnancy and abortion, and a recent history of infertility with the complaint, the most significant findings were the strong associations between other gynaecological complaints and moderate–severe dysmenorrhoea (Table 4). Dysmenorrhoea was also associated with a younger age at menarche and menorrhagia. There was no association with specific methods of contraception. RTIs were very common (prevalence of 28.3%), although only a minority were sexually transmitted (prevalence 4.2%); there was no association between either factor and dysmenorrhoea. Full sexually transmitted infections (STI) data are reported elsewhere.[20] There was no association between menstrual restrictions and dysmenorrhoea.

The results of the final multivariate analyses with all significant socio-demographic, psychosocial and reproductive factors are shown in Table 5. A combination of reproductive factors (younger age at menarche, menorrhagia, nulliparity), psychosocial factors (illiteracy, violence) and other gynaecological and somatic complaints were independently associated with dysmenorrhoea.

Variants of dysmenorrhoea

There were no significant differences in the associations we found when we repeated the analyses with any dysmenorrhoea (i.e. including mild complaints) as the outcome, with the exception that illiteracy was no longer significantly associated with the outcome in the final model. The key differences observed when dysmenorrhoea of premenstrual onset

Table 3. Association of psychosocial factors with moderate–severe dysmenorrhoea (*n* = 2262 unless otherwise specified)

Factor	Prevalence of dysmenorrhoea	Univariate OR (95% CI)	*P*-value	Multivariate OR (95% CI)*	*P*-value
Age at marriage (*n* = 1542)**					
<18	47 (37.9%)	1		1	
18–20	116 (31.0%)	0.74 (0.5–1.1)		0.88 (0.6–1.4)	
21–24	168 (29.7%)	0.69 (0.5–1.0)		0.91 (0.6–1.4)	
≥25	125 (26.1%)	0.58 (0.4–0.9)	0.01***	0.82 (0.5–1.3)	0.5***
Husband verbal abuse (*n* = 1542)**					
No	380 (28.8%)	1			
Yes	76 (34.2%)	1.29 (0.9–1.7)	0.10		
Husband physical abuse (*n* = 1542)**					
No	407 (29.0%)	1			
Yes	49 (34.7%)	1.30 (0.9–1.9)	0.16		
Husband sexual abuse (*n* = 1542)**					
No	432 (29.1%)	1		1	
Yes	24 (42.9%)	1.83 (1.1–3.1)	0.03	1.90 (1.1–3.3)	0.02
Violence from others					
No	686 (32.0%)	1		1	
Yes	69 (58.0%)	2.93 (2.0–4.3)	<0.001	3.0 (2.0–4.4)	<0.001
Autonomy in decision making					
High	218 (29.8%)	1		1	
Medium	342 (35.0%)	1.27 (1.0–1.6)		1.12 (0.9–1.4)	
Low	195 (35.3%)	1.28 (1.0–1.6)	0.03***	1.10 (0.9–1.4)	0.4
Somatoform symptom score					
0–1	154 (21.5%)	1		1	
2–3	110 (24.3%)	1.17 (0.9–1.5)		1.24 (0.9–1.6)	
4–7	260 (40.4%)	2.47 (1.9–3.1)		2.82 (2.2–3.6)	
>7	231 (51.2%)	3.82 (2.9–4.9)	<0.001***	4.85 (3.7–6.4)	<0.001***
CISR scores					
0	368 (26.7%)	1		1	
1–2	98 (38.6%)	1.73 (1.3–2.3)		1.86 (1.4–2.5)	
3–4	79 (38.7%)	1.74 (1.3–2.4)		1.91 (1.4–2.6)	
5–8	97 (49.0%)	2.64 (1.9–3.6)		2.99 (2.2–4.1)	
>8	113 (50.0%)	2.75 (2.1–3.7)	<0.001***	3.04 (2.2–4.1)	<0.001***
Alcohol use in the past 3 months (*n* = 2187)					
No	709 (33.0%)	1		1	
Yes	19 (50.0%)	2.03 (1.1–3.9)	0.03	2.19 (1.1–4.2)	0.02
Tobacco use in the past 3 months (*n* = 2187)					
No	715 (33.3%)	1			
Yes	13 (31.7%)	0.93 (0.5–1.8)	0.83		

*Adjusted for age, literacy and replacement status.
**Married women only.
***P-value for trend.

was categorised separately were that premenstrual onset dysmenorrhoea was more strongly and consistently associated with economic adversity (e.g. low education and indicators of poverty) and gender disadvantage (younger age at marriage, less autonomy and spousal physical abuse). There was also a weak association with STI (adjusted OR 1.52, 0.9–2.4, 0.08). Menstrual dysmenorrhoea was more strongly associated with infertility.

Discussion

Our paper describes, to the best of our knowledge, the largest population-based study of menstrual health in India. In our sample of women aged 18–50 years, we found a high prevalence of menstrual dysfunction. The most common menstrual disorder was dysmenorrhoea which was reported by over half of the participants and, in moderate to severe intensity, by

Table 4. Association of reproductive health factors with moderate–severe dysmenorrhoea (n = 2262)

Factor	Prevalence of dysmenorrhoea	Univariate OR (95% CI)	*P*-value	Multivariate OR (95% CI)*	*P*-value
Obstetric factors					
Ever pregnant					
No	325 (43.2%)	1		1	
Yes	430 (28.5%)	0.52 (0.4–0.6)	<0.001	0.70 (0.5–0.9)	0.005
Number of pregnancies (n = 1509)					
1	198 (28.6%)	1			
2	193 (28.5%)	0.99 (0.8–1.2)			
3+	39 (27.5%)	0.94 (0.6–1.4)	0.8**		
Lifetime induced abortions (n = 1509)					
No	318 (27.3%)	1		1	
Yes	112 (32.6%)	1.29 (0.99–1.7)	0.05	1.40 (1.1–1.8)	0.01
Infertility in the past year (n = 1542)***					
No	394 (28.3%)	1		1	
Yes	62 (41.3%)	1.78 (1.3–2.5)	0.001	1.73 (1.2–2.4)	0.002
Use of IUCD (n = 1542)***					
No	433 (29.5%)	1			
Yes	23 (31.9%)	1.12 (0.7–1.9)	0.6		
Had a sterilisation operation (n = 1542)***					
No	331 (29.1%)	1			
Yes	125 (31.0%)	1.097 (0.8–1.4)	0.5		
Use of oral contraceptives (n = 1542)***					
No	443 (29.5%)	1			
Yes	13 (30.2%)	1.03 (0.5–2.0)	0.9		
Gynaecological complaints					
Vaginal discharge					
No	596 (31.2%)	1		1	
Yes	159 (45.0%)	1.80 (1.4–2.3)	<0.001	1.70 (1.3–2.1)	<0.001
Itching in genitals					
No	604 (31.4%)	1		1	
Yes	151 (44.8%)	1.77 (1.4–2.2)	<0.001	1.90 (1.5–2.4)	<0.001
Pain in abdomen (not related to periods)					
No	589 (30.2%)	1		1	
Yes	166 (53.7%)	2.69 (2.1–3.4)	<0.001	2.82 (2.2–3.6)	<0.001
Dysuria					
No	639 (31.1%)	1		1	
Yes	116 (55.2%)	2.73 (2.0–3.6)	<0.001	2.80 (2.1–3.8)	<0.001
Dyspareunia***					
No	411 (28.3%)	1		1	
Yes	45 (50.6%)	2.59 (1.7–4.0)	<0.001	2.41 (1.5–3.7)	<0.001
Menstrual health					
Menarche (years)					
≤12	266 (39.5%)	1		1	
13–14	352 (31.1%)	0.69 (0.6–0.8)		0.70 (0.6–0.9)	0.001
15+	137 (30.0%)	0.66 (0.5–0.8)	<0.001**	0.72 (0.5–0.9)	0.01
Menorrhagia					
No	643 (31.5%)	1		1	
Yes	112 (51.1%)	2.28 (1.7–3.0)	<0.001	2.48 (1.9–3.3)	<0.001
Amenorrhoea					
No	717 (33.4%)	1			
Yes	38 (32.2%)	0.94 (0.6–1.4)	0.8		
Polymenorrhoea					
No	720 (33.7%)	1			

(continued)

Table 4. (Continued)

Factor	Prevalence of dysmenorrhoea	Univariate OR (95% CI)	P-value	Multivariate OR (95% CI)*	P-value
Yes	35 (27.3%)	0.74 (0.5–1.1)	0.7		
Menstrual restrictions					
No	199 (33.3%)	1			
Yes	556 (33.4%)	1.00 (0.8–1.2)	1.0		
RTIs					
Any RTI (n = 2155)					
Negative	632 (33.6%)	1			
Positive	96 (34.9%)	1.06 (0.8–1.4)	0.7		
Any STI (n = 2191)					
Negative	705 (33.6%)	1			
Positive	36 (39.1%)	1.27 (0.8–1.9)	0.3		

*Adjusted for age, literacy and replacement status.
**P-value for trend.
***Married women only.

one-third of the participants. The complaint was associated with significant levels of disability; the majority of sufferers took analgesics or bedrest to cope with the pain and there was a linear association between severity of pain and its impact.

Table 5. Final multivariate model of demographic, psychosocial and reproductive risk factors for dysmenorrhoea of moderate–severe intensity (n = 2262)

Factor	OR (95% CI)	P-value
Age (years)		
18–24	1	
25–29	0.78 (0.6–1.1)	
30–34	0.54 (0.4–0.8)	
34–40	0.46 (0.3–0.7)	
40–50	0.43 (0.3–0.6)	<0.001*
Age at menarche (years)		
≤12	1	
13–14	0.75 (0.6–0.9)	
15+	0.70 (0.5–0.9)	0.01*
Illiterate	1.32 (1.0–1.7)	0.06
Violence from others	2.23 (1.5–3.4)	<0.001
Somatoform symptom score		
0–1	1	
2–3	1.21 (0.9–1.6)	
4–7	2.63 (2.0–3.4)	
>7	3.67 (2.7–4.9)	<0.001*
Ever pregnant	0.53 (0.4–0.7)	<0.001
Menorrhagia	1.92 (1.4–2.6)	<0.001
Lower abdominal pain	1.78 (1.3–2.3)	<0.001
Dysuria	1.98 (1.4–2.7)	<0.001
Subject replacement status	1.29 (1.1–1.6)	0.01

*P-value for trend.

The timing of onset of dysmenorrhoea was associated with the severity of pain; thus, a greater proportion of participants with severe pain had premenstrual onsets. Well-established reproductive and demographic risk factors such as younger age, nulliparity, younger age at menarche and menorrhagia were replicated in our study. In addition, we found strong associations with other somatic complaints characteristic of somatoform disorders, depression and anxiety, and other gynaecological complaints. Spousal sexual violence and violence from others were also independently associated with the complaint. However, there was no association with tobacco use, specific types of contraceptive use or RTIs.

Our findings of the high rates of dysmenorrhoea are comparable to reports from other developing countries, including India.[2] In our study, the burden of dysmenorrhoea was greater than any other gynaecological complaint,[4] including vaginal discharge and lower abdominal pain, both of which are the focus of reproductive health programmes in developing countries. It was also evident that the complaint was associated with a significant impact on the ability of women to carry out their daily activities. Thus, dysmenorrhoea is not a trivial complaint; as a result of its high prevalence and adverse impact, this complaint should be considered an important target for reproductive health programmes.[1] We found an independent association of dysmenorrhoea with social determinants, viz., deprivation (in particular, low education) and gender disadvantage (e.g. sexual violence), in particular for premenstrual onset dysmenorrhoea. Violence experienced from others (i.e. other than the spouse) was an independent risk factor; of the 119 women who reported nonspousal violence, the majority of single women were abused by their parents or relatives, while the majority of married or divorced women were abused by their in-laws. Gender

disadvantage has been linked to a number of common women's health complaints.[3,4,21] The strength of the associations were considerably attenuated on adjustment for mental health variables and we think that the most likely mechanism is at least partly mediated through poor mental health in women who live in oppressive relationships.

Dysmenorrhoea was associated with depression and anxiety, and with other somatic complaints typically associated with somatoform disorders; this association showed a dose–response relationship. They were also strongly associated with other gynaecological complaints, a finding similar to that reported from the Gambia.[22] In studies of the risk factors for the complaint of abnormal vaginal discharge in south Asia, a number of authors, including ourselves, have reported a strong association with CMDs.[4,23] It is possible, then, that in some women, dysmenorrhoea is part of a broader somatoform syndrome, characterised by a high degree of co-morbidity with other somatic complaints, including gynaecological complaints, for which no discernible organic pathology can be demonstrated. Despite much research on the biological and psychosocial risk factors for somatoform disorders and 'medically unexplained symptoms', there is little substantive evidence to explain their aetiology.[24] Medically unexplained symptoms may be best understood in terms of the way bodily perceptions are processed; symptom perception is in part determined by environmental, emotional and cognitive characteristics, such as specific cognitive illness schemes.[25] Thus, the choice of symptoms may be influenced by a variety of factors; in the case of the complaint of dysmenorrhoea, social factors and the experiences of female relatives (such as sisters) may be important as a determinant of a cognitive illness scheme.

The principal limitation of our study is the risk of selection bias; one of the independent risk factors for dysmenorrhoea was age and younger women were less likely to participate. Furthermore, subject replacement status was independently associated with the risk of the complaint, suggesting that our efforts to ensure a random replacement strategy were not successful. However, we have adjusted for replacement status in all multivariate analyses. We do not have data on potential biological aetiologies for dysmenorrhoea, notably prostaglandins. On the other hand, being a community-based study, our findings are more likely to be generalisable than treatment setting studies where barriers to care may impose unknown selection biases. We were able to achieve high participation rates and ensured a high standard of quality control of gold-standard laboratory and epidemiological measures.

Since our study is a cross-sectional survey, we cannot make definitive interpretations about the direction of causation. However, given the temporal relationship between some risk factors and the complaint, we propose a conceptual framework (Figure 1) to explain the association between the determinants we report in our analyses and dysmenorrhoea.
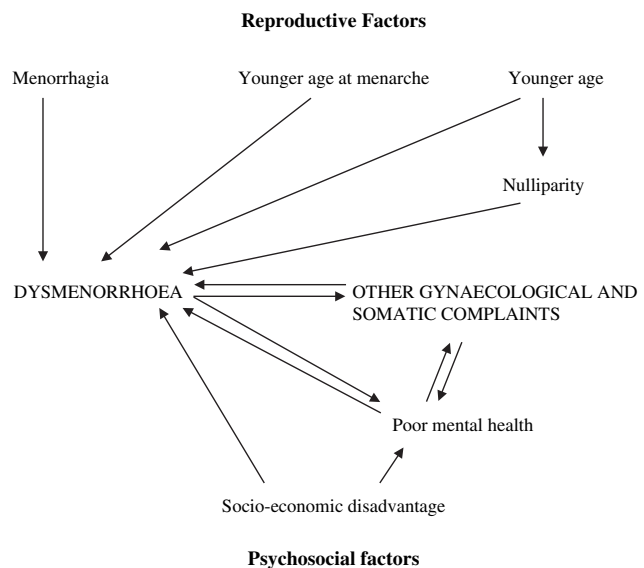

Figure 1. A conceptual framework for the determinants of dysmenorrhoea.

Reproductive and demographic factors, whose influence is probably mediated through biological pathways, include younger age, nulliparity, menorrhagia and younger age at menarche. Psychosocial factors, notably low education, violence and poor mental health, are also independent risk factors. The effect of these factors may be partly mediated through a similar pathway as that of other medically unexplained somatic complaints, which were strongly associated with dysmenorrhoea. Thus, dysmenorrhoea, at least in some women, may be interpreted as a medically unexplained symptom, not dissimilar to conditions such as chronic pelvic pain, chronic backache and irritable bowel syndrome.[24,26] Typically, these symptoms are strongly associated with each other and with depression and anxiety.[27] Both these characteristics were also found to be applicable to dysmenorrhoea. The clinical approach to dysmenorrhoea must include an assessment of factors related to gender disadvantage and mental health, particularly other somatic complaints. In women who do experience these factors, in addition to the judicious use of non-steroidal anti-inflammatory drugs, the evidence of the efficacy of psychological treatments (such as cognitive behaviour therapy) and antidepressants for other medically unexplained symptoms may provide an appropriate basis for interventions.

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Conflict of interest

None of the authors have declared any conflict of interest.

Contributors

V.P. was responsible for the design of the study and data analysis. The remaining authors were involved with the implementation of the study in Goa, including training of researchers, quality control of data and data management. All authors were involved with interpretation of data, drafting of the paper and approval of the final version submitted. The corresponding author and all other authors have full access to all the data. The corresponding author had final responsibility for decision to submit for publication. ■

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