Mood and the Menstrual Cycle: A Review of Prospective Data Studies

Sarah Romans, MB, MD[1]; Rose Clarkson, MD[2]; Gillian Einstein, PhD[3]; Michele Petrovic, BSc[4]; and Donna Stewart, MD, DPsych[5]

[1]Department of Psychological Medicine, University of Otago Wellington New Zealand, formerly Department of Psychiatry, University of Toronto, Ontario, Canada; [2]Department of Psychiatry, Dalhousie University, Halifax, Canada; [3]Department of Psychology, University of Toronto, Toronto, Ontario, Canada; [4]Hospital for Sick Children, Toronto, Ontario, Canada; and [5]University Health Network, Toronto, Ontario, Canada

ABSTRACT

Background: The human menstrual cycle (MC) has historically been the focus of myth and misinformation, leading to ideas that constrain women's activities.

Objectives: We wished to examine one pervasive idea, that the MC is a cause of negative mood, by studying the scientific literature as a whole. We briefly reviewed the history of the idea of premenstrual syndrome and undertook a systematic review of quality studies.

Methods: We searched PubMed, PsycINFO, and article bibliographies for published studies using non-help–seeking samples with daily mood data collected prospectively for a minimum of 1 complete MC. We critiqued their methodologies and tabulated the key findings.

Results: Of 47 English language studies identified, 18 (38.3%) found no association of mood with any MC phase; 18 found an association of negative mood in the premenstrual phase combined with another MC phase; and only 7 (14.9%) found an association of negative mood and the premenstrual phase. Finally, the remaining 4 studies (8.5%) showed an association between negative mood and a non-premenstrual phase. Considering the only 41 adequately powered studies, the same phase links were reported by 36.6%, 41.5%, and 13.5% of studies, respectively. Their diversity of methods (sampling, instruments, and cycle phase definitions) precluded a meta-analysis.

Conclusions: Taken together, these studies failed to provide clear evidence in support of the existence of a specific premenstrual negative mood syndrome in the general population. This puzzlingly widespread belief needs challenging, as it perpetuates negative concepts linking female reproduction with negative emotionality. (*Gend Med.* 2012;9:361–384)

Key words: menstrual cycle phase, mood, myth cultural stereotype, premenstrual.

INTRODUCTION

A link between the premenstrual phase of the menstrual cycle (MC) and negative mood is often thought to be well established.[1–4] This idea has a long history, being first mooted in the scientific literature in 1931 by gynecologist Robert Frank and psychoanalyst Karen Horney.[5] A broad mood-somatic premenstrual syndrome (PMS) was actively promoted by Katharina Dalton in the United Kingdom during the post-World War II years[6]; she implicated progesterone deficiency as its cause. During the 1960s, PMS gradually supplanted Frank's earlier term of "premenstrual tension,"[7–9] and PMS continues to be the common term in the developed world.[10,11] However, the definition of PMS, whether referring to mood alone or mood plus physical symptoms (eg, bloating), is not clear when the term is used in both the scientific literature and in lay discussions. There is also confusion about the timing of the purported syndrome—whether it ends promptly with the onset of menses[12] or some 2 or 3 days later as outlined in the American Congress of Obstetricians and Gynecologists Education pamphlet Premen-

Accepted for publication July 11, 2012.

http://dx.doi.org/10.1016/j.genm.2012.07.003
1550-8579/$ - see front matter

strual Syndrome AP057. This matter is discussed in some detail by the Bancroft monograph in 1993.[10] Various criteria in use were recently critiqued by an international multidisciplinary group, which suggested the use of categories of core premenstrual disorder and variant premenstrual disorder.[13] However, if it can be shown that the symptoms extend typically into the menses phase, an alternative name to premenstrual should be found.

This article assesses the strength of scientific evidence in support of a well-defined PMS occurring in the female population as a whole. Many studies concluded that they showed evidence for PMS use data from women seeking clinical help for mood problems, or when these studies only examined mood during the premenstrual phase without any non-premenstrual comparison phase.

Whether the premenstrual phase is a "risk factor" for negative mood cannot be addressed if a study does not compare other phases of the MC with it. Similarly, studies using help-seeking samples cannot address the issue of a specific PMS in the general population. It appears that only a minority of women have a disabling mood syndrome linked to the MC (currently called premenstrual dysphoric disorder [PMDD] in *Diagnostic and Statistical Manual of Mental Disorders–IV*).[14–16] Its prevalence has been estimated to occur in 3% to 9% of the adult female population,[17,18] although a recent, carefully conducted community study reported an even lower prevalence of 1.3%.[19]

Given the long-established tendency to label women's behavior as overly emotional and to attribute this to female reproductive function, the social and cultural context of premenstrual mood research is important.[11,20,21] Weisz and Knappen[22] presented data showing low and internationally highly variable PMS consultation rates, suggesting that PMS has become emblematic of unnecessary medicalization of women's lives.

There is a lack of consensus among researchers about which methods to use when collecting data about women's menstrual experiences. There are >60 instruments available; 1 of the first to be developed and widely used was the Moos Menstrual Distress Questionnaire (MDQ).[23–26] Several researchers working in the field have called for improved, more refined instruments.[27–29] A key methodological issue relates to negative versus positive symptoms.[30] Many instruments ask about negative experiences, such as depression, anxiety, irritability only, or place more emphasis on negative than on positive experiences, such as happiness. This limits a complete description of premenstrual mood experiences.[23,24,31–33] This is important because a woman may have generically greater mood amplitude change, for both positive and negative mood, in certain cycle phases. If only negative mood is studied, it will erroneously be concluded to be the only direction in which mood varies. Stewart[34] found that 66% of women attending a gynecologic clinic for nonmenstrual cycle reasons reported at least 1 positive symptom premenstrually. Chrisler et al[35] created the Menstrual Joy Questionnaire (MJQ) to study how positive moods varied with the MC and how to correct the focus on negative phenomenon only. Using the MJQ, Lee[36] reported that some women were extremely positive about menstruation, valuing their cyclical changes. Given this confusion, we thought it of interest to survey PMS literature using a fixed set of criteria for experimental design.

McFarlane et al[37–39] stated clearly that well-designed menstrual mood studies should use prospective ratings and obscure the menstrual focus of the research from the participants to minimize the effect of possible PMS stereotyping. Furthermore, McFarlane et al[39] recommended that data should be gathered during all phases of the MC. Following these recommendations, we examined relevant articles to see how well they met these design criteria and what results they generated.

METHODS

We used Medline and PsycINFO to retrieve all articles describing human studies with prospective ratings of mood, affect, or emotions recorded during the MC. Studies with prospective daily ratings were identified using filters of day, days, daily, or everyday mentioned in the record.

Ovid MEDLINE was searched from 1950 to the present for the following terms: emotions or affect (anger, anxiety, boredom, euphoria, frustration/happiness, hostility, jealousy, laughter, loneliness, depression, affective symptoms) with MC, PMS,

PMS cycle, and day, days, daily, and every day with humans. This search generated 469 articles.

PsycINFO was searched from 1806 to the present. Search terms used were psychosocial factors with emotions, personality traits, emotional responses, with MC, PMS, and day, days, and daily with humans. This search yielded 177 articles.

We did not include non-English language studies or the 4 unpublished dissertations located by PsycINFO. There were a few studies with prospective ratings gathered for <7 days each week (eg, the Davydov study), where data were gathered on 4 days per MC (2 days where the participant was at work, 2 where she was not at work for the follicular and luteal phases).[40] For clarity, we limited choice of article to those that provided daily data for a minimum of 1 complete MC. We also included the control data only from studies in which the main participants were seeking help for a MC mood problem. Some research groups published >1 article from 1 dataset. In these situations, we chose the study with the most information on mood and MC.

Two of the authors (SR and DS) reviewed the abstracts and, if necessary, the whole article to see whether they met our inclusion criteria of prospective daily ratings using a sample of non-help–seeking women over at least 1 complete MC. Each article was then examined for its key methodological features (as outlined by McFarlane)[38,39] as well as its statistical approach; these are summarized in the **Table**. The main findings from each article are given in the **Table**'s right-hand column, abstracting summary sentences from each article and coding results into 4 patterns of association with MC phases according to the **Table**'s legend.

Sample size adequacy was estimated using original data presented by Moos et al.[23] Their scores for negative affect in the intermenstrual phase were means (SDs) of 10.93 (4.60), and in the premenstrual phase were 16.96 (8.05). Using a 1-tailed test (premenstrual is greater than intermenstrual) with 80% power and $P < 0.05$ suggested a minimal sample size of 15, calculated using Stata (Stata Corp, College Station, Texas). Studies with <15 participants were included for their intrinsic historical interest.

Statistical Analysis

We used SPSS version 18 (PASW; IBM, Chicago, Illinois) for frequency counts and cross tabulations.

RESULTS

Our search resulted in 646 articles; 47 articles met our criteria of daily prospective data for at least 1 complete cycle and were analyzed further. The **Table** shows the main sample characteristics, design features, and overall results from these studies, presented chronologically, by year of publication.

Sample Characteristics

Sample sizes ranged from 6 to 900, with a mean size of 92.1 (15.5). Studies published before 1990 generally had smaller sample sizes (mean [SD] 50.5 [14.1]) than those published after 1990 (139.2 [42.6]) (Kruskal-Wallis test; $P = 0.002$). Over half (25 of 47) studied only 1 MC for all participants. Over one-third (16 of 47; 34%) used undergraduate tertiary university or nursing school students.

Study Design

Most of the studies (32; 68%) included positive items. Over half (26 of 47) did not obscure the MC research focus; 2 studies tested whether this made a difference by both systematically obscuring and not obscuring the focus.[47,69]

Study Analysis

None of the studies used general linear mixed modeling for analyzing correlated longitudinal data.[85,86] Some used repeated measures ANOVA, but many simply averaged scores across time.

Study Findings

Eighteen (38.3%) of the studies reviewed found no evidence of negative mood association with any MC phase. Another 18 (38.3%) found negative mood in the premenstrum combined with another MC phase—most often it was actual days of menses giving a "perimenstrual" pattern reported by 25.5% of the total. Seven studies (14.8%) reported the classical premenstrual pattern, with negative mood found in the premenstrual phase only. Finally, 4 studies (8.5%) found greater negative mood in the non-premenstrual phase only. Studies

Table. Studies of mood and menstrual cycle in the general population.

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Silbergeld et al[41] 1971 USA	8 healthy women, aged 19–31 y, in a study of effects of an OC on mood and behavior, using a blind crossover design with a placebo arm	Focus not obscured Positive items included No men 6 MC phases 4 Cycles ANOVA 2-way	a. There was no MC phase association for depression or anxiety.	1
Janowsky et al[42] 1973 USA	11 women, aged 18–25 y, OC use not reported, 11 mood and behavioral items daily	Focus not obscured Positive items included No men 5 MC phases At least 1 cycle ANOVA 1-way	a. There was the least amount of negative affect during ovulation. b. Greatest negative affect was on the day before the onset of menses. c. Results for positive items were not reported.	2
Patkai et al[43] 1974 Sweden	6 healthy women, aged 22–25 y, only weekday data, a study of catecholamine urinary excretion. 8 mood-alertness variables (brisk, tense, concentrated, apprehensive, irritable, efficient, gloomy, restless)	Focus not obscured No positive items No men 4 MC phases; data from menstrual days not reported 1 or 2 Cycles ANOVA	a. Only 2 of 8 factors (apprehensiveness and restlessness) varied with MC phase. Restlessness was greatest premenstrually; apprehensiveness was greatest postmenstrually.	3
Wilcoxon et al[44] 1976 USA	33 (11 men, 11 women taking OCs, and 11 not taking OCs), psychology undergraduate students	Focus not obscured Positive items included Men included 3 MC phases 1 Cycle (35 d) ANOVA RM	a. Negative affect was equal in men and women. b. There was an increase in negative affect during both the premenstrual and menstrual phases. c. Stressful events accounted for more variance in negative mood than cycle phase.	3
Rossi and Rossi,[45] 1977 USA	82 (15 men, 67 women; 24% using OCs) undergraduate university students	Focus not obscured Positive items included Men included 5 MC phases 1 Cycle (40 d) Multiple regression	a. Positive moods peaked during the ovulatory phase. b. Negative mood peaked in the luteal phase. c. Positive mood was low on Tuesdays and high on Fridays for both genders.	2

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Beumont et al[46] 1978 Australia	30 women tertiary students, none on OCs, mean (SD) age 20.5 (2.2) y	Focus not obscured No positive items No men 16 d before menses and 9 d after menses analyzed 1 Cycle (35 d) Paired *t*-tests	a. Most psychological symptoms were during menses (peaked at day 1), and were preceded by a gradual rise during the premenstruum, "a menstrual rather than premenstrual accentuation of the symptoms."	3
Englander-Golden et al[47] 1978 USA	46 advanced level women undergraduate zoology students, 20 on OCs	Focus both obscured and not obscured 1 Positive item, arousal Men included, but not analyzed 3 MC phases, 1 Cycle (11 wks) ANOVA RM	a. Negative affect and arousal were not associated with cycle phase in the obscured condition for either OC or non-OC women. b. Negative affect ($P < 0.01$) and arousal ($P < 0.01$) were associated with MC phase in the nonobscured condition. c. Negative affect was highest for non-OC users during menses.	1
Campos and Thurow[48] 1978 USA	36 undergraduate women students, 18 on OCs	Focus not obscured 1 Positive item No men 3 Menstrual phases 2 Cycles χ^2 3 × 2	a. Irritability and tension was related to MC phase, and was higher during both the premenstrual and menstrual phases. b. Depression and happiness were not related to MC phase.	3
Abplanalp et al[49] 1979 USA	33 psychological healthy women aged 23–39 y recruited by advertisement, daily POMS, with additional positive mood and activity items	Focus not obscured Positive items included No men 3 MC phases 3 Cycles *t*-tests (2-tailed)	a. Tension/anxiety during menses were greater than intermenstrual phase, vigor during the intermenstrual phase was greater than during menses.	4

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
			b. There was little support for premenstrual symptomatology. c. Retrospective data showed an increase in premenstrual negative affect.	
Benton[50] 1982 Wales	18 undergraduate women, aged 18–22 y, none on OCs. A study of effect of a pheromone on mood, placebo data only abstracted here. 4 VAS scales ("happy-depressed," "lethargic-lively," "sexy-unsexy," "irritable-good-tempered"	Focus not obscured No men Positive items included 5 MC phases 1 Cycle ANOVA 2 way	a. There was more depression at the beginning and end of the cycle (ie, menstrual and premenstrual phases, exact statistics were not provided). b. There was no association with MC phase for "lethargic-lively," "sexy-unsexy," and "irritable-good-tempered" scales.	3
Parlee[31] 1982 USA	7 women, 22–32 y, recruited by advertisement, non-OC users. Daily POMS and an activation check list	Focus obscured No men Positive items included 3 MC phases, 3 Cycles (90 d) Times series autocovariance, plus power spectral analysis, if significant	a. Grouped data showed that depression was lower premenstrually than around ovulation. b. Anger–hostility was highest peri ovulatorily; there was a trend for vigor to be highest premenstrually. c. In contrast, in retrospective accounts, women reported higher negative affect premenstrually. d. There was no cyclicity in individual records, only in the grouped data.	4

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Lahmeyer et al[51] 1982 USA	11 women, non-OC users, psychologically healthy women recruited by advertisement, average age 23 y, range 19–35 y, with only 1 >30 y Daily MDQ and anxiety items	Focus not obscured Positive items included No men 6 MC phases 1 cycle ANOVA (RM)	a. Negative affect, arousal, and anxiety were not significantly linked to MC phase.	1
Sutker et al[52] 1983 USA	21 women (12 using OCs) and 9 men, recruited by advertisement in a study of alcohol use, all average drinkers. Age not stated.	Focus obscured No positive items Men included 3 MC phases 2 Cycles *z*, *t*-test ANOVA	a. Anxiety, depression and hostility were all greater during menses than ovulatory or premenstrual phases for non-OC women. b. There were no mood differences between phases for OC women or men.	4
Slade[53] 1984 England	N = 118, female nursing students, recruited from nursing school. There were also 5 men whose data were not analyzed. Age: 70 non-OC users 23.8 (7.7) y with 17 >30 y, 48 OC users, 21.4 (4.1) y	Focus obscured No positive items No men 5 MC phases 2 Cycles (8 wks) Cosine wave and GoF	a. There was no premenstrual or menstrual peak in emotions or concentration. b. Psychological changes occurred randomly throughout the MC.	1
van den Akker and Steptoe[54] 1985 England	N = 100, hospital staff volunteers, non-OC users, aged 16–35 y	Focus obscured Positive items included Men included 3 MC phases 1 Cycle, 35 d, ANOVA, RM	a. More symptoms were reported in both the premenstrual and menstrual phases compared with the follicular phase (physical and psychological data were not given separately).	3
Marriott and Faragher[55] 1986 England	65 women attending Family Planning Clinic, 34 OC users aged 27.0 (5.4) y, 31 nonusers 29.4 (6.2) y. MDQ daily	Focus partially obscured Positive items included No men Analysis by day, not has, days minus 12 to 12. 1 Cycle ANOVA 2 way	a. Symptoms increased 7–9 d premenstrually, subsiding by days 3–5 (days 12–16 were not studied). b. Arousal showed a trend only (P = 0.06), statistics for negative affect were not provided separately.	3

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
			c. There was no difference between OC users and non-OC users.	
Woods[56] 1987 USA	345 women, community based, census residential block random sampling. Age 32.0 (6.8) y, range 18–45 y	Focus not obscured Positive items included Men not included 4 MC phases 3 Cycles (90 d) Means (SDs)	a. 13% reported increased symptoms premenstrually. b. 13% reported decreased symptoms premenstrually. c. Maximal symptoms were during menses.	4
Cohen et al[57] 1987 Canada	32 undergraduate women in a study of food cravings	Focus not obscured Single mood item No men 2 MC phases 1 Cycle, 5 wks, ANOVA RM	a. Affect was less positive during the luteal phase (10 d) than during the 10 follicular days.	2
McFarlane et al[37] 1988 Canada	N = 45, 15 non-OC using women, 15 on OCs, 15 men), psychology undergraduate students	Focus obscured One bipolar item Men included 5 MC phases 2 Cycles (70 d) ANOVA RM	a. Unpleasant mood was not associated with MC phase. b. Non-OC women reported more pleasant mood in the follicular and menstrual phases than men or women on OCs. b. There were greater mood fluctuations with the day of week than with the MC phase.	1
Van den Boogaard and Bijleveld[58] 1988 Netherlands	44 women, 16 using OCs, aged 20–39 y, mean 28 (4.7) y, also 15 men aged 20–40 y. Modified MDQ with additional items, factor analyzed into 9 factors, 2 on mood	Focus not obscured Positive item included Men included 3 MC phases 1 Cycle (35 d) ANOVA non-par	a. Visual inspection showed no MC phase differences for men or women on negative or positive affect; none were found with a Kruskal-Wallis analysis.	1
Mansfield et al[59] 1989 USA	9 women aged 22–42 y, and their husbands, recruited by advertisement, all non-OC users. Data phoned in. Wives' MC phases were used for men.	Focus obscured Positive items included Men included 5 MC phases 1–3 Cycles (3 mo) MANOVA	a. In women, negative affect was not associated with the MC phase.	1

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
	Factor analysis gave 2 factors, arousal and negative affect		b. In men, arousal was higher during their partners perimenstrual phase than during the follicular phase. c. There was a weekday effect, which was stronger than the MC phase effect.	
Metcalf et al[60] 1989 Metcalf et al[61] 1995 New Zealand	Women with and without PMS aged 25–46 y recruited through advertisement, data here from the non-PMS control group. Age with PMS 35.0 (4.8) y, no PMS 33.2 (5.6) y	Focus not obscured Positive items included No men Analysis by day, not MC phase, 1–3 Cycles (56 d) Fourier series, significance assessed with linear regression	a. In non-PMS women, there were no significant mood patterns in days –15 to +15. b. In non-PMS women, mood swings were less intense than in PMS women and were scattered throughout the menstrual cycle. c. In the 1995 paper: there were no MC phase differences for positive mood in non-PMS women.	1
Bisson and Whissel[62] 1989 Canada	22 women psychology undergraduate volunteers, non-OC users Factor analysis gave 2 factors “friendly extraversion” and “timidity”	Focus obscured Positive items included No men 3 MC phases 1–2 Cycles (49 d) ANOVA	a. Friendly extraversion was related to MC phase, timidity was not. b. MC phase differences were much weaker than other variables, which were also tracked (individual differences, daily life events, stress).	1
Christensen et al[63] 1989 Australia	43 psychology undergraduate students, aged 25–45 y, 30 with and 13 without PMS, control group data extracted here	Focus not obscured No positive items No men 2 MC phases, No. of cycles not stated ANOVA 2 way	a. The control group experienced no difference in dysphoria between MC phases.	1

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Ainscough[64] 1990 England	51 women, recruited from 2 hospitals and 2 schools, aged 29–49 y, mean 38.7 y	Focus obscured No positive items Men included (n = 1) 3 MC phases 2 Cycles (8 wks) *t*-tests, paired	a. There was no increase in negative affect during the premenstrual or menstrual phases. b. Most women reported increased premenstrual negative affect when they were surveyed retrospectively.	1
Walker and Bancroft[65] 1990 Scotland	109 women 20–35 y not help seeking, recruited through a magazine survey, but who believed they had significant cycle changes 61 OC users, 48 nonusers. Mean ages 25.6–26.9 y; SD not given	Focus not obscured Positive items included No men 4 MC phases 2 Cycles (84 d) ANOVA RM	a. There was mild cyclical variation, with most symptoms occurring in the premenstrual and menstrual phases. b. There was high individual and intercycle variation. c. Overall, there was no "clinically meaningful cyclical variation."	3
Charette et al[66] 1990 Canada	43 psychology undergraduate students, aged 25–45 y, non-OC users, using alcohol, but without alcohol problems	Focus obscured No positive items No men 5 MC phases 2 Cycles ANOVA RM	a. Negative affect did not differ by MC phase. b. Neither did alcohol consumption.	1
Rivera-Tovar and Frank[67] 1990 USA	217 psychology undergraduate students, aged 17–29 y, non-OC users, not pregnant, healthy with regular menses	Focus obscured No positive items No men 2 MC phases pre- and postmenstrual 7 d 2 Cycles 30% Increase score premenstrually	Only 4.6% had LLDD as shown by 30% increase premenstrual over postmenstrual values for 5 of 10 symptoms. No other patterns assessed.	2
Almagor and Ben-Porath[68] 1991 Israel	50 women aged 18–47, 40 undergraduates, 30 technicians, 30 non-OC users, 20 on OCs. 49 items → positive and negative affect factors	Focus not obscured Positive items included No men 5 MC phases 1–2 Cycles (45 d) ANOVA, mixed	a. OC users had higher positive affect than non-OC users, which was not associated with their MC phase. b. Negative affect was not associated with MC phase or OC use.	1

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Gallant et al[69] 1991 USA	34 women and 23 men, aged 20–49 y, recruited by advertisement, 6 factors studied (dysphoric mood, well-being, physical symptoms, personal space, food cravings, depression)	Focus systematically obscured and not obscured Positive items included Men included 7 MC phases 2 mo, 2 cycles ANOVA RM	a. Dysphoria was higher during menses than during all other phases, except the late luteal phase (P = 0.005 to 0.03). b. There were no significant differences between aware and unaware women. c. There were small effects in this nonclinical sample.	3
McFarlane and Williams[38] 1994 Canada	70 (60 women, 10 men) recruited by advertisement from the community designed to be an older sample, age range not given	Focus obscured Positive items included Men included 5 MC phases 4 Cycles (120 d) *t*-tests	a. In 35% women, negative mood was associated with a MC phase (11.7% premenstrual, 10.0% menstrual, 13.3% other). b. 55% had no mood (positive or negative) links with their MC phase. c. 5% of women had a classical premenstrual phase only pattern, whereas another 7% had some premenstrual cyclicity.	3
Walker[65] 1994 England Same data as Walker and Bancroft[70] 1990	109 women 20–35 y, mean 26.6 (4.1) y, recruited through a magazine survey, not help seeking, but who thought they had cycle changes. 61 OC users, 48 nonusers	Focus not obscured Positive items included No men 4 MC phases 2 Cycles (84 d) Means and subtraction	a. Among non-OC users, 44% had a premenstrual negative mood change, 8% had a premenstrual positive mood change in cycle 1 (0% and 65% in cycle 2).	3

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
			b. Among non-OC users, 54% had a negative change in premenstrual irritability in cycle 1 (4% and 71% in cycle 2). 13% had a positive change.	
Fontana and Palfai[71] 1994 USA	78 healthy psychology undergraduate non-OC users, aged 18–28 y, divided post hoc into 22 with premenstrual symptoms (PMD) and 56 controls. A study of stressors and coping	Focus obscured No positive items No men 2 MC phases, 1 MC, 35 d ANOVA RM	a. Controls showed no difference in dysphoria between the premenstrual and postmenstrual phases; in contrast, those with PMD did.	1
van den Akker et al[72] 1995 England	153 volunteers from 3 ethnic groups: Afro-Caribbean, whites, Asian, aged 18–48 y, means 27.3 (5.9) to 29.3 (8.1) y	Focus not obscured No positive items No men 3 MC phases 1 Cycle (35 d) ANOVA	a. Psychological mood scores increased both premenstrually and during menses "paramenstrual." b. Whites reported more symptoms than other ethnicities.	3
Freeman et al[73] 1996 USA	Psychometric study of a 17-item Daily Symptom Report (DSR) with PMS and non-PMS women. Data here from 54 comparison women, aged 29.8 (7.8) y, recruited by advertisement, in good health with no PMS.	Focus not obscured No positive items No men 2 MC phases 1 Cycle *t*-tests	a. Among comparison women, 13 DSR (7 mood) items had lower means in the postmenstrual (5–10) days than in the 6 premenstrual days. These mood items were irritability, fatigue, mood swings, nervous tension, anxiety, depression, and crying.	2
Hardie[74] 1997 Australia	N = 101 employed women (20–64 y; mean 38.6 [10.8] y) University employees	Focus obscured Positive items included No men 4 MC phases 2 Cycles ±Multiple regression	a. Marked affective changes were as likely postmenstrually as premenstrually. b. Weekly marked change was as prevalent as MC change.	3

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Henderson and Whissell[75] 1997 Canada	20 university women, aged 19–29 non-OC users, completed the Emotions Profile Index (4 pairs of opposite emotions); self rated after data collection as PMS yes or no (11 = yes)	Focus not obscured Positive items included No men 3 MC phases 1 Cycle ANOVA RM	a. For non-PMS women, depression and gregariousness (happiness) did not differ by MC phase. b. For self-identified PMS women, depression was greater during the premenstruum than during menses, which in turn was greater than postmenstrually c. Gregariousness was lower premenstrually than during menses and postmenstrually.	1
Van Goozen et al[76] 1997 Netherlands	19 healthy women, aged 24–40 y, recruited by advertisement, non-OC users, neuroendocrine study, mean ages 29.9 and 27.9 (no cycle complaint); SDs not given	Focus not obscured Positive items included No men 4 MC phases 1 Cycle ANOVA RM	a. Only 1 of 5 mood variables (tension) was associated with the MC phase; this was higher premenstrually.	2
Fontana and Badawy[77] 1997 USA	22 women attending a PMS clinic and 14 controls, recruited from the community by advertisement, all healthy, non-OC users. Age details not given	Focus obscured No positive items No men 2 MC phases 1 Cycle, (35 d) ANOVA RM	a. Controls showed no difference in emotional symptoms between their premenstrual and postmenstrual phases; in contrast, those with PMD did.	1
Einon[78] 1997 England	40 women, non-OC users, mean age 23 y, recruited by advertisement, in a study of ambient light and MC influences on mood, 11 mood items (5 positive) rated twice daily	Focus obscured for half the sample Positive items included No men included Analysis by day 1 MC cycle (32 d) *t*-tests, ANOVA	a. There were large unsystematic fluctuations in mood, most mood dips occurred outside the premenstruum. b. Self-identified PMS women had more changes in mood premenstrually than during follicular days.	1

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Sveindottir and Backstrom[79] 2000 Iceland	83 women, aged 20–40 y, recruited from the National Registry, 34 aged 20–29 y, 49 aged 30–39 y	Focus not obscured Positive items included No men 2 MC phases 2 Cycles (15–60 d) Fishers exact, non-par	a. Two women (2.4%) showed a classical premenstrual syndrome and 5 (6.0%) showed a premenstrual magnification pattern. b. The remaining women displayed mixed symptom patterns	3
Cohen et al[57] 2002 USA	513 women, aged 36–44 y, 24 items in 6 categories, 4 concerning mood (depression, irritability, anxiety/tension, mood lability)	Focus not obscured No positive items No men 2 MC phases 1 Cycle Logistic regression	a. 6.4% had greater scores in the luteal phase than in the follicular phase on ≥1 symptoms of PMDD. The converse pattern was not discussed.	2
Ross et al[80] 2003 Australia	187 women, 18–45 y, mean 29.9 (8.6) y, recruited by advertisement, 34% OC users	Focus obscured No positive items No men 3 MC phases 2 Cycles (70 d) ANOVA RM	a. Negative affect in both the premenstrual and menstrual phases was significantly greater than in follicular phase. b. 21% had a premenstrual decrease, 54% had a premenstrual increase and 25% had no premenstrual change in negative affect.	3
Abraham et al[81] 2003 Australia	119 healthy women aged 18–41 y consulting their GP, 94 OC users, 25 nonusers in a study of OC (2 types, mono- and triphasic) effect on physical and mood symptoms. Six mood items used	Focus not obscured Positive items included No men 5 MC phases 2 Cycles ANOVA and general linear modeling	a. Non-OC users showed menstrual cyclicity for the depressed/sad item, with non-significant trends for the irritable and tense items. b. The mean scores for the tired, depressed and tense items were numerically higher during menses than premenstrually.	3

(continued)

Table (continued).

Reference, Year, Place	Sample	Study Characteristics	Main Findings*	
Meaden et al[82] 2005 USA	900 women, 13–53 y, mean not given, Census residential block sampling. The study examined PMDD symptoms in the community	Focus obscured Positive items included No men Data analyzed by day 2 Cycles Time sequence charts	a. Symptoms peaked days –3 to +2 around the onset of menses, showing a perimenstrual pattern. b. Women endorsed more distress if symptoms were positively worded than if they were negatively worded.	3
Natale and Albertazzi[83] 2006 Italy	N = 62, healthy women, aged 20–25 y, 18 on OCs. A study of mood, OCs, and the menstrual cycle, recruited by advertisement. 8 VAS items → global mood and vigor.	Focus obscured Positive items included No men 4 MC phases–1 cycle (5 wks) ANOVA mixed 2 way	a. Global mood was not related to MC phase. b. Controls showed no difference in dysphoria between the premenstrual and postmenstrual phases; in contrast, those with PMD did. c. There was no effect of OCs on mood	1
Haywood et al[84] 2007 UK	N = 80, women not on OCs, aged 20–43 y, mean 31.5 (5.3) y Women with young children (1–3 y) recruited though health visitors	Focus not obscured No positive items No men 2 MC phases, 2 MC (63 d; only 1 was analyzed) Regression hierarchical 3 step	a. 79% showed a small excess of symptoms during the luteal phase compared with the follicular phase. b. 21% showed a small excess of symptoms during the follicular phase compared with the luteal phase. c. Social support from mothers was associated with higher luteal phase psychological symptoms, there was an inverse trend with the need for approval.	3

ANOVA RM = analysis of variance using repeated measures; GoF = Goodness of Fit; GP = general practitioner; intermenst = intermenstrual; LLDD = late luteal dysphoric disorder; MC = menstrual cycle; MDQ = Menstrual Distress Questionnaire; OC = oral contraceptive drug; premenst = premenstrual; postmenst = postmenstrual; POMS = profile of mood; PRISM = Prospective Record of Impact and Severity of Menstrual Symptoms; VAS = Visual Analogue Scale.

*Category of each study's main result: 1 = no association with any MC phase; 2 = associated with premenstrual phase only; 3 = associated with premenstrual and other phase(s); 4 = associated with other phase only (ie, non-premenstrual phase[s]).

with a sample size of at least 15 participants had similar findings: 36.6% had no negative mood association with any MC phase; 42.5% had negative mood in the premenstrum plus another MC phase—most often in the menstrual phase with 17% reporting this pattern; and 7.3% had negative mood in the non-premenstrual MC phase. Only 14.6 % reported the classic premenstrual pattern.

Studies with the focus obscured were no more likely statistically to report a premenstrual mood change than the other studies. To determine this using the χ^2 test, it was necessary to combine premenstrual only and premenstrual with another phase mood change (uncorrected χ^2 3.4; $P = 0.06$).

DISCUSSION

The major finding of this review was that clear evidence for a specific premenstrual phase related mood occurring in the general population is lacking. A common pattern was for negative mood to continue on through the days of menses and not be confined to the premenstrum days only. However, approximately 40% of the studies found no link between mood and MC phase, and a further 9% of studies (or 8% for those that were adequately powered) reported a link with non-premenstrual phases only. This overall conclusion (of no premenstrual dysphoric mood association) was in line with Gannnon's 1981 review of 15 studies.[87] The dominance of the premenstrual–menstrual pattern of negative mood was previously reported by Woods et al,[88] who used the term perimenstrual distress. Angst et al[89] also preferred the term perimenstrual.

We used strict inclusion criteria for our review; following the suggestions of McFarlane et al,[39] we reviewed only studies that used prospective ratings, obscured the menstrual focus of the research from participants, and gathered mood data during all phases of the MC. Some influential studies were necessarily excluded by these criteria. These included the study of Endicott et al,[90] which collected daily data for at least 1 cycle, but did not report quantitative data for the whole cycle. The study by Christensen and Oei[91] was also excluded because daily ratings were made only by the PMDD treatment-seeking participants. The Californian Health Maintenance Organization[92] study was also excluded, in which the comparison group was biased by the exclusion of women who had never experienced premenstrual symptoms. The work by Davydov et al[40,93] was excluded because the prospective data were not collected each day.

In examining prospective mood MC studies, we uncovered a diverse set of recruitment strategies and a wide range of instruments, making an overall synthesis challenging. We were also able to document the various methodological shortcomings of studies selected as being the better ones. We required a minimal data collection time of 1 month; given the cycle to cycle variability of mood symptoms, 2 or 3 complete MCs were needed for greater accuracy. With our strict criteria, only 3 studies were included that used a true random sample, the optimal strategy for developing a picture of a whole population.[56,82,94] It was regretful that more research teams did not address this important design principle. The lack of a full range of sociodemographic characteristics, including age and education, limited the generalizability of the data. The common use of convenience samples, such as undergraduate university students (**Table**) introduced bias, because they only studied young women of highly educated status. Further, a substantial number of studies had small samples, which were inadequate for proper power; surprisingly, no article discussed the issue of adequate power. Time-series modeling, statistical analytical models necessary to deal with the time-correlated nature of MC data collected daily, were not used by any study. It was also noteworthy that the articles did not analyze MC phase variability in positive mood items, reflecting a researcher mind set. Finally, many did not obscure the focus of the study; thus, if the woman participants had expectations about their MC, those expectations might have well influenced the findings.

Given the lack of clear scientific evidence for increased negative mood limited to the premenstrual phase, why is the idea of PMS in the general population so persistent? Many noted the imprecise boundaries of PMS.[11,13] Rodin[20] went further and suggested that, "the uncertainties around the definition of PMS is a persistence of tacit shared

cultural knowledge about the effect of the reproductive system on women's behavior, disguised as value-free scientific fact." Bancroft et al[95] stated that the concept of PMS failed to advance the understanding of the etiology or attempts to improve treatments. Johnson[96] considered PMS a Western culture-specific phenomenon, and suggested that it needs to be seen in the context of "conflicting social expectations that women be both productive and reproductive." Positive menstruation associations were reported in some non-Western cultures; many women regard menstruation as a welcome natural occurrence.[97,98] In Brazil, menstruation is associated with femaleness, youth, fertility, and health.[99] One study from India found women viewed menstruation as more natural and healthy than women in North America.[100] However, the experience of menstruation was also negatively constructed in many non-Western cultures.[101] Reports of MC-related symptoms were available from a wide range of cultures.[94] Hasin et al[102] noted that social and cultural factors affected the perception and interpretation of symptoms, and that recent immigrants were less socialized by the popular media. A United States study using different cultural subgroups suggested that subjective premenstrual distress was a widespread phenomenon, but that the symptoms involved varied with the culture.[103] Choi[104] wrote in 1995 that scientific research into the MC failed to acknowledge the sociocultural context in which the research was conducted and assumed a linear relationship between biology and behavior. In most societies, menstruation carries heavy symbolic meaning, which has been an academic focus in anthropology.[20,101] Historically, menstruation was often feared and considered incapacitating, dangerous and dirty; in many cultures, menstruating women were subjected to taboos and concealment norms.[105] Freud[101] and others[106,107] suggested that menstrual taboos were motivated by the superstitious dread of menstrual blood.

Certainly, highly negative overall images of menstrual function prevail.[108] Two studies revealed that women thought to be menstruating were regarded as less competent, less likable, less energized, less sexually appealing, and more irritable, sad, and angry than nonmenstruating women.[107,109] There has been a great failure in promoting positive images of menstruation.[110] There is a strong menstruation concealment norm. Women in many cultures report social pressure to hide their menstruation,[111] and adolescent girls are taught to keep menstruation a secret.[112,113] Many societies place taboos and restrictions on menstruating women.[114–118] Menstruation is usually discussed in negative and derogatory language.[112] Analysis of menstrual symbolism repeatedly focuses on concepts of dangerousness and defilement, of taboo, and pollution.[101] Popular media reinforce the image of menstruation as undesirable and shameful.[119] Media coverage of menstruation has been described as providing "inaccurate information, limited perspectives and distortion of scientific evidence."[120]

Given that attitudes toward menstruation are widely negative, women's expectations of themselves during menstruation may be negative as well. Anson[121] examined the negative negative attitudes towards menstruation in Israeli women students. He presented evidence that negative attitudes towards menstruation and premenstrual experiences were transmitted from mother to daughter. Both women and men responded using cultural stereotypes about menstruation and gender roles.[122–124] Considerable evidence suggested that both women and men attributed adverse experiences to the MC, particularly the premenstrum, whereas, in contrast, positive experiences were seen as arising from external sources.[13,125–129] Slade and Bains[130] studied 60 women attending a family planning clinic, and found that negative moods experienced premenstrually were attributed to internal health factors, whereas positive moods were attributed to external lifestyle and environmental factors. Two studies deliberately misled women about their MC phase; both found that women who thought that they were premenstrual reported significantly more symptoms than those who did not.[126,127] The research group led by Marvan and Escobedo[131] randomly assigned Mexican women to 1 of 2 video watching groups; the experimental group viewed a tape on the negative consequences of PMS, and the control group watched a video giving neutral information on the MC. In con-

trast to the control group, women in the experimental group reported more severe premenstrual symptoms after watching the videotape, demonstrating that expectations could be molded.

The bodily sensations hypothesis suggested that actual changes across the MC prompt women who have high anxiety sensitivity to misattribute their physical sensations.[127] The expectations hypothesis stated that women's reports of menstrual symptoms were influenced by expectations developed from cultural beliefs and stereotypes, which explained the greater reporting of symptoms in retrospective accounts than in prospective accounts.[126,127,132] The menstrual reactivity hypothesis combined these 2 hypotheses, and suggested that some women focus a lot on bodily changes; their interpretation of these changes depended on both actual experiences, as well as their cultural expectations.[124] Many women and men continued to attribute general difficulties to the MC, even when alternative explanations were more likely.[10,56,95,129,133] This tendency might harm young women by encouraging negative and powerful, self-fulfilling expectations surrounding their MC.

The ongoing widespread usage of the term PMS buttresses the idea that women's negative mental states are largely determined by their hormones.[101,134] Establishing or refuting the validity of the concept of PMS in the general population becomes particularly relevant as new methods of using oral contraceptives offer the possibility of preventing menstruation altogether. Many women, including those without MC-related symptoms, would like to reduce the frequency of menstruation, and a significant proportion desire total amenorrhea.[135,136] Negative attributes associated with the MC might be reinforcing this desire for amenorrhea with unknown outcomes.

Attitudes towards menstruation might be changing among young women. A British study found that young women were more likely to attribute positive attitudes to the MC than older women.[137] In a Mexican study comparing college-aged students with middle-aged respondents, younger people viewed menstruation as requiring less secrecy, and were less likely to endorse menstrual proscriptions than older women.[29,118] Our group reported on a recent survey of a community sample of women; when asked to identify influences on their mood, very few (<5%) named the MC.[138]

CONCLUSIONS

In summary, the current state of evidence shows little support for a specific premenstrual negative mood change occurring with any regularity in the general population. Negative stereotypes about the MC require that any future studies be carried out with the focus of the study obscured. As well, future studies should ensure adequate sample size and a wide age distribution of menstruating women, preferably using random community sampling. Cohort studies to see whether a small group of women with perimenstrual symptomatology move in and out of PMDD criteria over time, and what precipitating risk factors, either biological or psychosocial, are found at the time of the switch, would be highly informative.

ACKNOWLEDGMENTS

This work was carried out in part with the support of Canadian Institutes of Health Research Grant (#MOP74678). Dr. Romans had the original idea for a published literature review and the scope of the articles to be covered. She was PI on the parent grant for which this literature in a less-developed form was the justification, assessed the selected articles for inclusion characteristic with Dr. Stewart, read the included articles at least once, and designed the table. Dr. Clarkson was part of the data collection phase of the parent research, undertook the bulk of article retrieval, wrote first drafts of the introduction and discussion, and read and edited the final drafts. Ms. Petrovic served as full-time manager of research team, maintained electronic library resource, organized finances, read drafts of article, and helped with final editing. Dr. Einstein contributed to overall intellectual work of the parent research team, critiqued emergent ideas in the literature review, and read and edited final draft. Dr. Stewart was an original member of research team and contributed to its intellectual work. She led the process for designing the systematic literature review, including search

terms and databases to be used, assessed the selected articles for inclusion characteristic with Dr. Romans, read the included articles at least once, read and edited the final drafts, guided the submission process, and helped with responses to reviewers comments. Each of the authors made a significant intellectual contribution to this work.

CONFLICTS OF INTEREST

The authors have indicated that they have no conflicts of interest regarding the content of this article.

REFERENCES

1. Gold JH, Severino SK. *Premenstrual Dysphorias: Myths and Realities*. Washington, DC: American Psychiatric Press, 1994.
2. Steiner M. Premenstrual syndromes. *Ann Rev Med*. 1997;48:447–455.
3. Yonkers KA, O'Brien PM, Eriksson E. Premenstrual syndrome. *Lancet*. 2008;371:1200–1210.
4. Richardson JT. The premenstrual syndrome: a brief history. *Soc Sci Med*. 1995;41:761–767.
5. Stolberg M. The monthly malady: a history of premenstrual suffering. *Med History*. 2000;44: 301–322.
6. Dalton K. The influence of menstruation on health and disease. *Proc R Soc Med*. 1964;57:262–264.
7. Morton JH, Additon H, Addison RG, et al. A clinical study of premenstrual tension. *Am J Obstetr Gynecol*. 1953:65:1182–1191.
8. Ferguson JH, Vermillion MB. Premenstrual tension; two surveys of its prevalance and a description of the syndrome. *Obstet Gynecol*. 1957;9: 615–619.
9. Behrman SJ, Buxton CL. Premenstrual tension. *Am J Obstetr Gynecol*. 1961:81:606–609.
10. Bancroft J. The premenstrual syndrome—a reappraisal of the concept and the evidence [see comments]. *Psychol Med*. 1993:24(Suppl):1–47.
11. Figert AE. Premenstrual syndrome as scientific and cultural artifact. *Integrative Physiol Behav Sci*. 2005;40:102–113.
12. Pinkerton J. Premenstrual Syndrome (PMS) in Merck Manuals Online Library. Merck Manual for Healthcare Professionals: 2010. Last revision January 2010. http://www.merckmanuals.com/professional/sec18/ch244/ch244g.html#. Accessed October 12, 2011.
13. O'Brien PMS, Bäckström T, Brown C, et al. Towards a consensus on diagnostic criteria, measurement and trial design of the premenstrual disorders: the ISPMD Montreal consensus. *Arch Womens Ment Health*. 2011;14:13–21.
14. Steiner M. Premenstrual dysphoric disorder. An update. *Gen Hosp Psychiatry*.1996;18:244–250.
15. Endicott J, Amsterdam J, Eriksson E, et al. Is premenstrual dysphoric disorder a distinct clinical entity? *J Women's Health Gender–Based Med*. 1999;8:663–679.
16. Smith MJ, Schmidt PJ, Rubinow DR. Operationalizing DSM-IV criteria for PMDD: selecting symptomatic and asymptomatic cycles for research. *J Psychiatr Res*. 2003;37:75–83.
17. Cohen LS, Soares CN, Otto MW, et al. Prevalence and predictors of premenstrual dysphoric disorder (PMDD) in older premenopausal women. The Harvard Study of Moods and Cycles. *J Affective Disord*. 2002;70:125–132.
18. Wittchen HU, Becker E, Lieb R, et al. Prevalence, incidence and stability of premenstrual dysphoric disorder in the community. *Psychol Med*. 2002;32:119–132.
19. Gehlert S, Song IH, Chang CH, et al. The prevalence of premenstrual dysphoric disorder in a randomly selected group of urban and rural women. *Psychol Med*. 2009;39:129–136.
20. Rodin M. The social construction of premenstrual syndrome. *Soc Sci Med*. 1992:35:49–56.
21. Martin E. *The Woman in the Body: A Cultural Analysis of Reproduction*. Boston: Beacon Press; 2001.
22. Weisz G, Knaapen L. Diagnosing and treating premenstrual syndrome in five western nations. *Soc Sci Med*. 2009;68:1498–1505.
23. Moos RH. The development of a menstrual distress questionnaire. *Psychosom Med*. 1968;30: 853–867.
24. Moos RH. Typology of menstrual cycle symptoms. *Am J Obstetr Gynecol*. 1969;103:390–402.

25. Moos RH, Kopell BS, Melges FT, et al. Fluctuations in symptoms and moods during the menstrual cycle. *J Psychosom Res*. 1969;13:37–44.
26. Brooks-Gunn J, Ruble DN. The Menstrual Attitude Questionnaire. *Psychosom Med*. 1980;42: 503–512.
27. Steiner M, Streiner DL, Steinberg S, et al. The measurement of premenstrual mood symptoms. *J Affective Disord*. 1999;53:269–273.
28. Haywood A, Slade P, King H. Assessing the assessment measures for menstrual cycle symptoms: a guide for researchers and clinicians. *J Psychosom Res*. 2002;52:223–237.
29. Marvan ML, Ramirez-Esparza D, Cortes-Iniestra S, et al. Development of a new scale to measure Beliefs about and Attitudes Toward Menstruation (BATM): data from Mexico and the United States. *Health Care Women Int*. 2006;27:453–473.
30. Choi PY, McKeown S. What are young undergraduate women's qualitative experiences of the menstrual cycle? *J Psychosom Obstetr Gynecol*. 1997;18:259–265.
31. Parlee MB. Changes in moods and activation levels during the menstrual cycle in experimentally naive subjects. *Psychol Women Q*. 1982;7:119–131.
32. Logue CM, Moos RH. Positive perimenstrual changes: toward a new perspective on the menstrual cycle. *J Psychosom Res*. 1988;32:31–40.
33. Asso D. A reappraisal of the normal menstrual cycle. *J Reprod Infant Psychol*. 1992;10:103–109.
34. Stewart DE. Positive changes in the premenstrual period. *Acta Psychiatr Scand*. 1989;79:400–405.
35. Chrisler JC, Johnston IK, Champagne NM, et al. Menstrual joy: the construct and its consequences. *Psychol Women Q*. 1994;18:375–387.
36. Lee S. Health and sickness: the meaning of menstruation and premenstrual syndrome in women's lives. *Sex Roles*. 2002;46:25–35.
37. McFarlane J, Martin CL, Williams TM. Mood fluctuations: women versus men and menstrual versus other cycles. *Psychol Women Q*. 1988;12:201–223.
38. McFarlane JM, Williams TM. Placing premenstrual syndrome in perspective. *Psychol Women Q*. 1994;18:339–373.
39. McFarlane JM. Premenstrual disorders. In: Blechman EA, Brownell KD, eds. *Behavioural Medicine and Women: A Comprehensive Handbook*. New York: The Guildford Press; 1998.
40. Davydov DM, Dhapiro D, Goldstein IB. Moods in everyday situations: effects of menstrual cycle, work, and personality. *J Psychosom Res*. 2004;56: 27–33.
41. Silbergeld, S, Brast N, Noble EP. The menstrual cycle: a double-blind study of symptoms, mood and behavior, and biochemical variables using enovid and placebo. *Psychosom Med*. 1971; 33:411–428.
42. Janowsky DS, Berens SC, Davis JM. Correlations between mood, weight, and electrolytes during the menstrual cycle: a renin-angiotensin-aldosterone hypothesis of premenstrual tension. *Psychosom Med* 1973;35(2):143–154.
43. Patkai P, Johannson G, Post B. Mood, alertness and sympathetic–adrenal medullary activity during the menstrual cycle. *Psychosom Med*. 1974; 36:503–512.
44. Wilcoxon LA, Schrader SL, Sherif CW. Daily self-reports on activities, life events, moods, and somatic changes during the menstrual cycle. *Psychosom Med*. 1976;38:399–417.
45. Rossi AS, Rossi PE. Body time and social time: mood patterns by menstrual cycle phase and day of the week. *Soc Sci Res*. 1977;6:273–308.
46. Beumont, PJ, Abraham SF, Argall WJ, et al. A prospective study of premenstrual tension symptoms in healthy young Australians. *Austral NZ J Psychiatry*. 1978;12:241–244.
47. Englander-Golden, P, Whitmore MR, Dienstbier RA. Menstrual cycle as focus of study and self-reports of moods and behaviors. *Motivation Emotion*. 1978;2:75–86.
48. Campos F, Thurow C. Attributions of moods and symptoms to the menstrual cycle. *Pers Soc Psychol Bull*. 1978;4:272–276.
49. Abplanalp JM, Donnelly AF, Rose RM. Psychoendocrinology of the menstrual cycle: I. Enjoyment of daily activities and moods. *Psychosom Med*. 1979;41:587–604.
50. Benton D. The influence of androstenol—a putative human pheromone—on mood throughout

the menstrual cycle. *Biolog Psychol*. 1982;15:249–256.
51. Lahmeyer HW, Miller M, DeLeon-Jones F. Anxiety and mood fluctuation during the normal menstrual cycle. *Psychosom Med*. 1982;44:183–194.
52. Sutker PB, Libet JM, Allain AN, et al. Alcohol use, negative mood states, and menstrual cycle phases. *Alcohol Clin Exp Res*. 1983;7:327–331.
53. Slade P. Premenstrual emotional changes in normal women: act or fiction? *J Psychosom Res*. 1984;28:1–7.
54. van den Akker O, Steptoe A. The pattern and prevalence of symptoms during the menstrual cycle. *Br J Psychiatry*. 1985;147:164–169.
55. Marriott A, Faragher E. An assessment of psychological state associated with the menstrual cycle in users of oral contraception. *J Psychosom Res*. 1986;30:41–47.
56. Woods NF. Premenstrual symptoms: another look. *Public Health Rep*. 1987;102(Suppl):106–112.
57. Cohen IT, Sherwin BB, Fleming AS. Food cravings, mood, and the menstrual cycle. *Hormones Behav*. 1987;21:457–470.
58. Van den Boogaard TG, Bijleveld CC. Daily menstrual symptom measures in women and men using an extended version of Moos's instrument. *J Psychosom Obstetr Gynecol*. 1988;9:103–110.
59. Mansfield PK, Hood KE, Henderson J. Women and their husbands: mood and arousal fluctuations across the menstrual cycle and days of the week. *Psychosom Med*. 1989;51:66–80.
60. Metcalf M, Livesey JH, Wells J, et al. Mood cyclicity in women with and without the premenstrual syndrome. *J Psychosom Res*. 1989;33:407–418.
61. Metcalf MG, Livesey JH. Distribution of positive moods in women with the premenstrual syndrome and in normal women. *J Psychosom Res*. 1995;39:609–618.
62. Bisson C, Whissell C. Will premenstrual syndrome produce a Ms. Hyde?: evidence from daily administrations of the Emotions Profile Index [see comment]. *Psychol Rep*. 1989;65:179–184.
63. Christensen AP, Oei TP, Callan VJ. The relationship between premenstrual dysphoria and daily ratings dimensions. *J Affective Disord*. 1989;16:127–132.
64. Ainscough CE. Premenstrual emotional changes: a prospective study of symptomatology in normal women. *J Psychosom Res*. 1990;34:35–45.
65. Walker A. Mood and well-being in consecutive menstrual cycles: methodological and theoretical implications. *Psychol Women Q*. 1994;18:271–290.
66. Charette L, Tate DL, Wilson A. Alcohol consumption and menstrual distress in women at higher and lower risk for alcoholism. *Alcohol*: *Clin Exp Res*. 1990;14:152–157.
67. Rivera-Tovar AD, Frank E. Late luteal phase dysphoric disorder in young women: *Am J Psychiatry*. 1990;147:1634–1636.
68. Almagor M, Ben-Porath YS. Mood changes during the menstrual cycle and their relation to the use of oral contraceptive. *J Psychosom Res*. 1991;35:721–728.
69. Gallant SJ, Hamilton JA, Popiel DA, et al. Daily moods and symptoms: effects of awareness of study focus, gender, menstrual-cycle phase, and day of the week. *Health Psychol*. 1991;10:180–189.
70. Walker A, Bancroft J. Relationship between premenstrual symptoms and oral contraceptive use: a controlled study. *Psychosom Med*. 1990;52:86–96.
71. Fontana AM, Palfai TG. Psychosocial factors in premenstrual dysphoria: stressors, appraisal, and coping processes. *J Psychosom Res*. 1994;38:557–567.
72. van den Akker OB, Eves FF, Service S, et al. Menstrual cycle symptom reporting in three British ethnic groups. *Soc Sci Med*. 1995;40:1417–1423.
73. Freeman EW, DeRubeis RJ, Rickels K. Reliability and validity of a daily diary for premenstrual syndrome. *Psychiatry Res*. 1996;65:97–106.
74. Hardie EA. Prevalence and predictors of cyclic and noncyclic affective change. *Psychol Women Q*. 1997;21:299–314.
75. Henderson B, Whissell C. Changes in women's emotions as a function of emotion valence, self-determined category of premenstrual distress, and day in the menstrual cycle. *Psychol Rep*. 1997;80:1272–1274.
76. Van Goozen SH, Wiegant VM, Endert E, et al. Psychoendocrinological assessment of the menstrual cycle: the relationship between hormones, sexuality, and mood. *Arch Sex Behav*. 1997;26:359–382.

77. Fontana AM, Badawy S. Perceptual and coping processes across the menstrual cycle: an investigation in a premenstrual syndrome clinic and a community sample. *Behav Med*. 1997;22:152–159.
78. Einon D. The influence of ambient light and menstrual status on the moods of a nonclinical population of young women. *Psychosom Med*. 1997; 59:616–619.
79. Sveindottir H, Backstrom T. Prevalence of menstrual cycle symptom cyclicity and premenstrual dysphoric disorder in a random sample of women using and not using oral contraceptives. *Acta Obstetr Gynecol Scand*. 2000;79:405–413.
80. Ross C, Coleman G, Stojanovska C. Prospectively reported symptom change across the menstrual cycle in users and non-users of oral contraceptives. *J Psychosom Obstet Gynaecol*. 2003;24:15–29.
81. Abraham S, Luscombe G, Soo I. Oral contraception and cyclic changes in premenstrual and menstrual experiences. *J Psychosom Obstetr Gynecol*. 2003;24:185–193.
82. Meaden PM, Hartlage SA, Cook-Karr J. Timing and severity of symptoms associated with the menstrual cycle in a community-based sample in the Midwestern United States. *Psychiatry Res*. 2005;134:27–36.
83. Natale V, Albertazzi P. Mood swings across the menstrual cycle: a comparison between oral contraceptive users and non-users. *Biol Rhythm Res*. 2006;37:489–495.
84. Haywood A, Slade P, King H. Psychosocial associates of premenstrual symptoms and the moderating role of social support in a community sample. *J Psychosom Res*. 2007;62:9–13.
85. Cnaan A, Laird NM, Slasor P. Using the general linear mixed model to analyse unbalanced repeated measures and longitudinal data. *Stat Med*. 1997;16:2349–2380.
86. Diggle, PJ, Heagerty PJ, Liang K-Y, et al. *Analysis of Longitudinal Data*, 2nd ed. Oxford: Oxford University Press; 2002.
87. Gannon L. Evidence for a psychological etiology of menstrual disorders: a critical review. *Psychol Rep*. 1981;48:287–294.
88. Woods NF, Most A, Dery GK. Toward a construct of perimenstrual distress. *Res Nurs Health*. 1982; 5:123–136.
89. Angst, J, Sellaro R, Merikangas KR, et al. The epidemiology of perimenstrual psychological symptoms. *Acta Psychiatr Scand*. 2001;104:110–116.
90. Endicott J, Nee J, Cohen J, et al. Premenstrual changes: patterns and correlates of daily ratings. *J Affective Disord*. 1986;10:127–135.
91. Christensen AP, Oei TP. Correlates of premenstrual dysphoria in help-seeking women. *J Affective Disord*. 1995;33:47–55.
92. Sternfeld B, Swindle R, Chawla A, et al. Severity of premenstrual symptoms in a health maintenance organization population. *Obstet Gynecol*. 2002; 99:1014–1024.
93. Davydov DM, Shapiro D, Goldstein IB. Moods in everyday situations: effects of menstrual cycle, work, and personality. *J Psychosom Res*. 2004;56: 27–33.
94. Sveinsdottir H. Prospective assessment of menstrual and premenstrual experiences of Icelandic women. *Health Care Women Int*. 1998;19:71–82.
95. Bancroft J. The menstrual cycle and the well being of women. *Soc Sci Med*. 1995;41:785–791.
96. Johnson TM. Premenstrual syndrome as a western culture-specific disorder. *Culture Med Psychiatry*. 1987;11:337–356.
97. Cheng CY, Yang K, Liou SR. Taiwanese adolescents' gender differences in knowledge and attitudes towards menstruation. *Nurs Health Sci*. 2007;9:127–134.
98. Hoerster KD, Chrisler JC, Rose JG. Attitudes toward and experience with menstruation in the US and India. *Women Health*. 2003;38:77–95.
99. Estanislau do Amaral MC, Hardy E, Hebling EM, et al. Menstruation and amenorrhea: opinion of Brazilian women. *Contraception*. 2005;72: 157–161.
100. Chaturvedi SK, Chandra PS. Sociocultural aspects of menstrual attitudes and premenstrual experiences in India. *Soc Sci Med*. 1991;32:349–351.
101. Buckley T, Gottlieb A, eds. *Blood Magic: An Anthropology of Menstruation*. Berkeley: University of California; 1988.
102. Hasin M, Dennerstein L, Gotts G. Menstrual cycle complaints: a cross–cultural study. *J Psychosom Obstetr Gynaecol*. 1988;9:35–42.

103. Janiger O, Riffenburgh R, Kersh R. Cross cultural study of premenstrual symptoms. *Psychosomatics*. 1972;13:226–235.
104. Choi PY. What is this news on the menstrual cycle and premenstrual syndrome? Introduction. *Soc Sci Med*. 1995;41:759–760.
105. Delaney J, Lupton MJ, Toth E. *The Curse: A Cultural History of Menstruation*. Chicago: University of Illinois; 1988.
106. Freud S. *Totem and Taboo: Resemblances Between the Psychic Lives of Savages and Neurotics*. New York: Vintage Books; 1918.
107. Roberts TA, Goldenberg JL, Power C, et al. "Feminine protection": the effects of menstruation on attitudes towards women. *Psychol Women Q*. 2002;26:131–139.
108. Snow LF, Johnson SM. Modern day menstrual folklore. Some clinical implications. *JAMA*. 1977; 237:2736–2739.
109. Forbes GB, Adams-Curtis LE, White KB, et al. The role of hostile and benevolent sexism in women's and men's perceptions of the menstruating women. *Psychol Women Q*. 2003;27:58–63.
110. Berg DH, Coutts LB. The extended curse: being a woman every day. *Health Care Women Int*. 1994; 15:11–22.
111. O'Flynn N. Menstrual symptoms: the importance of social factors in women's experiences. *Br J Gen Practice: J Royal Coll Gen Pract*. 2006;56:950–957.
112. Brooks-Gunn J, Ruble DN. The development of menstrual–related beliefs and behaviors during early adolescence. *Child Dev*. 1982;53:1567–1577.
113. Uskul AK. Women's menarche stories from a multicultural sample. *Soc Sci Med*. 2004;59:667–679.
114. McMaster J, Cormie K, Pitts M. Menstrual and premenstrual experiences of women in a developing country. *Health Care Women Int*. 1997;18: 533–541.
115. Garg S, Sharma N, Sahay R. Socio-cultural aspects of menstruation in an urban slum in Delhi, India. *Reprod Health Matters*. 2001;9:16–25.
116. Moawed S. Indigenous practices of Saudi girls in Riyadh during their menstrual period. *East Mediterranean Health J*. 2001;7:197–203.
117. Irinoye OO, Ogungbemi A, Ojo AO. Menstruation: knowledge, attitude and practices of students in Ile-Ife, Nigeria. *Niger J Med*. 2003;12:43–51.
118. Marvan ML, Cortes-Iniestra S, Gonzalez R. Beliefs about and attitudes toward menstruation among young and middle-aged Mexicans. *Sex Roles*. 2005;53:273–279.
119. Simes MR, Berg DH. Surreptitious learning: menarche and menstrual product advertisements. *Health Care Women Int*. 2001;22:455–469.
120. Chrisler JC, Levy KB. The media construct a menstrual monster: a content analysis of PMS articles in the popular press. *Women Health*. 1990;16:89–104.
121. Anson O. Exploring the bio-psycho–social approach to premenstrual experiences. *Soc Sci Med*. 1999;49:67–80.
122. Sigmon ST, Dorhofer DM, Rohan KJ, et al. The impact of anxiety sensitivity, bodily expectations, and cultural beliefs on menstrual symptom reporting: a test of the menstrual reactivity hypothesis. *J Anxiety Disord*. 2000;14:615–633.
123. Sigmon ST, Dorhofer DM, Rohan KJ, et al. Psychophysiological, somatic, and affective changes across the menstrual cycle in women with panic disorder. *J Consult Clin Psychol*. 2000;68:425–431.
124. Sigmon ST, Rohan KJ, Boulard NE, et al. Menstrual reactivity: the role of gender-specificity, anxiety sensitivity, and somatic concerns in self-reported menstrual distress. *Sex Roles*. 2000;43: 143–161.
125. Koeske RW, Koeske GF. An attributional approach to moods and the menstrual cycle. *J Pers Soc Psychology*. 1975;31:473–478.
126. Ruble DN. Premenstrual symptoms: a reinterpretation. *Sci*. 1977;197:291–292.
127. Klebanov P, Jemmott J. Effects of expectations and bodily sensations on self-reports of premenstrual symptoms. *Psychology Women Q*. 1992;16: 289–310.
128. Ussher JM. Research and theory related to female reproduction: implications for clinical psychology. *Br J Clin Psychol*. 1992:31:129–151.
129. Nicolson, P. The menstrual cycle, science and femininity: assumptions underlying menstrual cycle research. *Soc Sci Med*. 1995;41:779–784.

130. Bains GK, Slade P. Attributional patterns, moods, and the menstrual cycle. *Psychosom Med*. 1988; 50:469–476.
131. Marvan ML, Escobedo C. Premenstrual symptomatology: role of prior knowledge about premenstrual syndrome. *Psychosom Med*. 1999;61:163–167.
132. Ruble DN, Brooks-Gunn J. Menstrual symptoms: a social cognition analysis. *J Behav Med*. 1979;2: 171–194.
133. Frye GM, Silverman SD. Is it premenstrual syndrome? Keys to focused diagnosis, therapies for multiple symptoms. *Postgrad Med*. 2000;107: 151–154; 157–159.
134. Fausto-Sterling A. Hormonal hurricanes: menstruation, menopause and female behavior, In Myths of Gender: Biological Theories About Women and Men. New York: Basic Books Inc; 1994.
135. Andrist LC, Arias RD, Nucatola D, et al. Women's and providers' attitudes toward menstrual suppression with extended use of oral contraceptives. *Contraception*. 2004;70:359–363.
136. Ferrero S, Abbamonte LH, Giordano M, et al. What is the desired menstrual frequency of women without menstruation-related symptoms? *Contraception*. 2006;73:537–541.
137. Lawlor S, Choi PYL. The generation gap in menstrual cycle attributions. *Br J Health Psychol*. 1998; 3:257–263.
138. Romans SE, Asllani E, Clarkson RF, et al. Women's perceptions of influences on their mood. *Women Health*. 2009;49:32–49.

Address correspondence to: Sarah E. Romans, MB, MD, Department of Psychological Medicine University of Otago, Wellington Clinical School of Medicine, 23A Mein Street, Newtown Wellington 6242, New Zealand. E-mail: sarah.romans@otago.ac.nz