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The World Health Organization Multinational Study of Breast-feeding and Lactational Amenorrhea. IV. Postpartum bleeding and lochia in breast-feeding women

*World Health Organization Task Force on Methods for the Natural Regulation of Fertility**

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Objective: To describe and compare the duration of lochia in seven groups of women; to investigate the occurrence of a possible "end-of-puerperium" bleeding episode; and to determine the frequency of bleeding episodes before postpartum day 56, which applies to the practice of the lactational amenorrhea method of contraception.

Design: Prospective longitudinal study with fortnightly follow-up, beginning within 7 days of delivery.

Setting: Five developing and two developed countries.

Patient(s): Four thousand one hundred eighteen breast-feeding women.

Intervention(s): Postpartum lochia and all days of bleeding per vaginam were recorded.

Main Outcome Measure(s): Duration of lochia, frequency of an end-of-puerperium bleeding episode, and frequency of postlochia bleeding episodes within 56 days of delivery.

Result(s): The median duration of lochia was 27 days; it varied significantly among the centers (range, 22–34 days). In 11% of the women, lochia lasted >40 days. An end-of-puerperium bleeding episode around the 40th day postpartum was reported by 20.3% of the women. Bleeding within 56 days of delivery (separated from lochia by at least 14 days) occurred in 11.3% of the women and usually was followed by a confirmatory bleeding episode 21–70 days later.

Conclusion(s): The duration of lochia varied significantly among the study populations, and long durations were not unusual. The significance of the end-of-puerperium bleeding episode is unknown. Most users of the lactational amenorrhea method will not experience a postlochia bleeding episode before postpartum day 56. (Fertil Steril® 1999;72:441–7. ©1999 by American Society for Reproductive Medicine.)

Key Words: Breastfeeding, lactation, amenorrhea, lochia, postpartum, menses, lactational amenorrhea method, LAM, international

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* See Appendix A.

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Although it has been experienced by most women who ever lived, postpartum lochia has received little attention in the medical literature. Until 1986, no attempts to measure its duration were found in publication (1). Knowledge of the normal duration of lochia can help identify when the postpartum discharge is excessively prolonged, suggesting pathology. Counseling about postpartum recovery can be enhanced by information about the duration of lochia and may improve women's preparation for the postpartum recovery process. One recent analysis of the duration of postpartum "bleeding" among 477 breast-feeding women in Manila, the Philippines, reported that the lochia endures for a median of 27 days, with nearly 10% of women still reporting lochia at 6 weeks postpartum (2). To our knowledge, the only other report of lochia duration was a study of 236 women in London, whose median duration of lochia was 33 days (1).

It is conceivable that the duration of lochia could be influenced by birth weight if a larger

fetus causes greater uterine distention than a smaller one, requiring a longer period of endometrial regeneration. Although Oppenheimer et al. (1) found a positive relation between birth weight and the duration of lochia, Visness et al. (2) did not, but they had excluded very large infants from their study. Conflicting results about the influence of parity on lochia duration also were seen between these two studies.

Because breast-feeding elicits oxytocin peaks, which cause uterine contraction as well as milk ejection, breast-feeding frequency could be expected to influence the duration of postpartum discharge. However, in the British study, the method of infant feeding used (breast versus bottle) was unrelated to the duration of lochia (1), and the frequency of breast-feeding at approximately 10 days postpartum was unrelated to lochia duration in the Manila study (2).

In some traditional societies, a bleeding episode, separate and distinct from the lochia, is anticipated and marks the end of the puerperium. This episode, at approximately 40 days postpartum, traditionally marks the end of postpartum abstinence from sexual intercourse. To our knowledge, before the Manila study, in which 26% of the parturients experienced a "sixth-week bleed" (2), no reports of such a phenomenon were available.

Postlochia bleeding in the postpartum period also holds significance for the use of the lactational amenorrhea method (LAM) of contraception. The LAM is the informed use of lactational amenorrhea as a period of contraceptive protection provided that the woman is fully or nearly fully breast-feeding her infant, for up to 6 months postpartum (3–10). In this method, any bleeding in the first 56 days (8 weeks) postpartum is ignored when determining whether the woman is amenorrheic (4). Thus, an important contraceptive question regarding the postpartum vaginal bleeding experience is whether a bleeding episode before the 56th postpartum day, which is separate and distinct from the lochia, represents the return of fertility or whether it is valid to ignore such an episode.

The main purpose of this analysis was to describe and compare the duration of postpartum lochia in seven groups of breast-feeding women and to investigate whether age, parity, birth weight, or the amount of breast-feeding affects this duration. In addition, the occurrence of a possible "end-of-puerperium" bleeding episode was examined. Finally, the occurrence of postlochia bleeding before the 56th postpartum day was explored.

MATERIALS AND METHODS

Subjects

Four thousand one hundred eighteen women were recruited into a multicenter study of the relation of breast-feeding to the return of menses (11, 12). All volunteers were healthy and delivered of healthy singleton infants. Only breast-feeding women were included in the study, and they intended to breast-feed for at least 6 months and had previously breast-fed an infant (hence there were no primiparas). The women were aged 20–37 years and were literate. They lived in Chengdu, China; Guatemala City, Guatemala; Melbourne and Sydney, Australia; New Delhi, India; Sagamu, Nigeria; Santiago, Chile; and Uppsala, Sweden.

This study was approved by the World Health Organization Secretariat Committee on Research Involving Human Subjects. Local ethical committee approval also was obtained in all centers, and all women participating in the study gave informed consent.

Study Procedures

Detailed descriptions of the study subjects, methods, and definitions used in this research were provided in earlier publications (11, 12). Procedures of specific relevance to this analysis are included here.

Women were admitted into the study within 7 days of childbirth and completed the study at the appearance of the second apparently normal menses, the occurrence of pregnancy, or their desire to leave the study. "Menstrual" diaries were kept by the women beginning on the day of admission to the study. The women were instructed to indicate in the diary any day on which they experienced bleeding or spotting per vaginam regardless of whether it resembled their previous menses. The date on which the woman reported that the lochia had ended was recorded on the follow-up record of a standard interview conducted fortnightly. No specific definition of lochia was made. The date of the end of lochia from the follow-up record was used to demarcate the lochia from the nonlochia bleeding/discharge in the menstrual diary.

The duration of lochia (in days) was determined by comparing the date of delivery with the date on which lochia ended. For each center and for all centers combined, the median duration of lochia was calculated by survival analysis (13). Observation times for subjects who started using hormonal contraception or inserted intrauterine devices were censored on the dates of such events. The median duration of lochia was compared between centers by log-rank test (13). Four potential correlates of the duration of lochia were investigated using Cox's proportional hazards regression analysis (13).

Maternal age was the woman's age at her last birthday. Parity was operationalized as her number of live births, excluding the study infant. Birth weight was approximated as the infant's weight at study admission (within 1 week postpartum), and the breast-feeding frequency used was that recorded at the time of the first follow-up visit (at approximately 3 weeks postpartum).

To estimate how commonly lochia temporarily stopped and then started again, the number of bleeding-free episodes before the cessation of lochia was determined. A bleeding-free episode was defined as one or more consecutive days during which no bleeding was reported.

TABLE 1

Duration of lochia by study center.

Study center	No. of women	Median no. of days of lochia	95% confidence interval	Minimum no. of days of lochia	Maximum no. of days of lochia	Percentage of women with lochia duration of >40 days
Chengdu	537	22	21–23	2	56	2.8
Guatemala	635	24	22–26	6	72	12.4
Melbourne/Sydney	595	31	30–32	5	90	18.7
New Delhi	533	26	25–28	3	75	8.8
Sagamu	503	23	22–24	6	80	4.8
Santiago	668	25	24–26	2	57	5.2
Uppsala	484	34	34–35	12	87	25.8
All centers	3,955	27	26–27	2	90	11.0

Note: $P<.001$ for differences among the study centers.

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To investigate the occurrence of an end-of-puerperium bleeding episode, the number and duration of nonlochial bleeding episodes within a week of postpartum day 40 (i.e., during days 33–47) were determined. A bleeding episode was defined as 1 or more consecutive days during which bleeding or spotting was reported.

The number and duration of bleeding episodes between the end of lochia and the 56th postpartum day also were determined. (In this analysis, the bleeding episode needed to be separated from lochia by at least 14 days because any bleeding within this short time after the perceived end of lochia could have been a continuation of the lochia.) To suggest whether a bleeding episode before postpartum day 56 was a potential marker for the return of fertility, it was noted whether a confirmatory bleeding episode occurred within the next 21–70 days (11, 12, 14).

RESULTS

Duration of Lochia

Of the 4,118 women admitted into the study, 3,955 (96%) reported a date on which lochia ended. Of this number, 1 woman started using hormonal contraception and 73 others had intrauterine devices inserted before the end of lochia, which resulted in their observations being censored. Among the 3,955 women, the median duration of lochia was 27 days, ranging from 22 days in Chengdu to 34 days in Uppsala (Table 1). In 11% of the women, lochia persisted for >40 days. Differences among the centers were statistically significant ($P<.001$), and further investigation of lochia duration was controlled by study center. The distributions of the duration of lochia by study center are shown in Figure 1.

The duration of lochia did not vary significantly according to the woman's age or number of live births, or to the 24-hour breast-feeding frequency reported at the first follow-up visit in any center. The infant's weight at study admission was significantly related to the duration of lochia in only two of the centers: Guatemala (risk ratio = 0.78, 95% confidence interval = 0.64–0.94) and Melbourne/Sydney (risk ratio = 0.82, 95% confidence interval = 0.68–0.98).

Among the 3,881 women with a reported date for the end of lochia (excluding the 74 subjects who started using hormonal contraception or an intrauterine device before the end of lochia), all but 89* had menstrual diaries through the date that lochia ended, leaving 3,792 (92.1% of the women admitted to the study) for whom the number of bleeding-free episodes during lochia could be determined. Overall, the women had a mean of 1.2 bleeding-free episodes during lochia, ranging from 0.6 in Chengdu to 1.9 in Sagamu. Overall, 15.1% of the women reported three or more bleeding-free episodes during lochia.

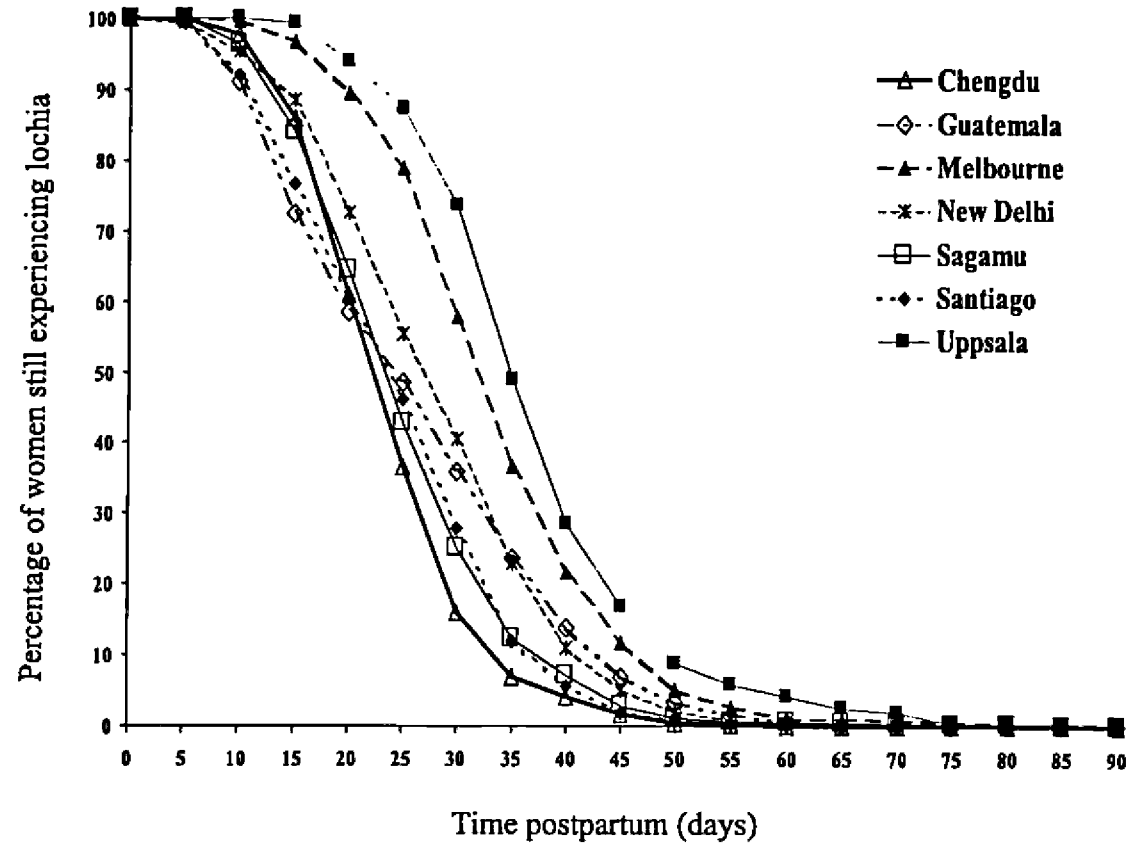
End-of-Puerperium Bleeding Episode

When we concentrated our examination on the period around the 40th postpartum day, 3,810 women (92.5% of those admitted to the study) had a reported date for the end of lochia and a menstrual diary through at least postpartum day 47 (1 week after postpartum day 40). Among these women, 29.3% (n = 1,116) had not yet finished lochia by postpartum day 33 (1 week before postpartum day 40). Among the 2,694 women who had finished lochia before postpartum day 33, 20.3% (n = 546) experienced a postlochial bleeding episode within a week of postpartum day 40 (i.e., between postpartum days 33 and 47), ranging from 3.1% in Chengdu to 51% in Santiago (Table 2). The differences among the centers were statistically significant ($\chi^2 = 438.4$, $P<.0001$). In this 2-week period, most (83.9%) of the women who experienced bleeding reported only one episode, and the episodes were a mean of 3.2 days in length (the mean length ranged from 2.5 days in Melbourne/Sydney to 3.6 days in Santiago and Uppsala).

* Most of these (n=79) were in one center (Santiago).

FIGURE 1

Percentage of women who still experienced lochia over time, by study center.



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Bleeding Before Postpartum Day 56

Three thousand seven hundred ninety-two women had both a reported date for the end of lochia and a menstrual diary through the end of the eighth postpartum week (56 days). Among these women, 1.5% (n = 55) still reported lochia at 56 days, and among the remaining 3,737 women, 25.4% (n = 950) reported at least one bleeding episode between the end of lochia and the 56th day, ranging from 5.4% in Chengdu to 63.3% in Santiago (Table 3). The differences among the centers were statistically significant ($\chi^2 = 639.9$, $P<.0001$). The mean duration of such bleeding episodes was 3.6 days, ranging from 2.7 days in Sagamu to 4.1 days in Chengdu.

Of the 3,792 women who reported a date for the end of lochia and who kept a menstrual diary through at least the 56th postpartum day, 429 (11.3%) had a bleeding episode between the end of lochia plus 14 days and the 56th postpartum day (Table 4). The proportion who experienced a bleeding episode during this interval varied significantly by

TABLE 2

Percentage of women with end-of-puerperium bleeding by number of episodes and by study center.

Study center	Percentage of women with indicated no. of bleeding episodes*					
	0	1+	1	2	3	4+
Chengdu	96.9	3.1	3.1	—	—	—
Guatemala	74.3	25.7	21.1	4.1	0.4	—
Melbourne/Sydney	78.4	21.6	16.4	3.0	1.5	0.6
New Delhi	76.4	23.6	22.8	0.3	0.5	—
Sagamu	95.9	4.1	3.4	0.7	—	—
Santiago	49.0	51.0	40.9	7.6	2.1	0.4
Uppsala	91.5	8.5	8.5	—	—	—
All centers	79.7	20.3	17.0	2.4	0.7	0.1

Note: This table includes 2,694 women whose end of lochia date was known and was earlier than postpartum day 33, and who had a menstrual diary completed through at least postpartum day 47. $P<.0001$ for the test of differences among study centers.

* One or more bleeding episodes after lochia has ended and within 1 week of postpartum day 40 (i.e., between days 33 and 47, inclusive).

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TABLE 3

Percentage of women with bleeding episodes between the end of lochia and the 56th postpartum day, by number of episodes and by study center.

	Percentage of women with indicated no. of bleeding episodes						
Study center	0	1+	1	2	3	4	5+
Chengdu	94.6	5.4	5.4	—	—	—	—
Guatemala	68.0	32.0	19.1	7.7	2.4	1.9	0.9
Melbourne/Sydney	75.4	24.6	16.9	4.7	1.7	0.9	0.3
New Delhi	71.2	28.8	27.1	1.1	0.4	0.2	—
Sagamu	91.6	8.4	6.8	0.4	0.6	0.2	0.4
Santiago	36.7	63.3	34.6	17.9	5.0	2.9	2.9
Uppsala	87.6	12.4	10.9	1.3	0.2	—	—
All centers	74.6	25.4	17.5	4.8	1.5	0.9	0.7

Note: This table includes 3,737 women whose end of lochia date was known and was earlier than 56 days postpartum, and who had a menstrual diary completed through at least postpartum day 56. $P<.0001$ for the test of differences among study centers.

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study center. In 358 of the 429 cases (83.4%), the women had yet another bleeding episode 21–70 days later (i.e., a confirmatory bleeding episode). The proportion who had a confirmatory bleeding episode also varied by center ($\chi^2 = 44.4$, $P<.0001$). In theory, if these women with the confirmatory bleeding episodes had been using the LAM and had ignored the nonlochia bleeding episode before postpartum day 56, they soon would have had another bleeding episode that disqualified them from further use of the method.

In the remaining 71 of the 429 women, the postlochia plus 14 days bleeding episode before postpartum day 56 was not followed by a confirmatory bleeding episode within 21–70 days. Had these women been using the LAM, they would have been able to continue using it. Twenty-seven of them had no subsequent bleeding during the rest of the study, whereas the remaining 44 remained amenorrheic for a median of 121 days. None of these 71 women became pregnant during the study, although not all of them were always susceptible to pregnancy.

TABLE 4

Occurrence of a confirmatory bleeding episode in women with a postlochia bleeding episode before postpartum day 56, by study center.

	Confirmatory bleeding episode within 21–70 days			
	Yes		No	
Study center	No.	Percentage	No.	Percentage
Chengdu	20	80.0	5	20.0
Guatemala	57	62.6	34	37.4
Melbourne/Sydney	46	90.2	5	9.8
New Delhi	121	93.8	8	6.2
Sagamu	11	78.6	3	21.4
Santiago	85	89.5	10	10.6
Uppsala	18	75.0	6	25.0
All centers	358	83.4	71	16.6

Note: This table includes 429 women whose end of lochia date was known, who had a menstrual diary completed through at least postpartum day 56, and who had a postlochia bleeding episode at least 14 days after the end of lochia and before postpartum day 56. $P<.0001$ for the test of differences among study centers.

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DISCUSSION

Although the duration of lochia varied significantly among the study centers, the median duration of lochia at all the centers combined was 27 days, which confirms precisely the duration reported in the Manila study (2). The study from London (1) reported a somewhat longer duration (33 days). It is of interest that the two samples of white women from developed countries had the longest durations of lochia in this study (31 days in Melbourne/Sydney and 34 days in Uppsala), similar to the British finding. The clinical significance of the disparity in lochia duration among the study centers is unclear, except for the implications of potentially excessive blood loss on the development of anemia.

This study determined that lochia usually stops and then starts again at least once in breast-feeding women, before it is completely finished. The study also showed that lochia durations of >40 days postpartum cannot be considered rare.

Because the definition of lochia was not operationalized, the date of lochia cessation was reported subjectively by the women. However, because none of the volunteers were primiparous, all had previous experience with lochia and were unlikely to have difficulty identifying it. When Oppenheimer et al. (1) asked British women to maintain a lochia diary according to color, more than one third did not report

the final phase of lochia known as "lochia alba" (a nonred, nonpink discharge) at all. It is unclear whether the women in their study—or in ours—did not have this type of lochia or whether they did not report it because they considered it to be a normal vaginal discharge. Accordingly, differences among studies, or in this analysis among centers, in the duration of lochia may be subject to a reporting bias, although it seems just as likely that these differences are valid.

No difference in lochia duration was observed according to the amount of breast-feeding recorded at approximately 3 weeks postpartum. Visness et al. (2) found no effect of breast-feeding frequency on the duration of lochia but admitted that there was little variance in this factor in their data set. In contrast, the present study found considerable variance in 24-hour breast-feeding frequency (ranging from 2–26 episodes, with a mean of 9.8 episodes and an SD of 2.9), suggesting that the absence of an effect of lactation on lochia is genuine. (Because the present study was limited to breast-feeding women, the potential difference between breast-feeding and bottle-feeding women was not addressed.) Although only one measurement of breast-feeding frequency—arbitrarily made at the first follow-up visit—was analyzed, this measure probably reflected basic differences in breast-feeding frequency within the lochia period.

Although parity and maternal age may influence some parameters of the menstrual cycle, these factors were unrelated to lochia duration in this study. Whether primiparous women experience lochia differently from women with previous live births cannot be determined from this study. An influence of birth weight on lochia duration was seen in two study centers. Although the London study did find such an effect (1), no excessively large infants were included in either the present study or the Manila analysis (2).

As in the Manila study, this analysis illustrates that one in every four or five breast-feeding women has a separate and distinct postlochia bleeding episode at the end of what is traditionally considered the postpartum period. Because the episode is not rare, it is unlikely to represent pathology. This study could not explore the clinical, social, or cultural significance of this episode. Although the variance among the centers in the reports of this postlochia bleeding episode is intriguing, the reason for it is not immediately evident.

In this study, 950 breast-feeding women (25.4%) had a postlochia bleeding episode before postpartum day 56, but when this bleeding was required to be separated from lochia by at least 14 days, this number fell to 429 (11.3%). Thus, if one considers only the bleeding episodes that are clearly separated from lochia, approximately 89% of breast-feeding women do not have such bleeding before the 56th postpartum day, and the question of whether to ignore it, if using the LAM, would not even arise.

Among the 429 women, a minority (16.6%) had no bleeding in the next 21–70 days, so if they had been using the LAM, there would have been no harm in ignoring the bleeding before postpartum day 56. However, most of the 429 women (83.4%) did experience a second bleeding episode in the next 21–70 days. This could mean either that when a bleeding episode does occur (that is clearly separated from lochia) before postpartum day 56, it is the start of cyclic bleeding, (i.e., the return of fertility) or that women can still safely ignore the bleeding before postpartum day 56 because they will experience another herald bleeding episode telling them to stop using the LAM. It cannot be deduced from this study whether the women were actually at greater risk of becoming pregnant by ignoring the bleeding episodes. There were no pregnancies among the 429 women, but these women were not always susceptible to pregnancy because they were intermittently sexually active and intermittently used contraceptive methods.

The advice to ignore bleeding episodes before the 56th postpartum day was based on studies of ovarian function during breast-feeding conducted before the Bellagio Consensus (4). Those studies observed that bleeding episodes before the 56th day were not associated with the restoration of fertility, and that the next cycle, when it occurred soon, was not fully functional. Thus, ignoring the early bleeding episode when applying the LAM guidelines was not thought to incur an additional risk of pregnancy. Although the results of the present study seem consistent with this notion, it is not possible to interpret the meaning of the absence of pregnancy under the LAM conditions when bleeding episodes that occurred before the 56th day were ignored.

The restrictions of the study related to sample selection, namely that only multiparous breast-feeding women were included, limit the findings and their generalizability. Nevertheless, this analysis is characterized by some important advantages over previous research. It is not restricted to a single population and basically comprises seven highly comparable studies. The sample studied in each country is larger than those of earlier studies, and the number of patients that were lost to follow-up was minimal. Because the major outcome measure in the project was menses, detailed information on bleeding per vaginam was collected prospectively, enabling this detailed analysis of postpartum bleeding and lochia.

This study was able to quantify the average duration of postpartum lochia at 3–5 weeks, with significant variations by population. Lochia durations of >40 days were not unusual. A separate and distinct end-of-puerperium bleeding episode occurred in one of every four or five women, although it is unclear how this phenomenon is clinically, socially, or culturally significant. Most LAM users will not experience a postlochia bleeding episode before postpartum day 56. Every difference in postpartum lochia or bleeding explored here by study center was statistically significant.

The meaning of such variation, by race or other local factors, is as yet unappreciated.

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References

1. Oppenheimer LW, Sherriff EA, Goodman JDS, Shah D, James C. The duration of lochia. B J Obstet Gynaecol 1986;93:754–7.
2. Visness CM, Kennedy KI, Ramos R. The duration and character of postpartum bleeding among breast-feeding women. Obstet Gynecol 1997;89:159–63.
3. Consensus Statement: breast-feeding as a family planning method. Lancet 1988;8621:1204–5.
4. Kennedy KI, Rivera R, McNeilly AS. Consensus statement on the use of breast-feeding as a family planning method. Contraception 1989;39: 477–95.
5. Kennedy KI, Labbok MH, Van Look PFA. Consensus statement—lactational amenorrhea method for family planning. Int J Gynecol Obstet 1996;54:55–7.
6. Labbok M, Cooney K, Coly S. Guidelines for breast-feeding and the lactational amenorrhea method. 3rd ed. Washington, DC: Institute for Reproductive Health, 1994.
7. Perez A, Labbok MH, Queenan JT. Clinical study of the lactational amenorrhea method for family planning. Lancet 1992;339:968–70.
8. Kazi A, Kennedy KI, Visness CM, Khan T. Effectiveness of the lactational amenorrhea method in Pakistan. Fertil Steril 1995;64:717–23.
9. Ramos R, Kennedy KI, Visness CM. Effectiveness of lactational amenorrhea in preventing pregnancy in Manila, The Philippines. Br M J 1996;313:909–12.
10. Labbok MH, Hight-Laukaran V, Peterson AE, Fletcher V, von Hertzen H, Van Look PFA. Multicenter study of the lactational amenorrhea method (LAM): I. efficacy, duration and implications for clinical application. Contraception 1997;55:327–36.
11. World Health Organization Task Force on Methods for the Natural Regulation of Fertility. The World Health Organization multinational study of breast-feeding and lactational amenorrhea. I. Description of infant feeding patterns and the return of menses. Fertil Steril 1998;70: 448–60.
12. World Health Organization Task Force on Methods for the Natural Regulation of Fertility. The World Health Organization multinational study of breast-feeding and lactational amenorrhea. II. Factors associated with the length of amenorrhea. Fertil Steril 1998;70:461–71.
13. Collett D. Modelling survival data in medical research. London: Chapman and Hall, 1994.
14. World Health Organization Task Force on Methods for the Natural Regulation of Fertility. The World Health Organization multinational study of breast-feeding and lactational amenorrhea. III. Pregnancy during breast-feeding. Fertil Steril 1999;72:431–40.

APPENDIX A

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