BJOG: an International Journal of Obstetrics and Gynaecology
March 2004, Vol. 111, pp. 231–238
DOI: 10.1111/j.1471-0528.2004.00063.x

Maternal morbidity during labour and the puerperium in rural homes and the need for medical attention: A prospective observational study in Gadchiroli, India

Rani A. Bang[a], Abhay T. Bang[a,*], M. Hanimi Reddy[a], Mahesh D. Deshmukh[a], Sanjay B. Baitule[a], Veronique Filippi[b]

Objectives To estimate the incidence of maternal morbidity during labour and the puerperium in rural homes, the association with perinatal outcome and the proportion of women needing medical attention.

Design Prospective observational study nested in a neonatal care trial.

Setting Thirty-nine villages in the Gadchiroli district, Maharashtra, India.

Sample Seven hundred and seventy-two women recruited over a one year period (1995–1996) and followed up from the seventh month in pregnancy to 28 days postpartum (up to 10 visits in total).

Methods Observations at home by trained village health workers, validated by a physician. Diagnosis of morbidities by computer program.

Main outcomes Direct obstetric complications during labour and the puerperium, breast problems, psychiatric problems and need for medical attention.

Results The incidence of maternal morbidity was 52.6%, 17.7% during labour and 42.9% during puerperium. The most common intrapartum morbidities were prolonged labour (10.1%), prolonged rupture of membranes (5.7%), abnormal presentation (4.0%) and primary postpartum haemorrhage (3.2%). The postpartum morbidities included breast problems (18.4%), secondary postpartum haemorrhage (15.2%), puerperal genital infections (10.2%) and insomnia (7.4%). Abnormal presentation and some puerperal complications (infection, fits, psychosis and breast problems) were significantly associated with adverse perinatal outcomes, but prolonged labour was not. A third of the mothers were in need of medical attention: 15.3% required emergency obstetric care and 24.0% required non-emergency medical attention.

Conclusions Nearly 15% of women who deliver in rural homes potentially need emergency obstetric care. Frequent (43%) postpartum morbidity, and its association with adverse perinatal outcome, suggests the need for home-based postpartum care in developing countries for both mother and baby.

INTRODUCTION

Information on maternal morbidity at home could provide the evidence necessary for planning safe motherhood outreach activities in developing countries. The data on the types and incidence of maternal morbidities in communities with limited access to health services are scarce. Estimates in developing countries vary between 16.5 pregnancy-related complications and more than 100 acute complications per maternal death.[1,2] However, maternal deaths themselves may be under-reported. International organisations anticipate that 15% of pregnancies develop complications which necessitate medical care. This estimate has not been thoroughly validated.[3,4]

Even though 63% of deliveries globally, and 75% in India, occur at home, these are rarely observed.[5,6] Most of the reported information on maternal morbidity are based on hospital deliveries or women's self-reports.[7] However, hospital deliveries are likely to be a selected group and hence not representative of the events in community. For a decade, efforts have gone into improving the measurement of morbidity through household surveys. However, retrospective data from individual interview surveys now appear of limited value for obtaining estimates of biomedical maternal morbidity in settings where a large proportion of women deliver at home. Cross sectional surveys using model questionnaires show wide differences in self-reported prevalence across countries and subpopulations.[8,9] Although it is tempting to interpret these differences as reflecting true variation in disease prevalence and health service use, a more likely explanation is the lack of robustness of using questionnaires for measuring biomedically defined morbidity. Second, validation studies have shown poor concordance of women's self-reports of obstetric complications with medical data. Morbidity on a

[a]*SEARCH, Gadchiroli, 442-605, India*
[b]*London School of Hygiene and Tropical Medicine, UK*

* **Correspodence**: Dr A. Bang, SEARCH, Gadchiroli, 442 605, India.

continuum, such as intrapartum bleeding, appears particularly difficult to ascertain because the threshold at which normal becomes abnormal may be perceived differently by women and the providers. Puerperal fever is also difficult to assess by retrospective inquiry in areas where other fevers are common.[10]

There is no satisfactory substitute for direct observation at home. So far, this has not been possible because of the absence of a suitable observer to record events during delivery and the puerperium at home. Our study aimed to estimate the type and incidence of intrapartum and postpartum maternal morbidity and the proportion of women needing medical attention during labour and puerperium when observed at home by trained village health workers in a rural area of India.

METHODS

A field trial of home-based neonatal care was conducted during 1995–1998 in rural Gadchiroli.[11] In the first year of the trial, the mothers and the neonates were prospectively observed at home in 39 villages without interventions.[12] This report is based on these observations.

The Gadchiroli district in the state of Maharashtra, India, is an underdeveloped district with Hindu and tribal farming populations. The Government health services consist of one district hospital (where a caesarean section can be performed) for a population of approximately one million, one Primary Health Centre with two non-specialist doctors per 20,000 population, and one nurse–midwife per 3000 population. In addition, private unqualified doctors provide medical treatment in villages.

Society for Education, Action and Research in Community Health (SEARCH) is a voluntary organisation working in Gadchiroli since 1986 with a community health care and research program. Male village health workers, one per 2000 population, collect vital statistics.[11] Traditional birth attendants, usually one per 500 population, were trained by SEARCH in 1988–1989 and since then they provide basic care during pregnancy, delivery and puerperium, and also treat pneumonia in children with co-trimoxizole.[13,14] Traditional birth attendants do not keep records except for the list of deliveries conducted.

In 1994, SEARCH selected 39 female village health workers in 39 intervention villages in the field trial. The village health workers had usually 5 to 10 years of school education and had permanent residence in the village. They were trained over a period of six months to interview pregnant women, record maternal history, observe and record events and time during labour and puerperium. After a pilot phase, they started collecting data in April 1995 in their own villages,[11] and collected baseline morbidity data for one year. Because most deliveries in the area were conducted by traditional birth attendants, who were associated with SEARCH, the village health workers worked in cooperation with traditional birth attendants.

The data collection methods have been published.[11,12] Here we shall describe data collection primarily in relation to mothers' health. The village health worker made a list of the pregnant women in her village and periodically updated it. She visited them during the seventh, eighth and ninth month of pregnancy and, using a structured questionnaire, recorded information on obstetric history, last date of menstruation and health complaints. The mother's height was measured using a tape measure and wooden rule.

The village health worker instructed pregnant women to inform her as soon as the mild labour pain started. She visited the woman at the onset of labour pain, asked information and, using a wrist watch, recorded the time of onset of labour pain and of rupture of membranes (*Mutondi Futne*). She, along with the traditional birth attendant, again visited when the strong labour pain started and made records. Traditional birth attendant and family members conducted the delivery, while the village health worker observed various events, practices, timings and made records on the printed form. Although hospital deliveries were uncommon, private doctors, most often unqualified, or nurses were some times called at home. They usually give oxytoxic injections to speed up the delivery. Mothers were shifted to hospitals only in desperate situations and often very late. If a doctor or nurse was called during the delivery and he/she gave treatment, or if the traditional birth attendant put her hand inside the vagina or interfered in any other way, it was recorded. The blood loss during labour was qualitatively recorded by the village health worker as normal or excessive. She also recorded whether the mother was unconscious or cold to touch at the end of delivery. Axillary temperature was recorded using a digital thermometer (Sakura, Japan).

The village health worker subsequently visited on the 2nd, 3rd, 5th, 7th, 14th, 21st and the 28th day after delivery to collect information by inquiring about and/or observing fever (axillary temperature), nature and odour of the vaginal discharge, blood loss, number of pads changed, breast problems, insomnia, abnormal speech or behaviour and fits.

All women who delivered in 39 study villages during April 1995 to March 1996 were recruited including those from other villages who had come to deliver in their parent's house. Women who went into labour in the village but were subsequently shifted to hospital, or those who, after a hospital delivery, returned to the village and spent the postpartum period in the village were also observed at home and the observed period was included in the study. We observed mothers till the completion of the neonatal period (28th day). If the mother left the village before the 28th day, the period of observation remained incomplete.

Traditional birth attendants had been trained to advise referral when indicated. SEARCH made available free

ambulance transport to the nearest Government hospital if the family wanted to shift the mother.

Once every 15 days, a physician visited every village, and therein, every house with a delivery. He checked the information recorded by the village health worker, cross checked it by questioning the mother, family and the traditional birth attendant, made his own observations and corrected and retrained village health worker if any errors were detected. To assess the quality of data collected by the village health workers, he filled parallel forms independently on 119 consecutive mothers and neonates. Information on 18 variables related to maternal morbidities was compared to estimate the agreement between village health workers and the physician.

Box 1: Case definitions

1. *Prolonged repture of membranes*: more than 24 hours between loss of water (*Mutondi Futne*) and onset of labour pain.
2. *Prolonged labour*: labour duration greater than 24 hours from the onset of mild pains to the birth of baby.
3. *Abnormal presentation*: Presenting part face, hand, shoulder, leg or breech.
4. *Retained placenta*: Placenta did not come out for more than one hour after baby's birth.
5. *Excessive bleeding on first day*: Excessive bleeding as perceived by female village health worker.
6. *Primary postpartum haemorrhage (PPH):* Excessive bleeding on first day and mother hypothermic ($<35.0^{\circ}$C) or unconscious.
7. *Secondary postpartum haemorrhage*: five days after delivery, mother used more than five pads a day or increased vaginal bleeding after bleeding had decreased or stopped; or any increase in use of pads (by at least 2) after it was less or none.
8. *Puerperal fever:* Temperature $> 37.8^{\circ}$C on any day during 2–28 days after delivery.
9. *Puerperal infection of genital tract*: Foul smelling vaginal discharge and fever; or foul smelling vaginal discharge and secondary PPH.
10. *Breast problems*: Retracted or cracked nipple (day one); or painful lumps in breast after delivery; or difficulties in breastfeeding.
11. *Need of emergency obstetric care:* Presence of primary PPH or retained placenta or prolonged labour or fits. (These complications are serious and can kill immediately.)
12. *Need of medical attention (non-emergency):* Presence of abnormal presentation or puerperal infection or psychosis or secondary PPH or breast problems with fever. (These complications are serious but do not kill immediately.)

Written consent for the observational and interventions (neonatal) studies were taken from the community leaders and women's groups in 39 villages. Ethical clearance was given by an external advisory committee formed for this study.[11,12]

We analysed the data using SPSS (version 7.1) and Epi-info (version 5.0). We used Taylor series 95% confidence intervals for relative risk and χ^2 tests with Yate's correction to compare the groups. The total number of deliveries (completed 28 weeks of gestation) in the study villages was recorded by the independent system of vital statistics collection (using male workers) which was assessed to be 99.5% complete.[11] The proportion of mothers and deliveries observed by village health workers and hence included in this study was estimated by comparing with these independent data. The mothers, studied and unstudied, were assessed for any selection bias by comparing the stillbirth rate, neonatal mortality rate and proportion of hospital delivery in the two groups.

RESULTS

A total of 1050 births (live + stillbirths) occurred in the 39 study villages from April 1995 to March 1996. Since 10 pairs of twins were born, the total was 1040 mothers delivered. Out of these, 772 (74.2%) women were recruited by village health workers into the study; 268 were not included mainly because village health workers were not aware about the pregnancy or were not informed about the delivery. This occurred most often when a woman from outside moved to the parents' house in study village a few days before delivery. Because this was the first year of the field trial of neonatal care, some families did not bother to inform village health workers about onset of delivery. The neonatal mortality rates in the births included and not included in the study were not significantly different (52.4 *vs* 47.5) but the stillbirth rates were; 24.3 *versus* 56.0; ($P < 0.02$). The proportion of women hospitalised during delivery was 5.1% (39/772) in the women observed *versus* 17.9% (48/268) in the women not observed ($P < 0.001$).

The characteristics of the 772 women studied are presented in Table 1.

Most, 733/772 (94.9%) delivered at home, and among the home delivered (percentages are out of total 772 deliveries):

- 627 (81.2%) deliveries were conducted by traditional birth attendants alone;
- 30 (3.9%) by only relative;
- 13 (1.7%) by only nurse;
- 15 (1.9%) by only doctor;
- 47 (6.1%) by nurse or doctor with traditional birth attendant;
- 1 (0.1%) information was missing.

Table 1. Socioeconomic and demographic characteristics of mothers ($n = 772$).

Characteristics	No.	%
Age (years)		
<15	1	0.1
15–19	75	9.7
20–24	337	43.7
25–29	261	33.8
≥30	92	11.9
Not recorded	6	0.8
Education		
Illiterate	468	60.6
1–4 years	89	11.5
5–10 years	197	25.5
>10 years	17	2.3
Not recorded	1	0.1
Occupation of mothers		
Agricultural work	763	98.8
Trade/craft	3	0.4
Salaried employment	5	0.7
Not recorded	1	0.1
Parity		
0	232	30.1
1–4	507	65.7
5–6	27	3.5
>6	6	0.7
Past history of		
Stillbirth	50	6.5
Neonatal death	95	12.3
No stillbirth or neonatal death	640	82.9
Height (cm)		
<135	3	0.4
135–139	5	0.6
140–144	59	7.7
145–149	310	40.2
150–154	272	35.2
>154	106	13.7
Not recorded	17	2.2
Mean height (SD)	149.6	(4.9)

Thus, 75 (9.7%) home deliveries were conducted by either a nurse or a doctor or both. Hospital deliveries, 39 out of 772 (5.1%), were conducted by a nurse or a doctor.

Hospital deliveries included in this study are those 39 (5.1%) women who delivered in the hospital but returned home and were observed in villages during the postpartum period. Out of these 39 hospital deliveries, 20 (2.6%) were shifted to hospital due to labour complications (mainly prolonged labour) even though delivery started at home, 15 (1.9%) women voluntarily went to hospital for delivery. In four (0.5%) deliveries, the reasons for hospitalisation were not recorded. Information on hospital deliveries was partly observed by village health workers and was included in the analysis.

The comparison of parallel data recorded by the village health workers and the physician on 18 maternal variables in 119 consecutive births showed a mean 94.8% agreement (range 79.5% to 100%) and mean kappa was 0.81 (SD = 0.19).

Altogether, 17.7% of the women experienced a serious complication during labour, and 42.9% had a problem during the postpartum period (Table 2). Abnormal presentation was mostly a breech (27 out of 31 cases). Although perceived excessive bleeding was recorded for 219 women (28.4%), it became life-threatening (primary postpartum haemorrhage) only in 25 (3.2%).

Medical presence or interventions at the time of labour took place in 217 (28%) cases. These included: (i) traditional birth attendants' insertion of hand to make delivery (1%); (ii) delivery attended by nurse or doctor or both at home (9.7%); (iii) nurse/doctor called at home for delivery and providing treatment to the mother (12.2%) (mainly for giving oxytoxic injections even though delivery was conducted by traditional birth attendant); (iv) hospitalisation before or during delivery (5.1%). Of these 217 women, 63 (29.0%) had a maternal labour complication documented by the village health workers.

Table 2. Maternal morbidities during labour and puerperium ($n = 772$).

Type of morbidity	No.	%	95% CI
During labour			
Prolonged rupture of membranes[a]	40	5.7	
Prolonged labour	78	10.1	
Abnormal presentation	31	4.0	
Retained placenta[b]	15	2.5	
Perceived excessive bleeding on first day	219	28.4	
Primary postpartum hemorrhage	25	3.2	
Any serious problem during labour[c]	**137**	**17.7**	**15.0–20.4**
During puerperium			
Secondary postpartum hemorrhage	117	15.2	
Puerperal fever	93	12.0	
Puerperal infection of genital tract	79	10.2	
Fits during puerperium	9	1.2	
Psychosis	2	0.3	
Severe anxiety or depression (insomnia)	57	7.4	
Breast problems	142	18.4	
Breast problems with fever	20	2.6	
Any of the above morbidities in puerperium	**331**	**42.9**	**39.4–46.4**
Any maternal morbidity in labour or puerperium[c]	**406**	**52.6**	**49.1–56.1**
A. Need of emergency obstetric care	**118**	**15.3**	**12.8–17.8**
B. Need of medical attention (non-emergency)	**185**	**24.0**	**21.0–27.0**
Total mothers in need of medical attention (A or B)	**268**	**34.7**	**31.3–38.1**

[a] Corresponding denominator is 696, information was missing on the rest.

[b] Corresponding denominator is 600.

[c] Does not include perceived excessive bleeding.

Table 3. Postpartum blood loss on different days ($n = 772$). Values are expressed in n (%).

Postpartum day	Bleeding stopped on or before	Still bleeding	Amount		
		Total	0 pads	1–4 pads	≥5 pads
2nd	97 (12.6)	675 (87.4)	6 (0.8)	653 (84.5)	16 (2.1)
3rd	96 (12.4)	676 (87.6)	6 (0.8)	666 (86.3)	4 (0.5)
5th	131 (17.0)	641 (83.0)	18 (2.3)	621 (80.4)	2 (0.3)
7th	308 (39.9)	464 (60.1)	22 (2.8)	442 (57.3)	0 (0.0)
14th	628 (81.3)	144 (18.7)	34 (4.4)	110 (14.3)	0 (0.0)
21st	715 (92.6)	57 (7.4)	25 (3.2)	32 (4.2)	0 (0.0)
28th	744 (96.4)	28 (3.6)	13 (1.7)	15 (1.9)	0 (0.0)

However, not all observed intrapartum complications were intervened upon. Cases of primary postpartum haemorrhage had the highest rate of intervention (56%) followed by prolonged labour (50%) and abnormal presentation (48.4%). Only 20% of women with retained placenta were intervened upon.

During the 28 days postpartum, 32.1% women reported foul smelling vaginal discharge, but by our case definition 10.2% had puerperal infections of genital tract. The proportion of women with breast problems was highest on the fifth day postpartum (9.1%) but most disappeared by day 28 (1.6%). Breast problems were associated with fever in 20 women (2.6%).

The duration of bleeding showed considerable variation (Table 3). Bleeding stopped between 7 and 13 days after birth in 320 (41.4%) women. However, 18.7% still had bleeding on the 14th day, and 3.6% complained of bleeding on the 28th day with half still using pads.

Altogether, 52.6% reported at least one intrapartum or postpartum morbidity and 23.7% had two or more morbidities. Acute life-threatening complications, which indicated need of emergency obstetric attention, occurred in 118 (15.3%) women; and 185 women (24.0%) needed non-emergency medical attention. Some women had both types of problem; altogether 34.7% women had indications for medical attention.

No maternal death occurred in the 772 deliveries observed by village health workers or in the 268 unobserved deliveries. However, there were19 stillbirths, 27 cases of severe birth asphyxia and 41 perinatal deaths. Abnormal presentation was strongly associated with these adverse perinatal outcomes, so were breast problems (Table 4). Purulent vaginal discharge with fever, fits and psychosis showed a significant association with stillbirths, and to a lesser degree, with perinatal deaths (not significant). Prolonged labour was not found to be associated with these outcomes.

DISCUSSION

This is the first reported study in a rural setting in a developing country where labour and the puerperium were prospectively observed at home in a systematic and objective manner to measure the incidence of maternal morbidities. The study demonstrates that rural Indian women experience a high (52.6%) burden of morbidity during

Table 4. Association of maternal morbidities with adverse perinatal outcomes. Values are expressed as relative risk (95% CI).

Maternal morbidity	Stillbirth ($n = 19$)	Severe birth asphyxia ($n = 27$)	Perinatal death ($n = 41$)
During labour			
Prolonged rupture of membranes	2.1 (0.5–8.6)	0.7 (0.1–4.7)	1.4 (0.5–4.4)
Prolonged labour	1.7 (0.5–5.6)	0.7 (0.2–3.0)	1.0 (0.4–2.6)
Abnormal presentation	10.9 (4.5–26.9)	8.3 (3.8–18.1)	8.7 (4.8–15.7)
Retained placenta	–	3.6 (0.9–14.3)	1.3 (0.2–8.9)
Primary postpartum hemorrhage	3.7 (0.9–15.3)	–	1.6 (0.4–6.1)
During puerperium			
Secondary postpartum hemorrhage	–	1.3 (0.5–3.3)	0.3 (0.1–1.2)
Puerperal fever	2.0 (0.7–5.7)	1.3 (0.5–3.6)	1.3 (0.5–2.9)
Puerperal infection			
Foul smelling vaginal discharge and fever	4.1 (1.3–13.3)	1.7 (0.4–7.0)	2.4 (0.9–6.2)
Foul smelling vaginal discharge and secondary postpartum hemorrhage	–	2.8 (1.0–7.8)	0.8 (0.2–3.3)
Fits during puerperium	10.0 (2.7–37.0)	3.3 (0.5–21.5)	4.4 (1.2–15.3)
Psychosis	21.3 (5.0–91.8)	–	10.1 (2.4–41.8)
Severe anxiety or depression (insomnia)	2.4 (0.7–7.8)	1.6 (0.5–5.3)	2.2 (1.0–5.0)
Breast problems	4.9 (2.0–11.9)	2.8 (1.3–6.0)	5.4 (3.0–9.8)

Note: ' – ' indicates RR can not be measured, as the outcome associated with the morbidity was zero.

labour and puerperium at home. While complications in labour (17.7%) were of a more serious nature, problems in the postpartum period were more frequent (42.9%). One in three women had indications for medical attention including one in six for urgent obstetric intervention because their survival was at risk. The most common complications were secondary postpartum haemorrhage, prolonged labour, puerperal infections and breast problems. Abnormal presentation and postpartum morbidities such as breast problems, puerperal infection, psychosis and fits were associated with adverse perinatal outcomes.

This study also demonstrates that, using trained village health workers, it is possible to obtain objective measurement of morbidity during childbirth. Such data have remained very scarce because prospective cohort studies to observe labour and puerperium at home in a rural area are not feasible in the absence of a trained observer present in villages.

This study has certain limitations. Our sample may under-estimate the incidence of morbidities because many hospital deliveries (48/268), which may have a higher proportion of problems, were not studied. Indeed, the proportions of hospital deliveries and stillbirths were higher in the 268 women not studied than in the 772 women studied. We also investigated a limited range of morbidities; for example, we do not have information on vaginal tears, anaemia, urinary tract infections or incontinence. Furthermore, our inquiry was limited to 28 days postpartum rather than the standard 42 days (six weeks) after delivery. Lastly, we do not report on antenatal complications such as antepartum bleeding. For all these reasons, the real incidence of morbidities may be higher. This must be kept in mind while extrapolating the results of the study.

No maternal death occurred in the observed or unobserved deliveries. This could be explained by the relatively small sample size of total deliveries (1040), and the fact that the period of observation did not include pregnancy up to six months or postpartum period beyond 28 days. Moreover, maternal deaths regularly occurred in the study area in the earlier as well as the later years. Hence, no maternal death in the reported year appears to be only a random chance occurrence.

The major strength of the study is in observing and following up women at home. The short timeframe of childbirth is a major difficulty in the measurement of intrapartum maternal complications. Researchers found it difficult to be with women at home at the time of delivery to observe morbidities.[6,7] Because SEARCH health workers were residents of the same village and worked alongside long-established traditional birth attendants, they were well accepted by the population and could be present at the time of delivery. Even then, information on some events could be recorded only in 600 out of 772 women. (Table 2). Information about duration of labour, retained placenta, temperature and degree of haemorrhage were directly observed and measured objectively. We used rigorous but practical case definitions of maternal morbidities. For example, WHO defines prolonged labour as labour lasting more than 12 hours after cervical dilatation had reached 3 cm (active labour) in spite of good uterine contractions.[15] Other definitions of 24 hours, or with a distinction between primigravidae and multigravidae are often used. As cervical dilatation was not assessed by the traditional birth attendants, we used the interval between onset of mild labour pains and delivery being greater than 24 hours as the definition of prolonged labour.

Similarly, a difficulty in the identification of postpartum haemorrhage is to establish a threshold at which normal physiological bleeding during childbirth becomes abnormal or dangerous so as to be called postpartum haemorrhage. To identify primary postpartum haemorrhage, we used maternal hypothermia or loss of consciousness associated with 'excessive bleeding' as the evidence of severity. Our definition of secondary postpartum haemorrhage uses information on the amount of blood loss indicated by the number of pads used during puerperium or increased bleeding after it had reduced or ceased.

The clinical diagnosis of puerperal infections of the genital tract is usually based on a combination of signs such as sub-involution of the uterus, uterine tenderness, purulent or foul smelling vaginal discharge and fever. In our study, we used the latter two criteria as we did not have information on sub-involution of the uterus and tenderness.

How does this study compare to others? Studies of medically defined morbidity associated with rural home deliveries (as opposed to self-reports) are rare. They include record reviews of traditional birth attendants and barefoot doctors and a randomised control trial with traditional birth attendants.[16–18] In 1965, Gordon *et al.*[19] reported a prospective study in rural Punjab, India, which used health visitors' observations or information collected by interviews on 862 home deliveries and puerperium, to estimate the incidence of morbidity. Ten percent of women had a complication during delivery and 22% a problem during the postpartum period, which was less than we found. The incidence of retained placenta (>1 hour) was 3%, similar to our findings (2.5%). However, postpartum fever was reported only in 6% women, compared with 12% in our study. Unfortunately, these studies were restricted to a particular type of complication or lacked objective measurements of complications. Thus, the Punjab study did not measure the blood loss, and did not record vaginal discharge or other evidence of infection, and thus may have under-reported morbidities.

Prual *et al.*[20] reported the incidence of severe maternal morbidity from obstetric causes in a longitudinal multicentric study with four contacts, twice during pregnancy, and one each at delivery and on 60th day postpartum in seven towns in West Africa. A very large proportion of the sampled women (80%) delivered in health institutions. The information about direct obstetric complications available

for hospital deliveries was supplemented by self-reports of complications during pregnancy and delivery or by interviews with traditional birth attendants. The authors estimated the magnitude of severe obstetric morbidity and hence the need for essential obstetric care to be 3–9%. However, this study was conducted in an urban setting with a majority of hospital deliveries. Its relevance to home deliveries in rural setting is questionable.

Our study also presents unusual data from developing country on the duration and pattern of blood loss (Table 3). A detailed study of postnatal blood loss in the UK found that 53% of women were still reporting vaginal blood loss on the 28th day after delivery, and in 35% the loss was red to pale pink.[21,22] In contrast, in our study, only 3.6% women reported continued bleeding on the 28th day. Rural Indian women may report less, because they are less likely to use white pads or observe these in adequate light. (The room in which home delivery and postnatal care are conducted is often quite dark.) Moreover, it is important to separate what may be natural and harmless from the abnormal. With our case definition, one in seven (15.2%) women in our sample had secondary postpartum haemorrhage. This could indicate other problems such as endometritis, retained products or sloughing of dead tissues after obstructed labour.

Data on the incidence of puerperal genital infections are patchy, but indicate that it usually lies between 1% and 4% but could be as high as 36% in urban settings with a high prevalence of sexually transmitted diseases.[23] In this study, we observed it to be 10.2%. We earlier found a high prevalence of various types of reproductive tract infections in women in rural Gadchiroli.[24] This, as well as retained placenta, or medical interference could be the possible causes of the observed incidence of puerperal infection in our study.

Self-reports of breast problems in developing countries range from 1% to 14%[9,19,25,26] with a variety of case definitions. In developed countries, such figures are usually higher; for example, self-reports of breast problems in a prospective study were as high as 33% on the first day in hospital and 22% at home up to eight weeks after delivery in the UK.[27] A study in Australia reported a mastitis prevalence of 17% over six months postpartum.[28] Breast problems were common (18.4%) in our sample, and declined with time as to be expected. The higher prevalence compared with other developing country data (1% to 14%) may be related to the frequency of the observations and the inclusion of engorgement (painful lumps) in our case definition. If the presence of fever along with breast problems is considered to suggest mastitis, its incidence was 2.6%, much lower than in the developed countries. Breast problems were associated with adverse outcomes, in particular, perinatal deaths and stillbirths, presumably because women had engorgements because they could not breastfeed. Alternatively, breastfeeding was not established which led to death.

Many postpartum morbidities had significant associations with adverse perinatal outcomes (Table 4). Adequate care during the postpartum period is needed for the sake of the mother as well as the neonate. Interestingly, prolonged labour was not associated with stillbirth, severe birth asphyxia or perinatal death, although it was associated with a higher proportion of medical interventions. Other studies also have found a lack of association between duration of second stage of labour and perinatal outcome.[29–33]

Our estimate of acute life-threatening complications (15.3%) appears to validate the WHO estimate that the expected number of serious obstetric complications is about 15% of the live births.[34] This 15% is the basic assumption for assessing whether the needs of pregnant women for essential obstetric services are being met. For example, the minimum acceptable standard of care for the proportion of births which should take place in health facilities has been set up at 15%.[3] Our study validates this assumption. Nevertheless, 24.0% women had other problems which also necessitate medical care, if not, emergency obstetric services.

Several studies have found a high prevalence of self-reported ill-health (from 23% to 92%) in the postpartum period.[9,25–27,35,36] This study found it to be 42.9% when observed prospectively. The difference could be partly due to local variation, but it also indicates the unreliability of the self-reported data on maternal morbidities.

In many developing countries, postpartum care is not provided to women at home. Only 17% of home-delivered women in India received a visit by health worker within two months after delivery.[37] Further research on the timing of postpartum health problems could help in deciding the timing of postnatal visits and set up targeted outreach activities for mothers at home.

SUMMARY

Our findings have three implications. First, nearly 15% women who deliver in rural homes potentially need emergency obstetric care for safe motherhood. Second, because 24.0% women needed non-emergency medical attention, it should be available to home-delivered women. And third, because 42.9% women had problems during the postpartum period, and because these were associated with adverse perinatal outcome, home-based postpartum care is necessary — both for the mother and the baby.

Acknowledgements

The authors would like to thank the women, traditional birth attendants and village health workers in the 39 study villages. The study would have been impossible without them.

Financial support for conducting the study was provided by The John D and Catherine T. MacArthur Foundation, Chicago, and The Ford Foundation, New Delhi.

Center for Population Sciences, London School of Tropical Medicine and Hygiene provided the facilities to some of the authors for data analysis. We thank Dr Rudiger Pittrof who gave useful suggestions and Tom Marshall for commenting on an earlier version of the paper.

IRB approval and Consent

This study was reviewed and ethical clearance was given by an External Advisory Committee. Written consent was taken from the leaders and women's representatives of all the 39 study villages.

References

1. Datta KK, Sharma RS, Razack PMA, Ghosh TK, Arora RR. Morbidity pattern amongst rural women in Alwar, Rajasthan — a cohort study. *Health Popul Perspect Issues* 1980;**3**:282–292.
2. Koblinsky MA, Campbell OMR, Harlow SD. Mother and more: a broader perspective on women's health. In: Koblinsky M, Timyan J, Gay J, editors. *The Health of Women: A Global Perspective*. Westview Press, Boulder: Westview Press, 1992.
3. UNICEF, WHO, UNFPA. *Guidelines for Monitoring the Availability and Use of Obstetric Services*. New York: UNICEF, 1997.
4. Wardlaw T, Maine D. Process indicators for maternal mortality programmes. In: Berer M, Sundari TK, editors. *Safe Motherhood Initiatives: Critical Issues, Reproductive Health Matters*. Oxford: Blackwell Science, 1999:102.
5. WHO. *Essential Newborn Care: Report of a Technical Working Group 1994*. Geneva: WHO, 1996.
6. International Institute of Population Sciences. *National Family Health Survey, India, 1992–93*. Bombay: International Institute of Population Sciences, 1995:237–238.
7. Fortney JA, Smith JB. Measuring maternal morbidity. In: Berer M, Sundari TK, editors. *Safe Motherhood Initiatives: Critical Issues, Reproductive Health Matters*. Oxford: Blackwell Science, 1999:43–50.
8. Stewart MK, Stanton CK, Ahmed O. Maternal health care. *DHS Comparative Studies No 25*. Calverton, Maryland: Macro International, 1997.
9. Fortney JA, Smith JB. The base of the iceberg: prevalence and perceptions of maternal morbidity in four developing countries. *The Maternal Morbidity Network*. Research Triangle Park: Family Health International, 1996.
10. Filippi V, Ronsmans C, Gandaho T, Graham W, Alihonou E, Santos P. Women's reports of severe (near-miss) obstetric complications in Benin. *Stud Fam Plann* 2000;**31**(4):309–324.
11. Bang AT, Bang RA, Baitule S, Reddy H, Deshmukh M. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *Lancet* 1999;**354**:1955–1961.
12. Bang AT, Bang RA, Baitule S, Deshmukh M, Reddy MH. Burden of morbidities and the unmet need for health care in rural neonates — a prospective observational study in Gadchiroli, India. *Indian Pediatr* 2001;**38**:952–965.
13. Bang RA, Bang AT, SEARCH team. Commentary on a community-based approach to reproductive health care. *Int J Gynecol Obstet* 1989;**3**:125–129.
14. Bang AT, Bang RA, Tale O, et al. Reduction in pneumonia mortality and total childhood mortality by means of community-based intervention trial in Gadchiroli, India. *Lancet* 1990;**336**:201–206.
15. World Health Organization care in normal birth: a practical guide. Document WHO/FRH/MSM/96.24. Geneva: WHO, 1996.
16. Wollast E, Renard F, Vandenbussche P, Buekens P. Detecting maternal morbidity and mortality by traditional birth attendants in Burkina Faso. *Health Policy Plan* 1993;**8**(2):161–168.
17. Bo-Ying L, Ai-Mei D, Jing-Ru Z. Outcomes of pregnancy in Hong-Qiao and qi-Yi communes. *AJPH* 1982;**72**(Suppl):30–32.
18. Bullough CHW, Msuku RS, Karonde L. Early suckling and postpartum haemorrhage: controlled trial in deliveries by traditional birth attendants. *Lancet* 1989:522–527.
19. Gordon JE, Gideon H, Wyon JB. Complications of childbirth and illnesses during the puerperium (in 862 Punjab village women: a field study). *J Obstet Gynaecol India* 1965;**15**(2):159–167.
20. Prual A, Bouvier-Colle MH, de Bernis L. Severe maternal morbidity from direct obstetric causes in West Africa: incidence and case fatality rates. *Bull WHO* 2000;**78**(5):593–602.
21. Alexander J, Garcia J, Marchant S. *The BliPP Study: Blood Loss in the Postnatal Period. Final Report*. Oxford: National Perinatal Epidemiology Unit, 1997.
22. Marchant S, Alexander J, Garcia J, Ashurst H, Alderdice F, Keene J. A survey of women's experiences of vaginal loss from 24 hours to three months after childbirth (the BLiPP study). *Midwifery* 1999; **15**(2):72–81.
23. Filippi V. Validation of women's perception of near-miss obstetric morbidity in South Benin [PhD Thesis]. London: London School of Hygiene and Tropical Medicine, 1999.
24. Bang RA, Bang AT, Baitule M, Choudhary Y, Sarmukaddam S, Tale O. High prevalence of gynaecological diseases in rural Indian women. *Lancet* 1989:85–87.
25. Bhatia JC, Cleland J. Obstetric morbidity in south India: results from a community survey. *Soc Sci Med* 1996;**43**(10):1507–1516.
26. Uzma A, Underwood P, Atkinson D, Thackrach R. Postpartum health in a Dhaka slum. *Soc Sci Med* 1999;**48**:313–320.
27. Glazener CMA, Abdalla M, Stroud P, Naji S, Templeton A, Russel IT. Postnatal maternal morbidity; extent, causes, prevention and treatment. *Br J Obstet Gynaecol* 1995;**102**:282–287.
28. Brown S, Lumley J. Physical health problems after childbirth and maternal depression at six to seven months postpartum. *Br J Obstet Gynaecol* 2000;**107**:1194–1201.
29. Cohen WR. Influence of the duration of second stage labour on perinatal outcome and puerperal morbidity. *Obstet Gynecol* 1977; **49**(3):266–269.
30. Menticoglou SM, Manning F, Harman C, Morrison I. Perinatal outcome in relation to second stage of labour. *Am J Obstet Gynecol* 1995;**173**(3 Pt 1):906–912.
31. Moon JM, Smith CV, Rayburn WF. Perinatal outcome after a prolonged second stage of labor. *J Reprod Med* 1990;**35**(3):229–231.
32. Saunders NSTG, Paterson CM, Wadsworth J. Neonatal and maternal morbidity in relation to the length of the second stage of labour. *Br J Obstet Gynaecol* 1992;**99**:381–385.
33. Kusiako T, Ronsmans C, Van der Paal L. Perinatal mortality attributable to complications of childbirth in Matlab, Bangladesh. *Bull WHO* 2000;**78**(5):621–627.
34. World Health Organization. *Indicators to Monitor Maternal Health Goals*. Document WHO/FHE/MSM/94.14. Geneva: WHO, 1994.
35. Goodburn EA, Chowdhury M, Gazi R, Marshall TF de C, Graham WJ, Karim F. *Maternal Morbidity in Bangladesh: An Investigation into the Nature and Determinants of Maternal Morbidity Related to Delivery and the Puerperium*. Dhaka: BRAC, 1994.
36. MacArthur C, Lewis M, Knox EG. *Health after Childbirth*. London: HMSO, 1991.
37. International Institute of Population Sciences. *National Family Health Survey (NFHS-2): Key Findings (1998–99)*. Mumbai: IIPS, 2000:14.

Accepted 15 October 2003