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CLINICAL ARTICLE

Perceptions of pregnancy complications in Haiti

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Abstract

Objective: To determine the incidence of perceived pregnancy complications and associated factors. **Methods:** During a census, 450 women identified themselves as pregnant and 388 were interviewed postpartum. **Results:** Complications were reported by 58.6%. Bleeding post-delivery was the most frequent complication (42.5%), followed by great pain (33.8%), bleeding during pregnancy (20.1%), and fever post-delivery (11.6%). Prenatal care at either a dispensary or a clinic was associated with reports of bleeding during pregnancy (odds ratio [OR] 9.06; 95% confidence interval [CI], 1.71–48.00 and OR 7.58; 95% CI, 1.53–37.48, respectively). Women who visited a doctor were less likely to report bleeding during pregnancy (OR 0.20; 95% CI, 0.08–0.55) or fever post-delivery ($P=0.015$). Herb use was associated with reported bleeding during pregnancy (OR 2.22; 95% CI, 1.12–4.40) and great pain (OR 1.94; 95% CI, 1.05–3.58). **Conclusion:** The perceived pregnancy complication rate in Haiti is high and is associated with access to health care. The association between use of herbs and pregnancy complications warrants investigation. © 2007 International Federation of Gynecology and Obstetrics. Published by Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Pregnancy complications still pose a large and under-realized burden globally. Complications occur in approximately 40% of pregnancies worldwide, and can be severe in up to 15% [1,2]. Of the 210 million women who are pregnant annually around the world, an estimated 30 million develop pregnancy complications, which are fatal in about 600,000 cases [3]. Hemorrhage, pre-eclampsia and eclampsia, and prolonged or obstructed labor are not only causes of significant

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maternal morbidity and mortality, but also contribute to perinatal and neonatal mortality [4–7].

Most of the available data about pregnancy complications in low income countries come from hospital-based data systems, record reviews, or birth logs. Few studies have examined the incidence of obstetric complications in rural communities of poorer parts of the world. In a study of pregnancy complications at the community level, which was nested in a neonatal care trial in India, 772 women were followed prospectively from the seventh month of pregnancy to 28 days postpartum. The most common intrapartum morbidities were prolonged labor, prolonged rupture of membranes, abnormal presentation and primary postpartum hemorrhage; the most common postpartum morbidities included breast problems, secondary postpartum hemorrhage, puerperal genital infections, and insomnia [8].

In a cross sectional study conducted in India, 3600 mothers of preschool-aged children were asked about complications with their last pregnancy. Approximately 10% reported symptoms of pre-eclampsia, 10% reported postpartum hemorrhage, and 17% reported symptoms of infections. Only 57% of women sought advice or treatment for excessive postpartum bleeding [9].

The present study examined the frequency of perceived complications in a cross-section of pregnant women identified through a population census in the Grand Anse region of Haiti. The overall maternal mortality ratio in Haiti is estimated to be 680/100,000 live births [10]. The Grand Anse region, located in the isolated southwest of Haiti, is thought to have the highest maternal mortality ratio, mostly because of the long distances traveled through mountains and rivers to reach health facilities.

2. Methods

This study was conducted in partnership with the Haitian Health Foundation (HHF); this is a private voluntary organization (PVO) that provides both public health and clinical maternal and child health services to the rural regions of Grand Anse in conjunction with the Ministry of Health. Between September and December of 2000, a population-based census was conducted of all participating villages in the Jeremie County of Haiti in the Grand Anse region, excluding the urban city of Jeremie. At the time of the census 57,930 people were identified, of which 11,489 (20%) were women of reproductive age. Demographic information was collected, and education and health services were provided. Women of reproductive age (15–49 years) were asked if they were currently pregnant. During the 3-month period, 450 (3.9%) women of reproductive age identified themselves as pregnant.

The study was approved by the University of Michigan Institutional Review Board, and permission was obtained from the Haitian Health Foundation. Between September and October 2002, as part of HHF programming, an attempt was made to contact the 450 women identified as pregnant during the census to retrospectively determine perceived pregnancy complications and infant outcomes. Sixty-two (13.8%) women or their families could not be found at follow-up, leaving 388 (86%) that were located and interviewed. None of the women refused to participate. The 6 women who had missing information and 3 women with possible perdition were excluded, leaving 379 women for the analysis.

Community health workers and their supervisors underwent training in the administration of the questionnaire, which had been translated into Creole, translated back into English, and field tested with women who were not participants in the study. Eligible women were located and interviewed at “health posts” (monthly gatherings where vaccinations, prenatal care, and other health services are delivered) or in their homes. If the participant was not able to answer the questions or was deceased, other adult family members were asked to function as proxies. Answers were translated into English and data were double entered.

Each interview lasted 15 to 20 min. Information on demographic and reproductive characteristics, access to service, birth status, obstetric care, and maternal complications was collected. Maternal status (alive/dead) was determined at the time of interview. Age of the mother was calculated from her stated date of birth. Information regarding prenatal care included whether the mother received any prenatal care (yes/no), number of prenatal visits, location of prenatal care (none, dispensary, clinic, rally post, hospital, or somewhere else), and the personnel from whom care was given (none, health agent, nurse, or doctor). Mothers were asked if they were referred to a doctor, by whom (none, health assistant, herself, Gebeau clinic, an idea, or educator), and whether they saw a doctor during the pregnancy. Infant vital status, at birth and at the time of the interview, as well as infant age at time of interview was also obtained. Obstetric information included mode of delivery (vaginal or cesarean), the delivery attendant (traditional birth attendant, nurse, family, or doctor), the place of delivery (home, hospital, or somewhere else), distance from place of delivery to home, and duration of labor. Women were also asked if they used herbs during delivery, whether they perceived any complications (yes/no), and whether they had a bleeding complication, seizures, fever or stuck labor, or other complications.

Descriptive statistics were calculated for perceived complications including bleeding during labor or post-delivery, having a fever during labor or post-delivery, having a tear, and having great pain, as well as for herb usage and infant deaths during the follow-up period. Cross-tabulations of each outcome by each covariate were examined using χ^2 tests to assess the strength of the association between outcomes and independent variables. Cross-tabulations between each complication were also examined. Covariates found to be associated in the bivariate analysis were tested in a multivariate model using logistic regression. Odds ratios and 95% confidence intervals for reproductive and obstetric risk factors were calculated. Data were analyzed using SPSS version 12.0.1 for Windows (SPSS Inc, Chicago, IL, USA).

3. Results

The characteristics of the study population are shown in Table 1. Maternal age at the time of the interview was between 16 and 51 years, with a mean age of 32.0 ± 7.9 . The majority of women (64.6%) were aged between 21 and 35 years. Most women (88.2%) had received at least one session of prenatal care, and nearly 71% had had at least 3 prenatal care visits. These visits were with someone they described as a nurse (56.5%). Very few (7.0%) received prenatal care from someone they described as a doctor. Prenatal care was provided at a rally post (38.8%), dispensary (22.4%), and clinic (26.1%). Thirty-five percent of women were advised to see a doctor, only half of whom (49.6%) saw a doctor at least once.

Table 1 Characteristics of the population

	Total births (n=379)	Bleed during labor	Bleed post-delivery	Fever during labor	Fever post- delivery	Great pain	Used herbs	Referred to doctor	Stillbirths	Non stillbirth deaths	Any child death
	n (%)	%	%	%	%	%	%	%	%	%	%
Total		20.1	42.5	5.0	11.6	33.8	22.6 ***	41.0	4.5	5.0	9.5
Age, years											
≤20	31 (8.2)	9.7	45.2	3.2	12.9	25.8	45.2	42.9	9.7	3.2	87.1
21–35	214 (56.5)	18.9	42.0	4.7	11.8	33.0	24.3	40.9	3.3	6.1	90.6
>35	134 (35.4)	25.2 *	44.3	6.1	11.5	38.5 *	14.5	40.9	4.5	3.7	90.8
Year of birth											
1971–1986	179 (47.2)	15.2	41.0	3.4	9.6	28.7	26.0	45.9	4.5	6.1	10.7
1951–1970	200 (52.8)	25.0	44.9	6.6	13.8	39.5	19.5	36.5	4.6 *	4.0	8.7 ***
Prenatal visits											
None	40 (11.8)	10.3	43.6	5.1	12.8	25.6	13.2	37.1	2.5	7.5	10.3
1 to 2 visits	60 (17.6)	21.7	43.3	6.7	11.7	36.7	20.0	38.3	11.7	10.0	21.7
3 to 4 visits	130 (38.2)	24.0	45.0	5.4	14.7	37.5	21.9	41.7	3.1	6.2	9.3
5 and more visits	110 (32.4)	15.5 ***	39.1 ***	5.5	10.0	31.8 ***	24.5	48.5 ***	2.7	0.9	3.6
Prenatal location											
None	40 (10.8)	10.3	43.6	5.1	12.8	25.6	13.2	37.1	2.5	7.5	10.3
Dispensary	43 (22.4)	20.5	37.3	4.8	7.2	28.9	19.3	74.1	2.4	3.6	6.0
Clinic	65 (26.1)	39.6	59.4	5.2	10.4	60.0	26.0	34.8	6.3	3.1	9.4
Rally post	64 (38.8)	10.5	35.7	4.9	16.1	23.1	23.2	25.0	4.9	6.3	11.2
Elsewhere	7 (1.9)	28.6 *	57.1	14.3	0.0	28.6	28.6	16.7 ***	0.0	14.3	14.3
Prenatal provider											
None	12 (3.2)	25.0	41.7	0.0	8.3	8.3	50.0	36.4	0.0	8.3	8.3
Health agent	123 (33.2)	12.3	33.6	6.6	11.5	28.7	24.0	46.3	4.1	6.5	10.7
Nurse	209 (56.5)	25.6	49.3	4.3	12.6	39.3	21.4	35.1	5.3	4.3	9.7
Doctor	26 (7.0)	19.2	42.3 *	3.8	3.8	30.8	15.4	72.0	3.8 **	3.8	7.7
Referral Person											
Health Personnel	101 (26.8)	12.1	34.3	5.1	6.1	29.3	19.2		7.0	4.0	11.0
Other	31 (8.2)	23.3	63.3	10.0	6.7	50.0	10.0		13.3	0.0	13.3
None	245 (65.0)	23.4 ***	43.9	4.5	14.8 *	34.6	25.6	***	2.5	6.1	8.6
Visited a doctor											
No	167 (50.4)	28.9	45.2	4.2	13.9	40.6	27.4	7.2	3.0	6.0	9.0
Yes	170 (49.6)	15.4	39.6	5.9	5.9	32.5 *	20.1	72.0	6.5 ***	3.5	10.1 ***
Mode of delivery											
Vaginal	368 (98.7)	20.7	43.5	4.9	11.7	33.8	22.7	39.9	3.8	4.6	8.4
Cesarean	5 (1.3)	0.0	20.0	0.0	0.0	80.0	20.0	80.0	40.0	20.0	60.0

Delivery location								*				
Home	359 (96.0)	20.1	43.5	5.0	12.3	33.5	23.0	39.6	4.2	4.7	8.9	
Hospital	12 (3.2)	25.0	25.0	8.3	0.0	50.0	8.3	72.7	16.7	8.3	25.0	
Somewhere else	3 (0.8)	33.3	66.7	0.0	0.0	66.7	33.3	0.0	0.0	0.0	0.0	
Delivery helper								*				
Traditional birth attendant	309 (82.6)	22.0	42.4	4.9	12.3	35.4	24.4	40.0	3.6	4.2	7.8	
Doctor or nurse	48 (12.8)	23.5	35.3	5.9	5.9	52.9	17.6	60.0	11.8	5.9	17.6	
Family	17 (4.5)	8.3	50.0	6.3	10.4	20.8	12.5	36.6	8.3	8.3	16.7	
Length of labor								*				
Up to 2 h	195 (54.5)	17.4	41.0	5.6	10.8	26.8	19.0	35.0	4.6	2.1	6.7	
Above 2 to 12 h	146 (40.8)	20.5	43.8	4.8	15.1	38.4	25.3	49.6	4.8	7.5	12.4	
More than 12 h	17 (4.7)	52.9	52.9	5.9	5.9	82.4	31.3	23.5	0.0	5.9	5.9	
Used herbs								*				
No	288 (77.4)	16.0	42.0	4.2	11.1	29.3		44.6	5.2	5.6	10.8	
Yes	84 (22.6)	33.3	45.2	8.3	14.3	50.0		28.6	2.4	2.4	4.8	
Bleed during labor			***			***	***	**				
No	298 (78.6)		33.6	4.7	11.4	21.5	18.8	44.6	5.0	4.7	9.8	
Yes	76 (20.1)		80.3	6.6	13.2	85.3	37.8	26.4	2.6	5.3	7.9	
Bleed post-delivery		***			**	***						
No	213 (57.0)	7.0		3.3	8.0	19.7	21.6	40.9	5.6	3.8	9.4	
Yes	161 (43.0)	37.9		7.5	16.8	53.8	23.9	40.0	3.1	6.2	9.4	
Fever during labor			**		***							
No	355 (93.7)	20.0	40.4		9.3	33.3	21.8	40.0	4.2	4.8	9.0	
Yes	19 (5.0)	26.3	59.6		57.9	52.6	36.8	50.0	10.5	5.3	15.8	
Fever post-delivery			**	***						*		
No	330 (87.1)	20.0	40.6	2.4		33.6	22.0	42.1	4.8	3.9	91.2	
Yes	44 (11.6)	22.7	61.4	25.0		39.5	27.3	25.8	2.3	11.4	86.4	
Had great pain		***	***				***					
No	245 (64.6)	4.5	30.2	3.7	10.6		17.1	43.2	4.5	4.9	9.4	
Yes	128 (33.8)	50.0	67.2	7.8	13.3		33.3	36.4	4.7	4.7	9.4	
Mother alive										***		
No	2 (0.5)								4.6	4.8	50.0	
Yes	377 (99.5)								0.0	50.0	9.4	

* $P < 0.05$.** $P < 0.01$.*** $P < 0.005$.

Almost all women delivered at home, with only 3.2% delivering in a hospital. In contrast to prenatal care, access to delivery care was poor with only 4.5% of women delivered by a skilled attendant. A traditional birth attendant or family member delivered 82.6% and 12.8%, respectively. Labor length was self-reported to be between 5 min to 36 h (mean 248 ± 4.8 min). Consistent with the low frequency of skilled attendants at birth, the cesarean delivery rate was 1.3%. In this population, using herbs during delivery was frequent, with 22.6% reporting that they had used herbs at some point during labor and delivery.

Both infant and maternal mortality was high. Two women (0.5%) died during the pregnancy or follow-up period, one of whose child also died during the follow-up period. A total of 358 women reported a live birth and 36 women reported that their baby was not alive at the time of the interview (101/1000 live births).

Some type of complication was self-reported by 58.6% of women. Bleeding post-delivery was the most frequent perceived complication (42.5%) and 33.8% of women reported having experienced great pain (Fig. 1). Tears (4.2%) and fever during labor (5.0%) were infrequently reported complications and were not amenable to further analysis.

The frequency of women reporting a complication during labor differed based on the way the question was asked. Of the women who originally said they did not have any labor complications (46.1%), 21 women (12%) subsequently reported having a labor complication when asked about specific symptoms. Of the women who originally said they did have labor complications (53.9%), 70 women (34.1%) did not report having any of the complication-specific symptoms.

Many of the perceived complications were associated (Table 1). Bleeding during labor was associated with great pain ($P < 0.001$). Bleeding post-delivery was associated with bleeding during labor ($P < 0.001$), fever during labor ($P = 0.009$), fever post-delivery ($P = 0.009$), and great pain ($P < 0.001$). Fever during labor was associated with fever post-delivery ($P < 0.001$).

In bivariate analysis, prenatal care location ($P = 0.004$) and referral person ($P = 0.017$) were significantly associated with bleeding post-delivery. Women who were referred to visit a doctor ($P = 0.051$) and those who visited a doctor ($P = 0.015$) were less likely to have a fever post-delivery in

bivariate analysis. None of the prenatal care and delivery characteristics factors were associated with fever during pregnancy or after delivery.

Adjusted odds ratios are shown in Table 2. Compared to women born between 1971 and 1986, older women, born between 1951 and 1970, were more likely to report bleeding during pregnancy (OR 2.75; 95% CI, 1.40–5.40). Women who received prenatal care at either a dispensary or clinic were also more likely to report bleeding during pregnancy (OR 9.06; 95% CI, 1.71–48.00 and OR 7.58; 95% CI, 1.53–37.48, respectively). Women who visited a doctor were less likely to report bleeding during pregnancy (OR 0.20; 95% CI, 0.08–0.55). Use of herbs was significantly associated with bleeding during pregnancy (OR 2.40; 95% CI, 1.17–4.92).

In the multivariate logistic regression, women who received prenatal care at a clinic were more likely to report great pain (OR 6.60; 95% CI, 2.10–20.71) than those who received no prenatal care. Being in labor for more than 12 h increased the odds of having great pain (OR 13.71; 95% CI, 2.65–71.07). Use of herbs was significantly associated with great pain (OR 2.34; 95% CI, 1.12–4.88). Bleeding during labor and post-delivery increased the odds of having great pain (OR 12.78; 95% CI, 5.43–30.05 and OR 3.63; 95% CI, 1.90–6.93, respectively).

Approximately 23% of women reported use of herbs; herb use was more common in women 20 years and under (OR 6.71; 95% CI, 2.71–16.61) and in the 21–35 years group (OR 2.18; 95% CI, 1.19–4.00) compared to women older than 35 years. Herb users were more likely to report bleeding in labor than those who did not use them (OR 2.22; 95% CI, 1.12–4.40) and great pain (OR 1.94; 95% CI, 1.05–3.58). There was no effect of herb use on infant outcome during the follow-up period. Women who were referred to a doctor were more likely not to use herbs (OR 0.43; 95% CI, 0.19–0.96).

4. Discussion

The Grand Anse region of Haiti is remote and access to emergency obstetric services is poor. The area is typical of a remote rural area in many parts of the world. This study reports the frequency of self-reported pregnancy complications in a rural community setting as determined by interviews of women who delivered an infant after being identified as pregnant during a community-based census.

Bleeding, fever, great pain, and perineal lacerations were the most commonly cited complications of pregnancy and more than half of women in the study reported having at least one complication. There was a significant association between “great pain” and bleeding both during pregnancy and after delivery. As bleeding and great pain were related to prenatal care location, access to care may increase the ability of a woman to recognize pregnancy complications. Women who perceive these symptoms may also be more likely to seek care at a particular location relative to those without the symptoms. Prenatal care location and provider were associated with referrals to doctors, and visits to doctors were associated with fewer reports of complications; however, less than half of the referred women visited a physician. This finding suggests an effective referral system, when utilized, is an important and potentially effective part of a maternal health program.

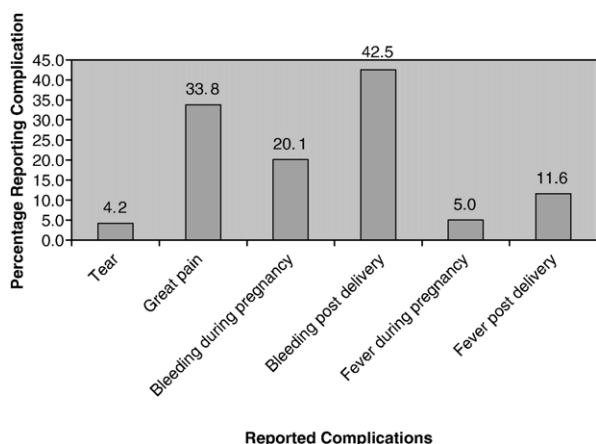


Figure 1 Frequency of reported complications.

Table 2 Adjusted odds ratio for having complications and for deaths by demographics (adjusted model included all variables with values in the column)

	Bleed during labor	Great pain	Used herbs	Referred to doctor	Stillbirths	Non stillbirth deaths	Any child death
	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Total							
Age, years			***				
≤20			6.71 (2.71–16.61)				
21–35			2.18 (1.19–4.00)				
>35			Reference				
Year of Birth	***						
1971–1986	Reference	Reference					
1951–1970	2.75 (1.40–5.40)	1.87 (0.99–3.54)					
Prenatal visits							
None					Reference	Reference	Reference
1 to 2 visits					0.28 (0.03–2.52)	2.55 (0.39–16.54)	0.30 (0.08–1.23)
3 to 4 visits					0.86 (0.09–8.05)	1.22 (0.21–6.96)	0.75 (0.19–2.94)
5 and more visits					1.87 (0.16–22.19)	0.21 (0.02–2.70)	2.91 (0.52–16.26)
Prenatal location	***	***					
None	Reference	Reference		Reference			
Dispensary	9.06 (1.71–48.00)	0.99 (0.28–3.54)		3.90 (1.04–14.67)			
Clinic	7.58 (1.53–37.48)	4.57 (1.29–16.20)		2.67 (0.65–10.95)			
Rally post	0.56 (0.12–2.59)	0.83 (0.27–2.57)		3.12 (0.87–11.13)			
Elsewhere	3.14 (0.21–47.09)	1.12 (0.09–13.38)		0.23 (0.02–3.05)			
Prenatal provider							
None	Reference	Reference		Reference			
Health agent	1.70 (0.17–17.27)	26.68 (1.89–377.17)		3.47 (0.54–22.20)			
Nurse	1.74 (0.19–16.08)	16.73 (1.27–220.69)		1.87 (0.33–10.75)			
Doctor	1.84 (0.15–21.95)	18.65 (1.00–348.19)		2.04 (0.27–15.44)			
Referral Person							
Health Personnel	0.54 (0.19–1.57)				0.36 (0.09–1.37)		
Other	1.01 (0.31–3.25)				0.20 (0.04–0.88)		
None	reference				reference		
Visited a doctor	***			***			
No	Reference			Reference			
Yes	0.20 (0.08–0.55)			40.09 (15.40–104.35)			
Mode of delivery		N/A			*		*
Vaginal		N/A			Reference		Reference
Cesarean		N/A			0.03 (0.00–0.74)		0.5 (0.00–0.84)

(continued on next page)

Table 2 (continued)

	Bleed during labor	Great pain	Used herbs	Referred to doctor	Stillbirths	Non stillbirth deaths	Any child death
	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Delivery location							
Home				Reference			
Hospital				2.71 (0.30–24.57)			
Somewhere else				N/A			
Delivery helper							
Traditional birth attendant		2.16 (0.85–5.48)					
Doctor or nurse		2.14 (0.27–17.30)					
Family		Reference					
Length of labor		***				*	
Up to 2 h	Reference	Reference		Reference		Reference	
Above 2–12 h	1.66 (0.83, 3.29)	1.75 (0.93–3.29)		1.86 (0.93–3.72)		5.26 (1.39–19.89)	
More than 12 h	2.98 (0.84, 10.56)	13.71 (2.65–71.07)		0.87 (0.16, 4.84)		5.57 (0.50–61.95)	
Used herbs	*	*		*			
No	Reference	Reference		Reference			
Yes	2.40 (1.17, 4.92)	2.34 (1.12–4.88)		0.43 (0.19–0.96)			
Bleed during labor		***	*				
No		Reference	Reference	Reference			
Yes		12.78 (5.43–30.05)	2.22 (1.12, 4.40)	0.92 (0.37–2.28)			
Bleed post-delivery		***					
No		Reference					
Yes		3.63 (1.90–6.93)					
Fever during labor							
No							
Yes							
Fever post-delivery							
No						Reference	
Yes						3.17 (0.97–10.37)	
Had great pain							
No			Reference				
Yes			1.94 (1.05–3.58)				
Mother alive						**	
No						72.30 (3.17–1648.08)	0.09 (0.01–1.49)
Yes						Reference	Reference

* $P < 0.05$.** $P < 0.01$.*** $P < 0.005$.

There was a notably low cesarean delivery rate (1.3%) among participants in this study. This rate is similar to that found in the Haiti Demographic and Health Survey of 0–1.1% in various regions [11]. High maternal mortality exists in areas with low cesarean delivery rates and indicates a lack of access to emergency obstetric care.

The association of the use of herbs and bleeding and pain during pregnancy is an important finding. The use of herbs in rural settings in low income countries is assumed to be common. For example, 80% of the population of Africa uses a traditional medicine for health care [12]. In this study, 22.6% of women used herbs at some point during labor. Further investigation into the cultural aspects of herb use with qualitative methods and bench research in the uterotonic potential of commonly used herbs is necessary to fully understand risks and potential benefits of herb use in rural regions.

The associations found in this study do not necessarily represent causality. Further research will be required to determine how knowledge of these associations can be used to improve maternal care programs in rural communities. Obstructed labor and pre-eclampsia/eclampsia were not detected through this survey. Further studies are needed to define ways to identify these complications at the community level. The interview results represent the perceptions of the participants. Validation of pregnancy complication responses at the community level would be necessary to determine the severity of the reported complications. Clinical information about the cause of deaths was also not available, as most of the deaths occurred in the home without further investigation. Maternal mortality reviews and near miss investigations are now being conducted in this region to identify areas of intervention. The use of a population-based census decreases selection bias and allowed for a follow-up rate of 86%, which is high for a rural population and indicates a low rate of out migration for women who have recently delivered. The 14% lost to follow-up rate is low, and no further information is available for that group.

From this study, it is evident that the rate of perceived complications is high. Perception of complications seems to increase when the patient has access to the health care system. The association of herb use and pregnancy complications warrants further study. In the global effort to reduce maternal mortality, community level recognition and initial

treatment of pregnancy complications is necessary to reduce the chance that complications progress to untreatable levels.

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References

- [1] UNICEF, WHO, UNFPA. Guidelines for monitoring the availability and use of obstetric services. New York: UNICEF; 1997.
- [2] Wardlaw T, Maine D. Process indicators for maternal mortality programmes. In: Berer M, Sundari T, editors. Safe motherhood initiatives: critical issues, reproductive health matters. Oxford: Blackwell Science; 1999. p. 24–30.
- [3] World Health Organization. The World Health Report 2002: reducing risks, promoting healthy life. Geneva: World Health Organization; 2002.
- [4] Anonymous. Healthier mothers and babies. *Morb Mort Wkly Rep* 1999;48:849–58.
- [5] Katz J, West Jr KP, Khatri SK, Christian P, LeClerq SC, Pradhan EK, Shrestha SR. Risk factors for early infant mortality in Sarlah District, Nepal. *Bull World Health Organ* 2003;81:717–25.
- [6] Kusiako T, Ronsmans C, Van der Paal L. Perinatal mortality attributable to complications of childbirth in Matlab, Bangladesh. *Bull World Health Organ* 2000;78:621–7.
- [7] Marsh DR, Darmstadt GL, Moore J, Daly P, Oot D, Tinker A. Advancing newborn health and survival in developing countries: a conceptual framework. *J Perinatol* 2002;22:572–6.
- [8] Bang RA, Bang AT, Reddy MH, Deshmukh MD, Baitule SB, Filippi V. Maternal morbidity during labour and the puerperium in rural homes and the need for medical attention: a prospective observational study in Gadchiroli, India. *BJOG* 2004;111:231–8.
- [9] Bhatia JC, Cleland J. Obstetric morbidity in south India: results from a community survey. *Soc Sci Med* 1996;43:1507–16.
- [10] World Health Organization. Maternal Mortality in 2000: estimates developed by WHO, UNICEF, UNFPA. Geneva: World Health Organization; 2004.
- [11] Stanton CK, Dubourg D, De Brouwere V, Pujades M, Ronsmans C. Reliability of data on caesarean sections in developing countries. *Bull World Health Organ* 2005;83:449–55.
- [12] World Health Organization. WHO traditional medicine strategy 2002–2005. Geneva: World Health Organization; 2002.