International Journal of Gynecology and Obstetrics xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

CLINICAL ARTICLE

Community survey on awareness and use of obstetric ultrasonography in rural Sarlahi District, Nepal

Naoko Kozuki [a], Joanne Katz [a,*], Subarna K. Khatry [b], James M. Tielsch [c], Steven C. LeClerq [a,b], Luke C. Mullany [a]

[a] Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA
[b] Nepal Nutrition Intervention Project – Sarlahi, Lalitpur, Nepal
[c] Department of Global Health, George Washington University Milken Institute School of Public Health, Washington, DC, USA

ARTICLE INFO

Article history:
Received 12 October 2015
Received in revised form 11 January 2016
Accepted 27 April 2016

Keywords:
Global health
Intrapartum-related complications
Maternal health
Neonatal health
Ultrasonography

ABSTRACT

Objective: To assess levels of awareness and use of obstetric ultrasonography in rural Nepal. *Methods:* Between March 2014 and March 2015, a cross-sectional survey was conducted among married women aged 15–40 years residing in rural Sarlahi District, Nepal, regarding their knowledge and use of obstetric ultrasonography during their most recent pregnancy. Regression analyses were conducted to identify reproductive health, socioeconomic, and other characteristics that increased the likelihood of undergoing an obstetric ultrasonographic examination. *Results:* Among 6182 women, 1630 (26.4%) had undergone obstetric ultrasonography during their most recent pregnancy, of whom 1011 (62.0%) received only one examination. Odds of receiving an ultrasonographic examination were higher among women with post-secondary education than among those with none (≥11 years' education: adjusted odds ratio [aOR] 10.28, 95% confidence interval [CI] 5.55–19.04), and among women whose husbands had post-secondary education than among those with husbands with none (≥11 years' education: aOR 1.99, 95% CI 1.47–2.69). Odds were lower among women younger than 18 years than among those aged 18–34 years (aOR 0.72, 95% confidence interval 0.59–0.90). *Conclusion:* Utilization of obstetric ultrasonography in rural Nepal was very limited. Further research is necessary to assess the potential health impact of obstetric ultrasonography in low-resource settings, while addressing limitations such as cost and misuse.

1. Introduction

Ultrasonography is an invaluable medical diagnostic technology that allows for noninvasive imaging of internal organs and other tissues. In the context of obstetric use, ultrasonography is used to confirm a pregnancy, verify multiple pregnancies, assign gestational age, monitor growth, detect fetal abnormalities, and diagnose placental or amniotic fluid problems. Even in settings where the equipment or operator skill does not enable all such examinations to be completed, a basic examination could be beneficial in both managing the prenatal period and assessing potential intrapartum-related risk. For example, early diagnosis of risk factors such as multiple pregnancy, non-cephalic presentation, and preterm birth (via gestational age dating) might be useful to inspire birth preparation in areas where access to tertiary-level care—or any facility-based care—is limited. An early examination at 10–14 weeks of pregnancy facilitates accurate gestational age dating and the detection of abnormalities, whereas later examinations (~18–22 weeks and/or ~30–34 weeks) allow an examination of fetal anatomy and growth [1].

Access to ultrasonography remains very limited in low-income countries, particularly in rural settings [2]. In Nepal, a diploma medical radiology diagnostic course was started in 1988 at the main teaching hospital in Kathmandu (Tribhuvan University Teaching Hospital), producing its first graduates in 1990 [3]. There are approximately 150 radiologists in the country (1 per ~185 000 individuals), and this small cadre is largely concentrated in Kathmandu Valley and other major cities [4]. In the USA, by contrast, more than 37 000 radiology professionals are registered with the American College of Radiology for a population of approximately 319 million [5]; the USA has approximately 20 times more radiologists per person than Nepal.

The primary aims of the present study were to describe current use and awareness of obstetric ultrasonography in rural Nepal and to identify predictors of use. A secondary aim was to understand the extent to which obstetric ultrasonography has been incorporated into prenatal care messaging at birthing centers in the study area.

2. Materials and methods

The present cross-sectional study was conducted in rural Sarlahi District, Nepal. Sarlahi District is located in the southern plains of Nepal, and its inhabitants mainly belong to the Madheshi ethnic group [6].

* Corresponding author at: Department of International Health, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe St. W5009, Baltimore, MD 21205, USA. Tel.: +1 410 955 7016.
E-mail address: jkatz1@jhu.edu (J. Katz).

http://dx.doi.org/10.1016/j.ijgo.2016.01.015
0020-7292/

Please cite this article as: Kozuki N, et al, Community survey on awareness and use of obstetric ultrasonography in rural Sarlahi District, Nepal, Int J Gynecol Obstet (2016), http://dx.doi.org/10.1016/j.ijgo.2016.01.015

The study was nested in the Nepal Oil Massage Study, a cluster-randomized community-based trial examining the impact of topical application of sunflower seed oil on neonatal mortality and morbidity as compared with traditionally used mustard seed oil (Clinicaltrials.gov NCT01177111). The parent study provides an intervention in the postpartum period, so we do not expect it to affect our findings reported here. The parent trial began enrollment in November 2010, but data for the present substudy on ultrasonography awareness and use were collected between March 1, 2014 and March 31, 2015. The parent study is still ongoing at the time of publication of the present report. Both the parent study and the substudy received ethical approval from the Johns Hopkins Bloomberg School of Public Health Institutional Review Board, Baltimore, MD, USA, and the Tribhuvan University Institute of Medicine, Kathmandu, Nepal. Owing to the low rate of female literacy in the community, the study staff verbally read the consent form to participants and the participants provided oral consent.

The study area encompasses 34 of 99 Village District Committees (an administrative unit) in the district and has a population of approximately 300 000. All married women of reproductive age (15–40 years) residing in this area were eligible for both the parent study and the present study. Eligible women were interviewed every 5 weeks to assess whether there was a missed menstrual period since the previous visit and, if so, they were offered a pregnancy test. If they tested positive, they were invited to participate in the study. Data on their anthropometry and socioeconomic status were recorded at the same visit. Families were instructed to notify the study staff immediately after delivery, and data on maternal and neonatal health and conditions during labor and delivery were collected during a home visit made right after this notification was received. During the substudy, questions on awareness and use of obstetric ultrasonography were collected at the postpartum visit.

For data analysis, the characteristics of the respondents were summarized and their survey responses on ultrasonography awareness and use were tabulated. Regression analysis was conducted, with receipt of obstetric ultrasonography during the most recent pregnancy as the outcome of interest. Seven exposure variables were assessed: number of prenatal care visits made (0, 1, 2–4, ≥5); maternal education (no formal education, 1–6 years, 7–10 years, ≥11 years); husband's education (no formal education, 1–6 years, 7–10 years, ≥11 years); socioeconomic status, as represented by ownership of *bari* (rain-fed uplands) and/or *khet* (irrigated lowlands; <1 katta, ≥1 katta [1 katta is approximately 338 m^2]) and housing structure (mainly thatch, grass, and/or branches; mainly wood, cement, and/or brick); maternal age (<18, 18 to <35, ≥35 years); gravidity (first pregnancy, 1–3 previous pregnancies, ≥4 previous pregnancies); and sex of live-born children before the index delivery (no previous live-born children, ≥1 live-born son, no live-born sons and 1–2 live-born daughters, no live-born sons and ≥3 live-born daughters). The categories for the variable "sex of live-born children" were chosen to understand whether preference for, and/or pressure to have, male children would affect use of obstetric ultrasonography. A logistic regression model was used to calculate the adjusted odds ratio (aOR) and 95% confidence interval (CI). $P<0.05$ was considered to be statistically significant. Stata version 13.0 (StataCorp, College Station, TX, USA) was used for the analyses.

Separately, to address the secondary aim, semi-structured interviews were undertaken with the highest-ranking clinician available at each of the 12 birthing centers in the study area in March 2014. All birthing centers in Nepal provide free prenatal care as well as intrapartum care. Additionally, the Safe Delivery Incentive Program has been in place since 2005; the program offers cash to women who attend four or more prenatal care visits and additional money if they deliver at a birthing center [7]. The interview guide included questions about the availability of supplies, equipment, and staff for intrapartum-related care, and about the protocol for addressing complicated deliveries. The protocol for referral for prenatal ultrasonography during prenatal care visits was also explored. The responses were organized into a matrix in Microsoft Excel 14.5.8 (Microsoft Corporation, Redmond, WA, USA), with each facility interview entered as a row and the main themes from the interview guide entered as columns, and salient themes were extracted.

3. Results

During the study period, 6182 women who had recently delivered were interviewed; 4686 (75.8%) interviews were conducted within 24 hours of delivery, 544 (8.8%) within 3 days of delivery, and 253 (4.1%) within 1 week of delivery. The mothers were young, and most had between one and three previous pregnancies (Table 1). More than two-thirds of the interviewed women had no formal education (Table 1).

Overall, 3962 (64.1%) women had heard of ultrasonography or "video X-ray" (a more commonly used term in this community). A large majority of those who had heard of ultrasonography believed that the examinations were for determining fetal position, and fewer than half reported that it was more generally for the fetus' health, for the mother's health, and/or for fetal sex determination (Table 2). More than half the women had heard about ultrasonography from their families, neighbors, and/or friends, whereas few had heard about it from certified clinical practitioners (auxiliary nurse midwives, health assistants, community medical assistants, staff nurses) or doctors (Table 2).

Among the 3962 women who had heard of ultrasonography, 3852 (97.2%) provided responses on its use. Overall, 1630 women had received an ultrasonographic examination during their most recent pregnancy, which equates to 26.4% of all women surveyed. Of those who underwent an examination, most received only one (Table 3). Approximately one-third of those who underwent an ultrasonographic examination reported that they had sought it because of physician recommendation, and almost one-half reported seeking it to check fetal position (Table 3). A small proportion reported that they received

Table 1
Characteristics of included mothers.

Characteristic	Value[a]
No. of prenatal visits during pregnancy (n=6175)	1.6 ± 0.8
0	1081 (17.5)
1	812 (13.1)
2–4	3816 (61.8)
≥5	466 (7.5)
Maternal education, y (n=6181)	2.5 ± 4.1
0	4230 (68.4)
1–6	664 (10.7)
7–10	957 (15.5)
≥11	330 (5.3)
Husband's education, y (n=6177)	4.7 ± 4.6
0	2490 (40.3)
1–6	1379 (22.3)
7–10	1703 (27.6)
≥11	605 (9.8)
Amount of land owned, katta (n=6168)[b]	16.4 ± 31.1
<1	1831 (29.7)
≥1	4337 (70.3)
Housing (n=6164)	
Mainly thatch, grass, and/or branches	4122 (66.9)
Mainly wood, cement, and/or brick	2042 (33.1)
Maternal age, y (n=6182)	23.3 ± 4.8
<18	520 (8.4)
18 to <35	5492 (88.8)
≥35	170 (2.7)
Gravidity (n=6182)	1.7 ± 1.7
First pregnancy	1761 (28.5)
1–3 previous pregnancies	3605 (58.3)
≥4 previous pregnancies	816 (13.2)
Sex of previous children (n=6181)	
≥1 live-born sons	2773 (44.9)
0 live-born sons, 1–2 live-born daughters	1222 (19.8)
0 live-born sons, ≥3 live-born daughters	246 (4.0)
No previous live-born children	1940 (31.4)

[a] Values are given as mean ± SD or number (percentage).
[b] 1 katta is equivalent to approximately 338 m^2.

Please cite this article as: Kozuki N, et al, Community survey on awareness and use of obstetric ultrasonography in rural Sarlahi District, Nepal, Int J Gynecol Obstet (2016), http://dx.doi.org/10.1016/j.ijgo.2016.01.015