

Bypassing birth centres for childbirth: an analysis of data from a community-based prospective cohort study in Nepal

Rajendra Karkee,¹ Andy H Lee^{2*} and Colin W Binns²

¹School of Public Health and Community Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal and ²School of Public Health, Curtin University, Perth, WA 6845, Australia

*Corresponding author. School of Public Health, Curtin University, GPO Box U1987, Perth, WA 6845, Australia.
E-mail: andy.lee@curtin.edu.au

Accepted 17 October 2013

Background In Nepal, women residing in rural areas tend to bypass local birth centres and deliver at urban hospitals, despite the availability of obstetric care in these centres. This study investigated the incidence of bypassing, characteristics of bypassers and their reasons for bypassing the birth centres.

Methods A prospective cohort study was undertaken in the Kaski district of central Nepal. The 353 pregnant women of 5 months or more gestation recruited from the community had access to local birth centres. They were interviewed at baseline using a structured questionnaire, and were followed up within 45 days post-partum. Comparisons were made between women who delivered at birth centres and those who gave birth at hospital. Logistic regression analysis was performed to determine the factors affecting the risk of bypassing.

Results Of the final sample of 258 participants who delivered in a health facility, 181 women (70.2%) bypassed their nearest birth centres to deliver at hospitals. Bypassers tended to be wealthy and have intrapartum complications, but the likelihood of bypassing apparently decreased by higher parity and frequent (four or more) antenatal care visits. Availability of operating facility, adequacy of medical supplies and equipment and competent health staff at the facility were the main reasons for their bypassing decision.

Conclusions The risk of bypassing for childbirth was high in central Nepal. Provision of quality and reliable emergency obstetric services together with well trained and competent staff at birth centres are recommended to reduce bypassing and pressure on the public hospital system.

Keywords Birth centre, bypassing, hospital delivery, maternity service, Nepal

KEY MESSAGES

- About 70% of pregnant women in central Nepal bypassed birth centres to deliver at urban hospitals, despite incurring additional travel time and cost. Such bypassing has led to under-utilization of birth centres with overcrowding of the public hospital.
- Several characteristics of bypassers were identified in relation to wealth, parity, frequency of antenatal care visit and intrapartum complications.

- Availability of operating facility, adequacy of medical supply and equipment, and competency of health staff were the main reasons behind the bypassing decision.
- Quality of emergency obstetric care should be improved to reduce bypassing and motivate women to deliver at local birth centres.

Introduction

Most of the maternal deaths in developing countries occur at home in rural areas (Ronsmans and Graham 2006). When women experience complications during pregnancy and childbirth at any point, referral and timely emergency management is crucial. Therefore, a core principle for maternal and newborn health programmes is a continuum of care from household and community to clinical care settings (Kerber *et al.* 2007; World Health Organization 2005). In this continuum, primary health-care centres serve as the linkage between community and referral hospital to provide obstetric care. Indeed, 'health centre intrapartum care strategy' has been advocated as 'the best bet to bring down high rates of maternal mortality' in developing countries (Campbell and Graham 2006). This strategy recommends pregnant women to deliver at those health centres capable of providing basic emergency obstetric care and are linked to referral hospitals for comprehensive emergency obstetric services. Since rural areas are characterized typically by poor physical accessibility and lack of human and material resources, especially for instrumental delivery and caesarean section, the strategy is an affordable way to provide emergency obstetric care to rural people in developing countries.

Nepal has integrated the primary health-care approach to provide essential health services through a four-tiered district health system (Karkee and Jha 2010): (1) female community health volunteers and outreach clinics in wards and villages at peripheral level, (2) health posts at village development committee level, (3) primary health-care centres at *illaka* level and (4) district hospitals at district headquarters. Under this system, continuum of maternity care comprises female community health volunteers who counsel on antenatal care and birth preparation; provision of antenatal and post-natal care at health posts; provision of antenatal, delivery and post-natal care at primary health-care centres and provision of comprehensive emergency obstetric services at district hospitals (KC *et al.* 2011). Selected health centres have been upgraded to provide normal delivery services or basic emergency obstetric care (Rath *et al.* 2007). Staff nurses and auxiliary nurses with additional training on midwifery skills, who are qualified as skilled birth attendants, lead the obstetric care in such birth centres in Nepal (MoHP [Nepal] 2006).

Primary health-care centres are not frequently accessed in many developing countries (Ager and Pepper 2005). Consumers often 'bypass' such centres to seek health services at hospitals (Akin and Hutchinson 1999; Bronstein and Morrisey 1991; Hotchkiss *et al.* 2007; Kahabuka *et al.* 2011; Leonard *et al.* 2002). Similarly, many women bypass local facilities to access delivery service at hospital farther away (Murray and Pearson 2006; Parkhurst and Sengooba 2009). In Nepal, despite the availability of emergency obstetric care service in local birth centres, women residing nearby still prefer to deliver at a hospital in the district health quarters (Department of Community Medicine and Family Health 2004; Family Health Division/Nepal Health

Sector Support Programme 2013). However, the extent and reasons of bypassing for childbirth have not been adequately investigated. The present study aimed to determine the incidence of bypassing, identify the characteristics of bypassers and examine their reasons for bypassing the local birth centres.

Methods

Study setting

Nepal is a low-income country in South Asia with diversified ecology and ethnicity. Hills and mountains make up 75% of the land which is difficult to access and pose challenges for health service provision. About 83% of the population lives in rural areas (Central Bureau of Statistics 2012). Maternal delivery services are free at all public and selected private health facilities. Monetary incentives are also offered to women who have attended the recommended four antenatal care visits and delivered at a health facility under the 'safe motherhood program' (MoHP [Nepal] 2011).

This study was conducted in the Kaski district of the Western Development Region of Nepal, a hilly area with a population of 490 429 and literacy rate of 82% according to the latest census (Central Bureau of Statistics 2012). There are about 117 500 females aged 15–49 years in the district with 13 800 expected pregnancies annually. The district is administratively divided into 42 village development committees (VDC) and 2 municipalities. About half the population lives in urban areas in the central valley which houses the two municipalities and a few VDCs. The rest of the VDCs spread out into the rural hilly terraces. The central valley, called Pokhara, has a public hospital and two teaching hospitals of private medical colleges. These three hospitals serve as referral hospitals for emergency obstetric care. In particular, the public hospital is a popular site for delivery, receiving 7500 delivery cases with an average of 85% bed occupancy rate in maternity wards between July 2011 and August 2012 (Family Health Division/Nepal Health Sector Support Programme 2013).

For the purpose of health service provision, the District Public Health Office of Kaski has divided the rural district into 13 'illakas'. Each 'illaka' includes several VDCs and at least one functioning 'birth centre' to provide free basic obstetric care services. Rural areas are connected with the central urban valley by non-gravelled roads, but transportation is infrequent and often obstructed during the monsoon season.

Study design and participants

A community-based prospective cohort study of maternity service utilization was undertaken between December 2011 and October 2012, when 701 women of 5 months or more pregnancy were recruited from six wards in Pokhara and seven *illakas* in the rural district. Details of the sampling strategy has been explained elsewhere (Karkee *et al.* 2013). The present

study focused on the subgroup of 353 women whose nearest health facility from their residence was a 'birth centre'. Comparisons were then made between women who delivered at birth centres and those who gave birth at hospital. The project was approved by the Human Research Ethics Committee of Curtin University (approval number HR 130/2011), Ethical Review Board of Nepal Health Research Council (approval number 88/2011) and the District Public Health Office of Kaski. An information sheet was given and read to each participant before obtaining her signed or thumbprint informed consent. Confidentiality of the information provided was maintained throughout the study. Participants were assured of their freedom to withdraw without any negative consequences.

Data collection

Baseline face-to-face interviews of the cohort sought information on socio-demographic and household characteristics including income and assets, and knowledge of the nearest birth centre. A follow-up interview was conducted within 45

days post-partum to investigate their utilization of antenatal and delivery care, as well as ante-partum and intrapartum morbidities. The reasons for bypassing the birth centre and for choosing the hospital were also solicited using a structured questionnaire. Both baseline and follow-up interviews were conducted during household visits by female data enumerators, who were local residents from each selected area and trained by the first author following a standardized protocol. All of them had completed 10th-grade education and possessed basic knowledge on maternity issues. They identified and recruited pregnant women in their localities with the help of community health volunteers and through antenatal registration in the birth centres.

Statistical analysis

Table 1 lists the independent variables of interest. An asset score for socioeconomic status was generated from the first component of a principal components analysis (Filmer and Pritchett 2001), utilising questions related to household assets.

Table 1 Characteristics of bypassers and non-bypassers for childbirth in Kaski District, Nepal

Factors	Non-bypassers (<i>n</i> = 77)		Bypassers (<i>n</i> = 181)		Crude odds ratio for bypassing (95%CI)	Adjusted odds ratio for bypassing (95% CI)	<i>P</i> ^a
	<i>n</i>	%	<i>n</i>	%			
Distance to birth centre (10 min): mean, SD	64	45	54	34	0.93 (0.87, 1.02)	0.94 (0.87, 1.02)	0.172
Age (years)							0.053
15–19	15	19.5	28	15.5	1	1	
20–24	41	53.2	90	49.7	1.17 (0.56, 2.43)	1.48 (0.61, 3.60)	
25–40	21	27.3	63	34.8	1.60 (0.72, 3.57)	4.57 (1.19, 12.84)	
Education level							0.229
None/primary	26	33.8	38	21	1	1	
Secondary and above	51	66.2	143	79	1.91 (1.06, 3.46)	1.64 (0.73, 3.69)	
Parity							0.028
0	37	48.1	104	57.5	1	1	
1	22	28.6	42	23.2	0.67 (0.35, 1.28)	0.44 (0.19, 1.01)	
2–7	18	23.4	35	19.3	0.69 (0.35, 1.36)	0.25 (0.08, 0.72)	
Caste							0.157
Lower caste	28	36.4	40	22.1	1	1	
Upper caste	36	46.8	117	64.6	2.27 (1.23, 4.18)	1.91 (0.89, 4.1)	
Janajati	13	16.9	24	13.3	1.29 (0.56, 2.96)	0.95 (0.37, 2.45)	
Household wealth							0.008
Low	26	34.7	38	21.2	1	1	
High	49	65.3	141	78.8	1.96 (1.08, 3.57)	2.50 (1.27, 4.93)	
Frequency of antenatal care visit							0.019
Less than four	11	14.3	57	31.5	1	1	
Four or more	66	85.7	124	68.5	0.36 (0.17, 0.73)	0.38 (0.17, 0.85)	
Antepartum morbidity							0.977
No	63	81.8	128	70.7	1	1	
Yes	14	18.2	53	29.3	1.86 (0.96, 3.61)	1.01 (0.42, 2.41)	
Intrapartum morbidity							0.005
No	62	81.6	109	61.9	1	1	
Yes	14	18.4	67	38.1	2.72 (1.41, 5.24)	3.41 (1.44, 8.05)	

^aFrom multivariable logistic regression model with all factors included.

The asset score was then used to derive wealth level (low, high). Distance to birth centre was measured by the time (min) taken on foot and/or by vehicle to reach the facility. Education level was categorized as none or primary, secondary or above. Caste was categorized according to the government's health system classification, namely, upper caste, lower caste, janajati and religious minorities. 'Upper caste' and 'lower caste' refer to the Indo-Aryan people, whereas 'janajati' refers to Tibeto-Burman people. The term 'religious minorities' denotes Muslims and Christians, but none of our respondents belonged to this caste.

During the follow-up interview, the participants were asked if they experienced any serious complication during the antepartum and intrapartum period. Common antepartum symptoms were heavy bleeding, swollen hand and body, loss of consciousness and convulsions, blurred vision, severe headache, high fever, severe abdominal pain and severe vomiting. Intrapartum complications included heavy bleeding, prolonged labour exceeding 12 h, placenta not delivered within 30 mins, loss of consciousness and convulsions.

The outcome variable was bypassing status of the participants. In addition to descriptive statistics, comparison between bypassers and non-bypassers was made using logistic regression analysis, with both crude and adjusted odds ratios (OR) and corresponding 95% confidence intervals (CI) to profile the likelihood of bypassing the local birth centres. All statistical analyses were performed in the SPSS package version 18.

Results

Sample characteristics

The mean gestational age of the 353 women at recruitment was 28.4 weeks (range 18 to 38 weeks), who took on average 61 [standard deviation (SD) 38] min to travel to the nearest birth centre on foot and/or by vehicle if applicable. The majority (67.7%) of participants were under 25 years of age. More than half of them were expecting their first child (52%) and belonged to the upper caste (57%). About a quarter of women reported at least one complication during the current pregnancy (25.2%) and delivery (28%). Almost all (98.4%) women had made at least one antenatal care visit in the birth centres and were aware of the availability of normal delivery services.

Bypassing

Figure 1 shows the flowchart of participants and their eventual delivery location. Of the initial 353 pregnant women in the cohort, the attrition rate was 6.5% and 258 women delivered at a health facility. Within this group, 77 women (29.8%) delivered at the nearest birth centres while 181 women (70.2%) bypassed birth centres to deliver at hospitals. The bypassing percentage ranged from 20% to 100% among these birth centres. The great majority of bypassers (90.1%) delivered at the public hospital. Bypassers travelled on average 81.4 (SD 70) min to the hospitals in Pokhara valley, usually by taxi, jeep or bus, even though the nearest birth centre was located within 54 (SD 34) min of travel. The non-bypassers mainly walked or were carried to the birth centres located within 64 (SD 45) min of travel on average.

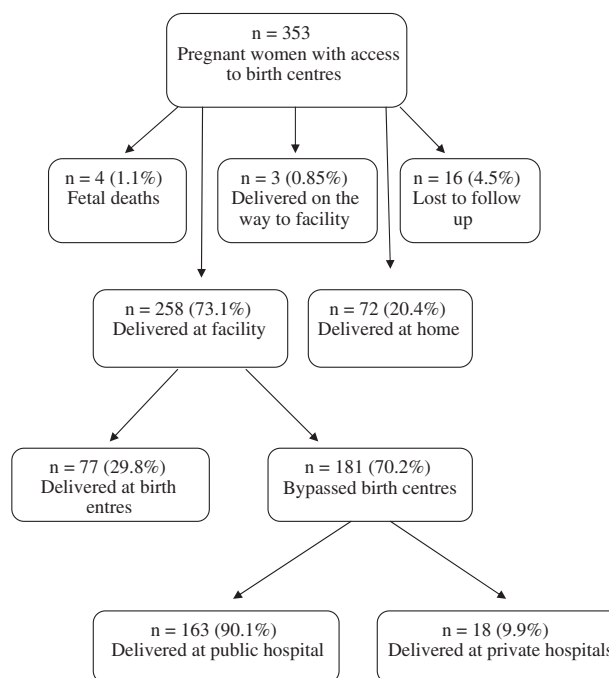


Figure 1 Flow chart of participants and their delivery location in Kaski district, Nepal, 2012

Comparison between bypassers and non-bypassers

Table 1 presents characteristics of the subgroup of 258 women who delivered at a facility with respect to bypassing status. The mean age was 23.4 (SD 3.9) years for bypassers and 22.7 (SD 4.0) years for non-bypassers. The crude odds ratios suggested that the risk of bypassing was positively associated with education level, household wealth and the presence of intrapartum morbidity, but inversely associated with the frequency of antenatal care visits, whereas the effects of age, parity, caste, distance to birth centre and presence of antepartum morbidity were not significant. However, multivariable logistic regression results confirmed that women were more likely to bypass nearest birth centres to deliver at hospital if they were relatively wealthy (OR 2.50, 95% CI 1.27–4.93) and had intrapartum complications (OR 3.41, 95% CI 1.44–8.05). Conversely, their likelihood of bypassing apparently decreased by higher parity (OR 0.25, 95% CI 0.08–0.72) and frequent (≥ 4) antenatal care visits (OR 0.38, 95% CI 0.17–0.85). The effect of education level became smaller and no longer statistically significant after adjustment for other factors, whereas a lack of evidence was found for the association between the women's age and the risk of bypassing.

Reasons for bypassing

Table 2 shows the reasons given by bypassers for their delivery decision. The most popular reason for bypassing birth centres was 'no operation facility' (75%), followed by 'inadequate drugs and equipment' (61%). Their decision to deliver at hospital was mainly due to 'adequate drugs and equipment' (85%) and 'competent health staff' (72%) at the hospital. On the other hand, attitude of the service provider appeared to have little influence on their bypassing decision.

Table 2 Reasons given by bypassers ($n = 181$) for childbirth in Kaski district, Nepal

Reasons for bypassing birth centre ^a	<i>n</i> (%)	Reasons for delivery at hospital ^a	<i>n</i> (%)
No operation facility	136 (75)	Adequate drugs and equipment	154 (85)
Inadequate drugs and equipment	111 (61)	Competent health staff	131 (72)
Not competent health staff	46 (25)	I used it before	20 (11)
Health facility not clean	5 (2)	Others used it/recommended	5 (2)
Nurse on leave at birth centre	3 (1.65)	Provider good attitude	2 (1.1)
Do not know about the facility	2 (1.1)		
Provider bad attitude	1 (0.55)		

^aMultiple responses.

Discussion

Facility delivery rates in Nepal have been increasing after removal of user fees in 2009 and introduction of incentives (Witter *et al.* 2011). Nevertheless, a recent demographic and health survey estimated only 35% of pregnant women deliver at health facilities (MoHP [Nepal] *et al.* 2012). In view of the large variations in delivery rate between districts (MoHP [Nepal] 2011), our study district appeared to have a good coverage with a facility delivery rate at 73.1%, yet 70.2% of pregnant women who delivered in facilities bypassed their nearest birth centre to deliver at hospital. This bypassing incidence was higher than previous reports in other developing countries. For example, 42.2% of rural Tanzanian mothers bypassed their nearest health facility to deliver in mission facilities and government district hospitals (Kruk *et al.* 2009a). In Kenya, between 46.3% and 59.5% of mothers residing in a rural district bypassed the municipal facility in favour of district or provincial hospitals when seeking antenatal care, infant immunization or other child health services (Audo *et al.* 2005).

Bypassing for delivery can be affected by transportation, distance and 'popularity' of the destination facility. In rural Uganda, bypassing rates were different between health facilities (Parkhurst and Ssengooba 2009). Similarly, the bypassing percentages varied substantially between birth centres in our study, which might be related to road connection in the rural areas. The public hospital in Pokhara is a regional tertiary hospital providing emergency obstetric care. It is a popular destination for delivery services among residents of Kaski and neighbouring districts (Family Health Division/Nepal Health Sector Support Programme 2013). Moreover, birth preparedness packages had been implemented in Nepal (Pradhan *et al.* 2012) and birth preparedness was found to be high in the study district (Karkee *et al.* 2013), which might partly explain the observed high facility delivery rate. However, the increased awareness could lead to a demand for high-quality care and increase the likelihood of bypassing the birth centres.

In this study, bypassers tended to be more wealthy than non-bypassers. Although delivery services are free at hospitals and women receive incentives to compensate for transportation costs, there can still be substantial costs associated with additional medicines, travelling and lodging (Borghini *et al.* 2006; Simkhada *et al.* 2012). Travel from the rural areas of Kaski district often requires hiring a taxi or jeep to avoid uncomfortable and unreliable public transport. Accommodation in the city for those accompanying the pregnant women can be

costly. Therefore, poorer families were less likely to bypass local birth centres which could incur extra costs to them. Rich individuals in Chad were similarly found to bypass low-quality health facilities in favour of more expensive higher quality facilities (Gauthier and Wane 2011). Wealth did not appear to be associated with bypassing for childbirth in Tanzania (Kruk *et al.* 2009a). However, the participants involved in that study were relatively homogeneous in terms of asset ownership and demographic characteristics. Intrapartum complications may require a lifesaving operation such as caesarean section which is currently not available in birth centres. As expected, women would seek specialist hospital care following complications at home or birth centre, and avoid the risk by delivering at hospital.

Interestingly, women with frequent antenatal care visits were less likely to bypass the birth centres. More antenatal care visits might indicate their trust and dependency on the nearby facility for service and counselling, which ultimately influences their decision to deliver at the birth centres. Our finding that higher parity reduced the likelihood of bypassing is consistent with a previous study in Tanzania (Kruk *et al.* 2009a), where higher parity women were less anxious and worried about delivery problems than their nulliparous counterparts.

In assessing obstetric care, women can be influenced by a respectful provider's attitude and availability of drugs and medical equipment (Kruk *et al.* 2009b). The main reasons for choosing hospital delivery by our bypassers were competent staff and adequacy of drugs and equipment at the urban hospitals, but not provider attitude, unlike the Tanzanian study (Kruk *et al.* 2009a) and a qualitative study in Cambodia (Ith *et al.* 2013). Within the Kaski district, women might be familiar with the local setting and have established a good relation with the birth-centre staff, so that provider attitude was not an issue, whereas the urban hospitals are often crowded with high bed occupancy rate in the maternity ward. Therefore, they bypassed because of perceived high technical quality of the hospitals. The role of perceived technical quality in bypassing the nearest health facility has been demonstrated in the literature (Ith *et al.* 2013; Jacobsen *et al.* 2012; Kruk *et al.* 2009a; Parkhurst and Ssengooba 2009). In spite of the additional travel time and cost incurred, the influx of pregnant women to public hospitals for childbirth deserves further inquiry and attention, particularly resource considerations by policymakers to cope with the increasing demand of emergency obstetric care.

Our study has several limitations. Selection bias could not be avoided because all participants were volunteers. There was inherent bias in participant response due to different interviewers despite the use of a structured questionnaire. Therefore, all data enumerators were trained by the first author to solicit information in the same manner following a standardized protocol. In this study, we did not assess the technical quality of birth facilities to confirm the perception of bypassers. Similarly, information was lacking on other potential factors which might be associated with bypassing, such as previous pregnancy complications and hospital delivery experience. Furthermore, some cases, especially women with intrapartum complications, might have been referred by birth-centre nurses to deliver at the urban hospitals. However, referral in maternity services is almost non-functional in Nepal and in practice emergency transportation has to be arranged by the patients themselves. Indeed, analysis of delivery registration data of the public hospital revealed that 98% of the cases were admitted without referral (Family Health Division/Nepal Health Sector Support Programme 2013).

Conclusion

An analysis of data from a community-based prospective cohort study found that 70% of pregnant women bypassed their nearest birth centre to deliver mainly at an urban public hospital in the Kaski district of Nepal. The risk of bypassing appeared to be related to wealth, parity, frequency of antenatal care visits, and intrapartum complications of the women, while availability of operating facility, adequacy of medical supplies and equipment and competent health staff at hospital were the underlying reasons expressed by our participants who bypassed the birth centres. To reduce bypassing and pressure on the public hospital system, provision of quality and reliable emergency obstetric services together with well trained and competent staff at local birth centres should be considered by health policymakers.

Acknowledgements

The authors are grateful to the assistance provided by staff of the District Public Health Office of Kaski, data enumerators, and participants who kindly gave their time for the interviews.

Conflict of interest

None declared.

References

Ager A, Pepper K. 2005. Patterns of health service utilization and perceptions of needs and services in rural Orissa. *Health Policy and Planning* **20**: 176–84.

Akin JS, Hutchinson P. 1999. Health-care facility choice and the phenomenon of bypassing. *Health Policy and Planning* **14**: 135–51.

Audo MO, Ferguson A, Njoroge PK. 2005. Quality of health care and its effects in the utilisation of maternal and child health services in Kenya. *East African Medical Journal* **82**: 547–53.

Borghi J, Ensor T, Neupane BD, Tiwari S. 2006. Financial implications of skilled attendance at delivery in Nepal. *Tropical Medicine and International Health* **11**: 228–37.

Bronstein JM, Morrisey MA. 1991. Bypassing rural hospitals for obstetrics care. *Journal of Health Politics, Policy and Law* **16**: 87–118.

Campbell OMR, Graham WJ. 2006. Strategies for reducing maternal mortality: getting on with what works. *The Lancet* **368**: 1284–99.

Central Bureau of Statistics. 2012. *National Population and Housing Census 2011*. Kathmandu: National Planning Commission Secretariat, Central Bureau of Statistics, Government of Nepal.

Department of Community Medicine and Family Health. 2004. *Utilisation of Emergency Obstetric Care in Selected Districts in Nepal*. Kathmandu: Institute of Medicine.

Family Health Division/Nepal Health Sector Support Programme. 2013. *Responding to Increased Demand for Institutional Childbirths at Referral Hospitals in Nepal: Situational Analysis and Emerging Options*. Kathmandu: Department of Health Services, Ministry of Health and Population [Nepal].

Filmer D, Pritchett LH. 2001. Estimating wealth effects without expenditure data-or tears: an application to educational enrollments in states of India. *Demography* **38**: 115–32.

Gauthier B, Wane W. 2011. Bypassing health providers: the quest for better price and quality of health care in Chad. *Social Science and Medicine* **73**: 540–9.

Hotchkiss DR, Piccinino L, Malaj A *et al.* 2007. Addressing the phenomenon of bypassing in Albania: the impact of a primary health care strengthening intervention. *The International Journal of Health Planning and Management* **22**: 225–43.

Ith P, Dawson A, Homer CSE. 2013. Women's perspective of maternity care in Cambodia. *Women and Birth* **26**: 71–5.

Jacobsen KH, Ansumana R, Abdirahman HA *et al.* 2012. Considerations in the selection of healthcare providers for mothers and children in Bo, Sierra Leone: reputation, cost and location. *International Health* **4**: 307–13.

Kahabuka C, Kvale G, Moland K, Hinderaker S. 2011. Why caretakers bypass primary health care facilities for child care - a case from rural Tanzania. *BMC Health Services Research* **11**: 315.

Karkee R, Jha N. 2010. Primary health care development: where is Nepal after 30 years of Alma Ata Declaration. *Journal of Nepal Medical Association* **49**: 178–84.

Karkee R, Lee A, Binns C. 2013. Birth preparedness and skilled attendance at birth in Nepal: implications for achieving Millennium Development Goal 5. *Midwifery* **29**: 1206–10.

KC A, Bhandari A, Pradhan YV *et al.* 2011. State of maternal, newborn and child health programmes in Nepal: what may a continuum of care model mean for more effective and efficient service delivery? *Journal of Nepal Health Research Council* **9**: 92–100.

Kerber KJ, de Graft-Johnson JE, Bhutta ZA *et al.* 2007. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. *The Lancet* **370**: 1358–69.

Kruk ME, Mbaruku G, McCord CW *et al.* 2009a. Bypassing primary care facilities for childbirth: a population-based study in rural Tanzania. *Health Policy and Planning* **24**: 279–88.

Kruk ME, Paczkowski M, Mbaruku G *et al.* 2009b. Women's preferences for place of delivery in rural Tanzania: a population-based discrete choice experiment. *American Journal of Public Health* **99**: 1666–72.

Leonard KL, Mliga GR, Haile Mariam D. 2002. Bypassing health centres in Tanzania: revealed preferences for quality. *Journal of African Economies* **11**: 441–71.

MoHP [Nepal]. 2006. *National Policy on Skilled Birth Attendants*. Kathmandu: Ministry of Health and Population, Government of Nepal.

- MoHP [Nepal]. 2011. *Annual Report of Department of Health Services (2010/2011)*. Kathmandu: Government of Nepal, Ministry of Health and Population.
- MoHP [Nepal], New ERA, ICF International Inc. 2012. *Nepal Demographic and Health Survey 2011*. Kathmandu, Nepal and Calverton, Maryland: Ministry of Health and Population [Nepal], New ERA, and ICF International Inc.
- Murray SF, Pearson SC. 2006. Maternity referral systems in developing countries: current knowledge and future research needs. *Social Science and Medicine* **62**: 2205–15.
- Parkhurst JO, Ssenooba F. 2009. Assessing access barriers to maternal health care: measuring bypassing to identify health centre needs in rural Uganda. *Health Policy and Planning* **24**: 377–84.
- Pradhan YV, Upreti SR, Naresh Pratap KC *et al.* 2012. Newborn survival in Nepal: a decade of change and future implications. *Health Policy and Planning* **27**(Suppl 3): iii57–71.
- Rath AD, Basnett I, Cole M *et al.* 2007. Improving emergency obstetric care in a context of very high maternal mortality: the Nepal Safer Motherhood Project 1997–2004. *Reproductive Health Matters* **15**: 72–80.
- Ronsmans C, Graham WJ. 2006. Maternal mortality: who, when, where, and why. *The Lancet* **368**: 1189–200.
- Simkhada P, van Teijlingen E, Sharma G *et al.* 2012. User costs and informal payments for care in the largest maternity hospital in Kathmandu, Nepal. *Health Science Journal* **6**: 317–34.
- Witter S, Khadka S, Nath H, Tiwari S. 2011. The national free delivery policy in Nepal: early evidence of its effects on health facilities. *Health Policy and Planning* **26**: ii84–91.
- World Health Organization. 2005. *World Health Report 2005: Make Every Mother and Child Count*. Geneva: World Health Organization.