Original research article

Do mobile family planning clinics facilitate vasectomy use in Nepal?

Sabu S. Padmadas[a,*], Fiifi Amoako Johnson[a], Tiziana Leone[b],
Govinda P. Dahal[c]

[a]*Department of Social Statistics and Demography, Centre for Global Health, Population, Poverty and Policy (GHP3), Faculty of Social & Human Sciences, University of Southampton, Southampton, United Kingdom*
[b]*Department of Social Policy, LSE Health, London School of Economics and Political Sciences, London, United Kingdom*
[c]*Institute of Population Health, University of Ottawa, Ottawa, Ontario, Canada*

Abstract

Background: Nepal has a distinct topography that makes reproductive health and family planning services difficult to access, particularly in remote mountain and hill regions where over a quarter of modern contraceptive users rely exclusively on vasectomy.
Study design: A three-level random intercept logistic regression analysis was applied on data from the 2011 Nepal Demographic and Health Survey to investigate the extent of influence of mobile family planning clinics on the odds of a male or a female sterilization, adjusting for relevant characteristics including ecological differences and random effects. The analyses included a sample of 2014 sterilization users, considering responses from currently married women of reproductive ages.
Results: The odds of a male sterilization were significantly higher in a mobile clinic than those in a government hospital (odds ratio, 1.65; 95% confidence interval, 1.21–2.25). The effects remained unaltered and statistically significant after adjusting for sociodemographic and clustering effects. Random effects were highly significant, which suggest the extent of heterogeneity in vasectomy use at the community and district levels. The odds of vasectomy use in mobile clinics were significantly higher among couples residing in hill and mountain regions and among those with three or more sons or those with only daughters.
Conclusion: Mobile clinics significantly increase the uptake of vasectomy in hard-to-reach areas of Nepal. Reproductive health interventions should consider mobile clinics as an effective strategy to improve access to male-based modern methods and enhance gender equity in family planning.
Implications: Family planning interventions in hard-to-reach communities could consider mobile clinic as an effective strategy to promote male-based modern methods. Improving access to vasectomy could substantially reduce unmet need for family planning in countries experiencing rapid fertility transition.
© 2014 Elsevier Inc. All rights reserved.

Keywords: Vasectomy; Family planning; Mobile clinics; South Asia; Demographic and health surveys; Nepal

1. Introduction

Over the last 15 years, Nepal has achieved a substantial reduction in fertility rates from 4.6 births to 2.6 births per woman [1–3]. Yet, the desired fertility stands at the replacement level of 2.1 births per woman, which implies that women have about one additional unwanted birth in their reproductive life [4]. The desire to stop having more children suggests high demand for family planning (FP) among Nepalese couples, particularly permanent methods.

Although contraceptive use is generally skewed toward females, Nepal is one of the countries in South Asia, apart from Bhutan, to have the highest prevalence of male sterilization [5]. According to the 2011 Nepal Demographic and Health Survey (NDHS), permanent methods constitute more than one-half of modern contraceptive use and about a third of all sterilized couples use vasectomy [4]. Yet, unmet contraceptive need for limiting fertility represents over two-third of total unmet need which vary considerably across population subgroups and ecological zones [4,6,7].

* Corresponding author. Division of Social Statistics and Demography, Faculty of Social and Human Sciences, University of Southampton, Highfield Campus, Southampton SO17 1BJ, United Kingdom. Tel.: +44 23 8059 4382; fax: +44 23 8059 3858.
E-mail address: S.Padmadas@soton.ac.uk (S.S. Padmadas).

One of the strategic goals of the National Family Planning Program in Nepal has been to improve access to modern contraception through mobile FP camps targeting the poorest-poor and socially excluded communities residing in geographically isolated and economically deprived areas [8,9]. FP services are generally delivered through a wide network of facilities at different levels, such as hospitals, primary health care (PHC) centers, health (sub)posts, private clinic/pharmacies, mobile camps and nongovernment organizations (NGOs) such as the Family Planning Association of Nepal (FPAN), Marie Stopes and Red Cross [9–11]. FP services in public sectors and some NGOs are available generally free of charge [12].

Sterilization services are usually offered through a network of static (fixed location), seasonal (fixed period of time) and mobile (community-based) sites. Mobile sterilization camps in Nepal have a long history spanning over three decades, and they operate mostly at the village level under the district administration [9–11]. The camps are often the major source for sterilization in remote areas with poor road network and in areas with health/subhealth units not adequately equipped to provide clinical services [12,13]. Most women who seek sterilization services in a clinic/camp in remote areas generally have little or no prior contraceptive use history [13]. Also, women in poor households discourage their husbands against vasectomy, instead choose sterilization on their own, due to fear of losing economic support from their sterilized husbands if they become ill or experience side effects [14].

Nepal has a distinct topography divided into three ecological zones: harsh terrain mountain zone, densely populated hill zone and *terai* (plain) zone where about one-half of the population resides with better access to transportation facilities [4]. The hill and mountain zones have generally poor access to health services [11–13]. These zones have relatively high fertility rates and high unmet need for limiting methods [4,6], and often mobile camps are the only convenient source for FP services [13]. In these remote areas, gynecological surgeons usually travel a long distance with the mobile unit, mostly during dry season, and offer long-term methods including vasectomy, mini-laparoscopy and laparoscopic sterilization [15]. Community health volunteers and female health workers provide information about mobile camps ahead of the schedule on a door-to-door basis [12].

A gender-oriented question arises in this context: do mobile clinics influence the type of sterilization outcome (male/female)? Although women generally exchange reproductive health experiences and interact with health workers/peers more frequently [16,17], men tend to participate in community FP camps and seek contraception either voluntarily or jointly with their spouses or through peer influence [18]. Such decisions are also determined by individual and program/supply factors, for example, education and autonomy [19,20], service standards, cash incentives [11] and other psychosocial and cultural influences including strong son preference [14,21–24]. There is also a perception that vasectomies would render men frail and potentially impair their ability to provide economic support for the family [14].

This paper investigates the influence of mobile FP clinics on vasectomy use in Nepal. We hypothesize that men use mobile FP clinics over other facilities for permanent methods than women.

2. Materials and methods

2.1. Data

Data for this study are drawn from the 2011 NDHS, which collected nationally representative data from 12,674 women aged 15–49 years [2]. Current FP users were asked specific questions about the method type and the source where the method was obtained. The reported source include the following: government hospital/clinic, PHCs, mobile clinic, NGO (FPAN, Marie Stopes, Adventist Development and Relief Agency, Nepal Red Cross and United Mission to Nepal), private clinics, pharmacy and other sources. Public–private partnerships involving NGOs also provide sterilization services through camps [12]. Unfortunately, the 2011 NDHS does not provide any information on whether sterilization services offered under the NGO sector include mobile and outreach services. This is a limitation of the present analysis. Survey instruments and sampling strategies of NDHS are reported elsewhere [4].

The present analysis initially considered 9460 currently married women, of these 50.4% reported using a method at the time of survey. Among current users (n=4787), 42% reported using sterilization — 24.9% female sterilization and 17.3% male sterilization. The final study sample constitutes 2014 sterilization users: 1194 female sterilization and 820 male sterilization users.

Both women and their spouses were asked similar questions about current contraceptive use. We consider only women responses for two reasons. First, wives generally report FP more accurately than men, although some husbands conceal their sterilization experience from their spouses/other family members. Second, NDHS interviewed men from only every second household sampled. We did not explore the male data for detailed statistical investigation since the sample size was small (n=537). Our investigation of the matched couple data showed consistency in reporting contraceptive use between husbands and wives, 89.5% and 94.9% for male and female sterilization, respectively. Interestingly, 4.5% of men reported not using male sterilization when their wives responded affirmative and 0.2% vice versa.

2.2. Measures

The outcome variable was the sterilization (male/female). Source of sterilization was the primary predictor categorized

into mobile clinic, government hospital/PHCs and NGOs/ private hospitals. Mobile FP clinics are part of the government systems coordinated by the district administrators [12,13]. The control variables included the following: residence (rural/urban); ecological zone (*terai*, hill and mountain); household wealth quintile estimated using principal components analysis based on ownership of consumer items and dwelling characteristics [25]; ethnicity differentiating respondents from socially excluded/marginalized communities [26,27]; wife's religion, her age at first cohabitation and her age at the time of husband/wife's sterilization; children's sex composition; education of husbands and wives; duration since sterilization and an autonomy indicator measuring wife's decision making power for her own health care.

2.3. Analytical approach

Multilevel logistic regression technique was used to examine the effect of sterilization source on the probability of vasectomy use, adjusting for relevant confounders and clustering effects [28]. Nonsignificant variables (wife's age, age at cohabitation and husband's age) were excluded. The variables were screened for multicolinearity before including those in the regression. Three-level binary logistic models were used considering 2014 respondents (level 1) nested in 275 communities (level 2) and 71 districts (level 3). Data clustering at the individual level did not vary significantly to those at the household level since most households had only one eligible respondent.

A sequential model building was implemented using *glmer* function in R version 2.15.1 [29], to determine whether the effect of sterilization source changes when community and district effects were accounted for along with other controls. Variance partitioning test was used to examine the effect of source of sterilisation in explaining the patterns of vasectomy use within and between community and districts.

3. Results

3.1. Descriptive

Of those who had a female sterilization, about 59% had the procedure in a government hospital, 19% in a mobile clinic and 22% in a private hospital (Table 1). In contrast, about 51% of all vasectomy users had the procedure in a government hospital, 33% in a mobile clinic and 17% in a private hospital.

About 36% of those who had vasectomy in rural areas had the procedure in a mobile clinic, and the corresponding figure in urban areas was about 11%. About 59% of those who had vasectomy in mountain areas had the procedure in a mobile clinic, where the share of overall sterilization use was also relatively high. Those who represented the poorest social strata had the highest use of vasectomy in a mobile

clinic, whereas their richest counterparts rely on government or private hospitals.

Among respondents who represent Chhetri community residing in hill areas, about 44% had vasectomy in a mobile clinic. The percentage was also relatively high among the Janajati (34%) counterpart, who represents backward communities. There was hardly any difference in vasectomy use in a mobile clinic between Hindus and non-Hindus. Among respondents with no formal education, about 40% had vasectomy in a mobile clinic when compared to those with primary (30%) or secondary school and above (18%). On the other hand, the pattern was different in the case of husband's education. Vasectomy use in a mobile clinic was relatively high among those with primary level education (44%) and low among those with secondary and above (27%). Vasectomy use in a mobile clinic was relatively high if other family members or husbands alone made the decision for wife's health care.

Couples who had two sons and a daughter represented the majority of sterilization users. Within this group, about 42% had a vasectomy in a mobile clinic when compared to those with a son and daughter (34%) or only sons (27%) or only daughters (11%). Vasectomy use in a mobile clinic was relatively high among older cohorts, reflected in wife's age at the time of spouse's sterilization. Unfortunately, the NDHS had no data on men's age at vasectomy.

3.2. Multilevel regression

The parameter estimates from a three-level random intercept logistic model are presented in Table 2. Model 1, which adjusted for the primary predictor variable and random effects, shows that the odds of a vasectomy were significantly higher in a mobile clinic than in a government hospital. Adding socioeconomic variables in model 2 reduced the variability by 23.8% at the community level and 55.9% at the district level. Both community and district effects remained highly significant. The influence of mobile clinics predicting higher odds of a male than a female sterilization remained highly significant at 1% level. Wife's education at secondary level and above increased the odds of vasectomy use, although the majority of vasectomy users were respondents with no education (Table 1). The odds of vasectomy were higher for Hill Brahmin ethnic community, and the difference was highly significant for the *Terai* Brahmin, Chhetri and related communities, the Hill Dalit, Hill Janajati and the *Terai* Janajati communities. The odds of vasectomy were significantly higher for those with "at least 1 daughter and three or more sons" and those with "only daughters" when compared to couples who had at least one daughter and two sons. Residence, current age of husband and wife, husband's education, wife's age at first cohabitation and religion and household wealth were not significant.

Adding the ecological zone variable increased the community effects by 10.4%, suggesting the extent of

Table 1
Percentage of users of female and male sterilization by source of the method and background characteristics, Nepal, 2011

Characteristics	Female (*n*=1194)				Male (*n*=820)			
	Government	Mobile	Private	No. of users	Government	Mobile	Private	No. of users
All	58.5	19.4	22.1	1194	50.7	32.8	16.5	820
Residence								
Urban	64.7	9.4	25.9	369	57.0	10.5	32.5	182
Rural	57.7	20.7	21.6	825	49.8	35.7	14.5	638
Ecological zone								
Terai	58.1	18.7	23.2	867	58.2	17.2	24.6	186
Hill	61.1	21.5	17.4	281	50.9	35.4	13.7	382
Mountain	47.4	31.6	21.1	46	32.7	58.9	8.4	252
Household wealth								
Richest	48.4	13.5	38.1	293	53.6	8.5	37.9	169
Rich	57.4	20.7	21.9	280	57.4	29.2	13.4	178
Middle	60.9	18.5	20.6	283	57.1	32.2	10.7	163
Poor	64.9	22.2	12.9	219	45.6	47.2	7.2	143
Poorest	60.6	24.6	14.8	119	34.1	53.8	12.1	167
Wife's ethnicity								
Hill, Brahmin	50.0	20.9	29.1	141	51.0	28.1	20.9	180
Hill, Chhetri	47.7	22.8	29.5	170	43.8	43.7	12.5	342
Terai, Brah, Chh, others	69.8	11.7	18.5	309	37.5	25.0	37.5	9
Newar	52.1	31.3	16.6	45	54.8	7.1	38.1	40
Hill Dalit	54.5	26.4	19.1	122	58.7	26.1	15.2	94
Hill Janajati	50.0	33.5	16.5	141	54.0	34.2	11.8	140
Terai Janajati	56.4	18.4	25.2	266	64.3	21.4	14.3	15
Wife's religion								
Hindu	59.6	18.7	21.7	1105	51.3	32.6	16.1	751
Non-Hindu	44.0	29.0	27.0	89	45.0	35.0	20.0	69
Wife's education								
None	62.0	20.4	17.6	809	48.6	39.7	11.7	494
Primary	54.4	17.5	28.1	189	53.0	29.5	17.5	160
Secondary+	45.2	16.8	38.0	196	54.1	18.2	27.7	166
Husband's education								
None	65.9	20.8	13.3	341	49.6	34.4	16.0	143
Primary	59.5	19.7	20.8	303	43.8	43.9	12.3	212
Secondary+	51.8	18.1	30.1	550	54.2	27.3	18.5	465
Wife's health care decisions								
Couple	54.2	21.4	24.4	520	51.8	32.0	16.2	415
Wife alone	62.3	17.8	19.9	304	58.4	24.2	17.4	173
Husband alone	61.7	17.5	20.8	297	42.8	41.6	15.6	214
Other family members	61.0	19.0	20.0	73	20.0	53.3	26.7	18
Sex composition of children								
At least 1 daughter, 2 sons	62.2	18.5	19.3	419	44.5	42.1	13.4	237
At least 1 daughter, 3+ sons	66.3	22.9	10.8	121	62.5	30.7	6.8	92
At least 1 daughter, 1 son	53.0	21.9	25.1	204	50.7	31.1	18.2	147
1 daughter, 1 son	52.8	22.6	24.6	136	46.7	34.4	18.9	115
Only sons	55.7	16.3	28.0	282	53.6	27.1	19.3	191
Only daughters	56.3	15.6	28.1	32	60.0	11.4	28.6	38
Wife's age at sterilization (y)								
<25	59.4	17.2	23.4	359	55.9	28.7	15.4	232
25–29	59.6	18.2	22.2	483	49.3	32.2	18.5	329
30–34	56.3	22.7	21.0	261	50.0	34.9	15.1	185
35–49	54.6	26.8	18.6	91	42.3	42.2	15.5	74
Time since sterilization (y)								
<5	52.4	14.0	33.6	313	38.5	36.0	25.5	191
5–9	55.6	18.9	25.5	330	56.4	27.5	16.1	228
10–14	64.5	24.0	11.5	322	49.1	36.5	14.4	235
15+	63.0	21.4	15.6	229	57.7	31.4	10.9	166

Notes: Percentages are based on weighted data, and the number of cases shown is unweighted. Associations examined for statistical significance using chi-square tests. Residence, wife's age at sterilization and duration since sterilization were not statistically significant. All other variables were significant at p<.001. *n* refers to number of observations. The row percentages shown add to 100.

Table 2
Estimates from logistic models predicting the likelihood of a male sterilization in a mobile or private clinic, adjusting for relevant individual characteristics and random intercept effects, Nepal, 2011 (*n*=2014)

Characteristics	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3 OR (95% CI)
Source of sterilization			
Government hospital	1.00	1.00	1.00
Mobile clinic	1.62 (1.20–2.19)***	1.69 (1.24–2.31)***	1.65 (1.21–2.25)**
Private clinic	0.96 (0.70–1.32)	0.86 (0.61–1.21)	0.90 (0.63–1.27)
Time since sterilization (y)			
0–4		1.00	1.00
5–9		1.04 (0.73–1.50)	1.07 (0.74–1.54)
10–14		0.95 (0.65–1.38)	0.98 (0.68–1.43)
15+		0.93 (0.61–1.41)	0.93 (0.62–1.41)
Wife's age at sterilization (y)			
<25		1.39 (0.82–2.37)	1.46 (0.86–2.49)
25–29		1.20 (0.73–1.96)	1.25 (0.76–2.04)
30–34		1.40 (0.84–2.32)	1.45 (0.87–2.40)
35+		1.00	1.00
Wife's education			
None			
Primary		1.18 (0.81–1.73)	1.17 (0.80–1.72)
Secondary or higher		1.77 (1.23–2.56)***	1.79 (1.24–2.58)**
Wife's ethnicity			
Hill Brahmin		1.00	1.00
Hill Chhetri		1.05 (0.72–1.53)	0.95 (0.65–1.39)
Terai, Brah, Chh, other		0.03 (0.01–0.08)***	0.05 (0.02–0.11)***
Newar		0.60 (0.33–1.11)	0.56 (0.31–1.02)
Hill Dalit		0.47 (0.29–0.76)***	0.46 (0.28–0.73)**
Hill Janajati		0.62 (0.41–0.96)*	0.58 (0.38–0.89)*
Terai Janajati		0.07 (0.04–0.14)***	0.08 (0.04–0.16)***
Sex composition of children			
At least 1 daughter, 2 sons		1.00	1.00
At least 1 daughter, 3+ sons		1.72 (1.09–2.71)**	1.70 (1.08–2.68)*
At least 1 daughter, 1 son		1.15 (0.79–1.67)	1.17 (0.81–1.70)
1 daughter, 1 son		1.18 (0.78–1.80)	1.19 (0.78–1.80)
Only sons		1.31 (0.93–1.86)	1.32 (0.93–1.86)
Only daughters		2.62 (1.34–5.10)**	2.58 (1.33–5.03)**
Ecological zone			
Terai			1.00
Hill			4.58 (2.64–7.96)***
Mountain			18.88 (8.81–40.43)***
Random effects			
Variance			
Community (PSU)	0.63 (0.54–0.73)***	0.48 (0.40–0.57)***	0.53 (0.44–0.61) ***
District	3.56 (3.12–4.00)***	1.57 (1.28–1.86)***	0.42 (1.28–0.57) ***
% change in variance			
Community (PSU)	−1.6	−23.8	+10.4
District	−7.3	−55.9	−73.2
Deviance	2023.1	1817.3	1771.3
Change in deviance (p-value)	10.5 (.015)	205.7 (.000)	46.0 (.000)

OR refers to odds ratios; CI refers to confidence interval. Significant at ***p<.001; **p<.01; *p<.05.

heterogeneity of vasectomy use between ecological zones (model 3). However, the between-districts variation reduced by 73.2%, suggesting that ecological region is highly relevant to explaining differences in vasectomy use at the district level. The odds of a vasectomy were significantly higher in the hill and mountain regions than *terai*. The adjusted probabilities confirm this pattern (Fig. 1). Potential interaction tested between ethnicity and ecological zone was not significant. This was partly due to small sample size in some of the categories of the ecological zone variable.

To understand the variations between-communities and between-districts, the community and district level variances were partitioned by the source of method, adjusting for the effects in model 3 of Table 2. A likelihood ratio test of the change in deviance showed that vasectomy use in government hospitals accounted for 70% of the variation between communities and that in mobile clinics accounted for 28.1% (Table 3). The variation in vasectomy use in private hospitals was not significant. However, at the district level, 42.1% of the variation in vasectomy use was attributed to the uptake in
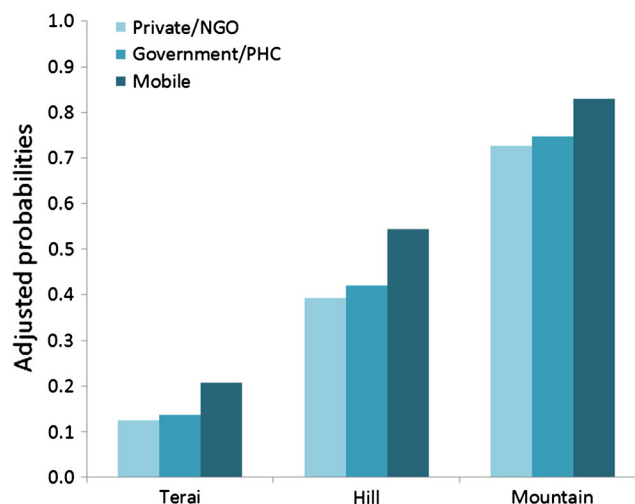
Fig. 1. Probabilities of a male sterilization by ecological region, adjusting for selected characteristics and random intercept effects, Nepal 2011.

mobile clinics, 25.6% in private clinics and 32.2% in government hospitals.

4. Discussion

Improving access to modern contraception and encouraging method mix require multiple intervention strategies [27]. This paper demonstrates evidence that mobile clinics significantly contribute to facilitating vasectomy use in Nepal, particularly in mountain and hill region, with considerable heterogeneity at the community and district levels. Policy makers and program managers involved in designing and implementing targeted FP interventions could consider mobile clinic as an effective strategy to improve access to male-based modern methods and enhance gender equity in FP.

Although mobile camps are primarily designed to reach socially deprived and marginalized communities, the present analyses show that the educated and upper caste Hill Brahmin communities are more likely to use mobile clinics for vasectomy. This could be attributed to the excessive

Table 3
Community and district-level variance partitioned by source of sterilisation, Nepal 2011

Cluster and sterilization source	Variance (95% CI)	VPC (%)
PSU		
Government	0.37 (0.30–0.45)***	70.0
Mobile	0.15 (0.10–0.20)***	28.1
Private	0.01 (0.00–0.02)	1.9
District		
Government	0.68 (0.50–0.86)***	32.2
Mobile	0.89 (0.67–1.11)***	42.1
Private	0.54 (0.37–0.71)***	25.6
Deviance	1705.6	
Change in deviance (p-value)	58.4 (.011)	

VPC refers to Variance Partitioning Coefficient. Significant at ***$p<.001$.

demand for limiting methods highly correlated with the increasing desire for small families among educated men and those from nonbackward communities [21,30]. The findings reinforce the existing evidence that Nepalese men limit their fertility once they have at least three sons in the family [18–20]. On the other hand, those with only daughters are also significantly likely to use vasectomy.

Vasectomy use is common in the highland, whereas female sterilization use is relatively high in *terai* zone. This is because *terai* is more accessible than hill and mountain areas where men wanting to limit fertility have limited options other than sterilization [21]. Such services are usually available only during mobile camps on either annually or biannually in their local areas. Also, the health facilities in the mountain and hill zones are often under resourced compared with the *terai* zone [13], which partly explains the high concentration of sterilization use in mountain and hill zones.

A pertinent question that arises is whether clients receiving sterilization services in mobile clinics are fully informed of the methods they have chosen and whether proper counseling was provided before and after the procedure. Although this question was beyond the scope of the present study, we investigated the limited data in the NDHS. The response rates were much lower than anticipated for most questions. About 44% of users were told about potential side effects of the method, and only about 30% were told about alternative method options (unweighted $n=$ 370). However, in most cases, a full range of methods are not offered in mobile camps because of the prescreening procedures completed during door-to-door campaigns [12].

Further qualitative research is needed to address the quality of care associated with FP service delivered through mobile clinics. From the program perspective, there is a scope for mobile clinics to expand method choices to include short-term effective modern contraceptive services [13]. This, in turn, can positively influence the overall uptake of

modern contraception particularly in areas where the demand for FP is very high.

References

[1] Retherford RD, Thapa S. The trend of fertility in Nepal, 1961–1995. Genus 1999;3–4:61–97.

[2] Thapa S, Neidell SG, & Dahal DR, editors. , Fertility transition in Nepal. Contributions to Nepalese Studies Vol. 25 (special issue); 1998.

[3] Retherford RD, Thapa S. Recent trends and components of change in fertility in Nepal. J Biosoc Sci 2004;36:709–34.

[4] Ministry of Health and Population [Nepal], New ERA, ICF International Inc. Nepal Demographic and Health Survey 2011. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and ICF International, Calverton, Maryland; 2012.

[5] United Nations. Department of Economic and Social Affairs, Population Division. World Contraceptive Use 2012 (POP/DB/CP/Rev2012. Available at http://www.un.org/esa/population/publications/WCU2012/MainFrame.html.

[6] Ministry of Health and Population [Nepal], New ERA, Macro International Inc. Nepal Demographic and Health Survey 2006. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and Macro International Inc.; 2007.

[7] Johnson K, Bradley SEK. Trend in economic differentials in population and health outcomes: Further analysis of the 2006 Nepal Demographic and Health Survey. Macro International Inc: Maryland; 2008.

[8] National Planning Commission [Nepal]. Tenth Plan (2002–2007). Kathmandu, Nepal: His Majesty's Government of Nepal, National Planning Commission; 2002.

[9] Tuladhar JM. Emergence and development of Nepal's Family Planning Program. In: Robinson WC, & Ross J, editors. The Global Family Planning Revolution: Three decades of Population Policies and Programs. Washington, DC: The International Bank for Reconstruction and Development/The World Bank; 2007.

[10] USAID, NFHP, UNFPA. Repositioning family planning strategic review of the Nepal National Family Planning Program, Outcomes of a National Consultative Meeting. USAID, Nepal Family Health Program and United Nations Population Fund; 2006.

[11] Tuladhar JM. Supply aspects of meeting demand for family planning. In: & Chapter 6, UNFPA, editor. South Asia Study on Population Policies and Programmes – Nepal; 1989, pp. 169–217.

[12] Wickstrom J, Yanulis J, Van Lith L, Jones B. Approaches to mobile outreach services for family planning: a descriptive inquiry in Malawi, Nepal, and Tanzania. The RESPOND Project Study Series: Contributions to Global Knowledge Report No. 13. Endanger Health, USAID, 2013. Available at http://www.respond-project.org/pages/files/6_pubs/research-reports/Study13-Mobile-Services-LAPM-September2013-FINAL.pdf.

[13] Thapa S, Friedman M. Females sterilization in Nepal: a comparison of two types of service delivery. Int Fam Plann Perspect 1998;24(2):78–83.

[14] Dahal GP. Sexual and contraceptive behavior among men in Nepal: the need for male-friendly reproductive health policies and services. New York: Edwin Mellen Press; 2008.

[15] Nazerali H, Thapa S, Hays M, Pathak LR, Pandey KR, Sokal DC. Vasectomy effectiveness in Nepal: a retrospective study. Contraception 2003;67(5):397–401.

[16] Madhavan S, Adams A, Simon D. Women's networks and the social world of fertility behavior. Int Fam Plan Perspect 2003;29(2):58–68.

[17] Boulay MJ, Storey D, Sood S. Indirect exposure to a family planning mass media campaign in Nepal. J Health Commun 2002;7(5):379–99.

[18] Bankole A, Singh S. Couples' fertility and contraceptive decision making in developing countries: hearing the man's voice. Int Fam Plan Perspect 1998;24(1):15–23.

[19] Do M, Kurimoto N. Women's empowerment and choice of contraceptive methods in selected African countries. Int Perspect Sex Reprod Health 2012;38(1):23–33.

[20] Blanc AK. The effect of power in sexual relationships on sexual and reproductive health: an examination of the evidence. Stud Fam Plann 2001;32(3):189–213.

[21] Dahal GP, Padmadas SS, Hinde PRA. Fertility limiting behavior and contraceptive choice among men in Nepal. Int Fam Plann Perspect 2008;34(1):6–4.

[22] Leone T, Matthews Z, Zunna GD. Impact and determinants of sex preference in Nepal. Int Fam Plann Perspect 2003;29(2):69–75.

[23] Stash S. Explanations of unmet need for contraception in Chitwan, Nepal. Stud Fam Plann 1999;30(4):267–87.

[24] Stash S. Ideal-family-size and sex composition preferences among wives and husbands in Nepal. Stud Fam Plann 1996;27(2):107–18.

[25] Rutstein S. Wealth versus expenditure: comparison between the DHS wealth index and household expenditures in four departments of Guatemala. Calverton, Maryland: ORC Macro; 1999.

[26] Bennett L, Dahal DR, Govindasamy P. Caste, ethnic and regional identity in Nepal: further analysis of the 2006 Nepal Demographic and Health Survey. Calverton, Maryland, USA: Macro International Inc; 2008.

[27] Thapa S, Pandey KR. Family planning in Nepal: an update. JNMA J Nepal Med Assoc 1994;32(111):131–43.

[28] Rashbash J, Steele F, Browne WJ, Goldstein H. A user guide to MLWin Version 2.1. UK: Centre for Multilevel Modelling, University of Bristol; 2009.

[29] R Development Core Team, R. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing3-900051-07-0; 2012.

[30] Sharma SK, Pratap N, Ghimire DR. Ethnic differentials of the impact of the Family Planning Program on contraceptive use in Nepal. Demogr Res 2011;25(27):837–68.