The influence of husbands on the contraceptive use of women in Nepal

Abstract

Objectives To investigate the influence of husband's opinion of family planning on the current and future use of modern contraception of women in Nepal, net of other confounders.

Methods The study uses the data for currently married women from the 2006 Nepal Demographic and Health Survey and presents binary logistic regression models of current use and future use of contraception. For current use, two models are fitted viz. one for modern reversible methods and another for female sterilization. Continuous variables are tested for non linearity and linear splines are fitted.

Results The study finds that 'husband's opinion of family planning' is the most significant predictor of both current and future use of modern contraception. For adopters of sterilization, number of living sons has greater predictive power. Linear splines show that the odds of contraceptive use increase then decrease with the woman's age. For future use, socio-economic status is an important predictor, so are ecological regional differences.

Conclusion Sex preference for male child is still prevalent in Nepal and men's patriarchal roles have much influence on contraceptive use of women. Increased male targeting is recommended along with making modern reversible methods more easily available, especially for the population in the lowest wealth quintiles and in the mountain and hill regions of the country.

INTRODUCTION

In Nepal the contraceptive prevalence rate has risen dramatically from 26 percent in 1996 to 44 percent in the current 2006 Demographic and Health Survey (DHS). Previously, high gender preference, patriarchal society with low value for the girl child, distrust in modern reversible methods and absence of service facilities in remote rural as well as hilly areas of Nepal had been identified as the main barriers in the adoption of family planning (FP; Stash 1999; Kane et al. 1990; Leone et al. 2003). The Government has tried to remove some of the barriers by providing mobile sterilization clinics in rural and/or remote areas where constant services from other facilities were non-existent and tried to strengthen overall population activities by establishing a National Population Committee (NDHS 2006). Some of the strategies include creation of social awareness through the mass media (Sharan and Valante 2002). Studies have found that both the introduction of mobile sterilization camps and the promotion of FP on the mass media have had positive effects on the increase of contraceptive uptake in Nepal (*ibid*, Thapa and Friedman 1998).Currently female sterilization and injectables are the most popular methods adopted by Nepalese couples.

Some ethnological studies have reported the dominant role of men in the patriarchal society of Nepal. Stash (1999) observes that "In rural Nepal women still obey men (husbands) and in taking decisions about family planning (FP) the husband's opinion rules supreme". Another study in Nepal states "husband's approval of FP" as the third most common reason for non–use of contraception (Kane et al. 1990).

In other parts of South Asia where similar patriarchal societies prevail, husband's opinion of FP has been identified as one of the four main obstacles to the adoption of modern contraceptive methods (Cleland et al. 2006). In Nepal, although it has been indicated in several studies that "husband's opinion of FP" is the major determinant of her subsequent use of any method, this factor has not been investigated in detail. The most recent DHS in Nepal (2006) finds that 75.9 percent women perceive that their husband's approve FP. For the other one quarter, who perceive that their husbands do not approve, the probability of use may be scanty. It is therefore imperative to investigate the effect of this variable on her actual use of various modern contraceptive methods. This paper attempts to look at the effect of `husband's approval of family planning' on contraceptive use in Nepal, controlling for socioeconomic, demographic, geographical and other factors.

Methods and |Materials

This study uses the 2006 Nepal DHS. The sample for this survey is based on a two stage, stratified, nationally representative sample of households. At the first stage of sampling, 260 Primary Sampling Units (PSUs; 82 in urban areas and 178 in rural areas) were selected using systematic sampling with probability proportional to size. A complete household listing operation was then carried out in all the selected PSUs to provide sampling frame for the second stage selection of households. At the second stage of sampling, systematic samples of about 30 households per PSU on average in urban areas and about 36 households per PSU on average in rural areas were selected in all the regions, in order to provide statistically reliable estimates of key demographic and health

variables. Further details of weighting are available in the Nepal DHS (MPHP et al. 2006).

Based on other studies of similar nature, pregnant women were classified as non-users (Kamal and Sloggett 1996). Similarly, women using traditional methods were coded as non-users in this study. Authors have also justified the reasons for having separate models for reversible and permanent methods (ibid). Two models were therefore constructed, one for Modern Reversible Methods (MRM) and the other for female sterilization. MRMs comprise of users of pills, IUD, implants, diaphragm and injection. Because the variable of interest was the woman's perception of her "Husband's opinion of FP", only currently married women were considered and couples using "condom" or "male sterilization" were excluded from the respective models. In both models binary logistic regression was used (variable coded 1 if user, 0 otherwise) and all analyses were performed using the set of Stata Survey ("svy") commands in the statistical package Stata which adjusts appropriately for the fact that the sample was both weighted and based on a cluster sampling design (Stata Corporation 1999). The variable "Husband's opinion of FP" was used as an explanatory variable and all potential confounders of contraceptive use were tested in the models.

Let us consider the vector $X' = (1, X_1, X_2, ..., X_p)$, where $X_1, X_2, ..., X_p$ are p independent variables. Then the multiple logistic regression model for the use of modern contraception among women is

$$P(Y = 1 | X) = \frac{e^{X'\beta}}{1 + e^{X'\beta}}$$

where Y is the dependent variable representing contraceptive use of women and β is the vector of logistic regression parameters, $\beta' = \left(\beta_0, \beta_1, ..., \beta_p\right)$.

Variables used
In the Nepal DHS (2006) women were asked about their perception of their husband's opinion of FP. Women were also asked about their inter-spousal communication on FP, both variables were considered in this analysis. Following previous models on covariates of contraceptive use demographic variables such as age of the woman, her number of living sons and daughters were considered here. Socioeconomic indicators included were wealth index, education of the woman and her husband's education. Urban/rural differentials in use have been noted in the Nepal DHS (ibid) and so have the differences between ecological regions Terai, Mountain and Hills. These were considered as control variables in this study.

Women's autonomy has been investigated in Nepal by previous studies (Hakim et al. 2006). Some questions on decision making were available from the survey which were then recomputed into a "decision making index" (Cleland et al. 1996). The construction of the index is explained in Appendix A. Other than this index, "women's current working status", and "whether she earns more than her husband" were included as indicators of autonomy. To evaluate the effect of a woman's intergenerational status

within the family, the variable "relationship with the household head" was used as a control (Hakim et al. 2006; Kamal et al. 1999). One cultural variable, "religion", was also considered as a potential confounder.

The variables 'whether visited by FP worker in last 12 months', 'whether she visited the health facility in the last 12 months', and 'whether she saw FP programme on TV in the last month' were included as indicators of the woman's exposure to FP.

RESULTS
(Table 1 about here)
In the MRM model, out of 5009 total currently married women, 24.1 percent were users of MRM and the rest were non-users. Figure 1 shows the current method mix of users of modern contraception in Nepal. In the sterilization model, out of 5106 women, 25.5 percent were found to be adopters of female sterilization, the rest being non users.
(Figure 1 about here)

All variables considered in this analysis were tested for two way association with the dependant variable, using chi square tests. Table 1 shows the frequencies for both the dependant variables along with their significance for chi square tests. In the MRM model, the variables age of woman, number of living sons, number of living daughters, rural/urban residence, socioeconomic index, woman's education, whether she earns more than her husband, relationship to household head, decision making score, frequency of talking to husband, approval of FP by husband, visited by FP worker in last 12 months, visited health facility in last 12 months, and heard of FP on TV in the last month had significant association with MRM use at the 5 % level. Respondent's working status and religion did not have significant association with use of MRM.
All the variables significant in the MRM model were also significant in the sterilization model. In addition, three extra variables husband's education, religion and current working status also had significant association with adoption of sterilization at the 5% level of significance.
For all the models presented in this study, the variable "husband's opinion of FP" is the variable of prime interest. For subsequent logistic regression analyses this variable was entered first into the model and then the model was built up using stepwise logistic regression techniques.

Tests of Non-linearity
For the continuous variable "age of the woman" a test for non-linearity was performed by adding a quadratic term in age to the regression model. The term was significant in both the models presented here. To account for the non-linearity in age, "linear splines" were used to create separate regression lines for each 5-year age group. For both models, a spline with 7 degrees of freedom was used, with knots placed at 5-year intervals. These spline terms were then used as explanatory variables in the final regression model. Further details about linear splines is provided in Appendix B.
(Table 2 about here)

MRM Model

In this model, the outcome variable is 'Use of any modern reversible method' versus non-use. Binary logistic regression results for the final parsimonious model is presented in Table 2. This model finds that `husband's approval of FP' is the most important predictor of use of modern reversible methods in Nepal. For women whose husbands approve of FP, the odds ratio of using MRM is estimated to be 5.4 (CI:3.8,7.7) times higher than those whose husbands do not. Following this variable, `Talk to husband about FP' is the next most significant predictor of MRM use. Compared to those who do not speak to their husbands about FP, those who do had about 4 times higher odds of use. Furuta and Salway have quoted similar results (2006).

In this model, woman's age was modeled using a linear spline with seven parameters, with knots placed at 5-year age intervals. A logistic regression was performed with "MRM" as the dependant variable and the linear spline terms as explanatory variables. Figure 2 shows that when all other variables are held constant, the odds of MRM use increases with age during adolescent years until age 20, remains approximately constant until age 45, after which the odds of use begin to decrease with age. Similar findings have been noted in other studies in the region (Kamal et al. 2007).

(Figure 2 about here)

'Number of living sons' was a significant predictor of MRM use in this model. Compared to those with no living sons, those with one living son had an estimated 1.7 times higher odds of use and those with two living sons had an estimated 1.5 times higher odds of use. For those who have three or more sons, the estimated odds ratio tapers off to 1.3. The same pattern was observed for number of living daughters.

Socio-economic variables were significant predictors of MRM use in this model. Compared to the poorest women, the poorer women had an estimated 1.5 times higher odds of use. Overall, a positive gradient of use was observed as wealth index increased from poorest to richest. Women in the richest group had an estimated 3 times higher odds of use compared to poorest women.

Compared to women with a decision making score of zero, those with low scores had an estimated 1.5 times higher odds of use. Similar estimates were obtained for women with middle (OR=1.6, 95% CI: 1.1 to 2.3) and high (OR=1.4, 95% CI: 1.1 to 1.9) scores.

Compared to the wives of the household heads, women who were daughters had an estimated 70% lower odds of use. The estimated odds ratio was similar for those who were daughters-in-law (OR=0.4, 95% CI: 0.3 to 0.5). Those who were heads themselves had about 90% lower odds of use and 'others' had about 60% lower odds of use in this model. These findings match those found by Furuta and Salway (2006) with respect to access to health care in Nepal.

Among exposure to FP variables, women who were visited by FP workers had an estimated 3.4 times higher odds of being a MRM user. Women who visited a health facility in the last 12 months had about 1.6 times higher odds of being a user. Women

who heard FP on TV had an estimated 1.4 times higher odds of being a user. All the findings are in the expected directions.

Among ecological regions, compared to women from Terai, women in the mountains had an estimated 1.4 times higher odds of use. A similar odds ratio was estimated for women in the Hills (OR=1.5, 95% CI: 1.2 to 1.9). This finding is new to the study.

Woman's education, her earning status, whether she earns more than her husband, her region of residence and her religion were not significant predictors of MRM use in this model at the 5 % level.

STERILIZATION

In this model, the outcome variable is 'adoption of female sterilization' versus non use. The final parsimonious model presented in Table 3. Alike the model on use of MRM, age of the woman showed non-linear association with adoption of sterilization. Hence, a linear spline with seven parameters was used, with knots placed at each of the five year age groups between 15-49. A logistic regression was performed with "sterilization" as the dependant variable and the linear splines as explanatory factors. Figure 3 shows that when all other variables are held constant, the log odds of adoption of female sterilization increases until ages 35, when there is a decline in use and remains the same until age 45, when it declines further as the woman grows older.
(Figure 3 about here)

However, when the model is controlled for the variable `one living son', the model finds that the adoption of female sterilization is fairly constant between ages 15 to 25, after 25 there is a 30% decline in use which continues as she gets older.
(Table 3 about here)

The final model presented in Table 3 finds that the "number of living sons" is the most significant predictor of adoption of female sterilization. Women with one living son have 16.2 (95% CI:8.3 to 31.6) times higher odds of using sterilization, compared to those with none. The estimated odds ratios are 7.0 (95% CI:5.1 to 9.8) and 2.9(95% CI:2.3 to 3.7) respectively for those with 'two living sons' and those with 'three living sons' respectively. It is observed that the odds ratio of use decreases when the 'number of living sons' increase.

'Husband's approval of FP' is the second most significant predictor of female sterilization. For women whose husbands approve of FP, odds of adoption increases 11.0 times (95% CI:.7.8 to 15.6)

For 'number of living daughters' the effect is also significant. The model finds higher odds of use when there is one living daughter (OR=1.5, 95% CI 1.1 to 2.0) as compared to none. The other categories did not have any predictive power on adoption of sterilization. Previous studies have also found that in Nepal there is a demand for at least one daughter (Leone et al. 2003).

In this model, however, 'talking to husband about FP' has an opposite effect compared to the MRM model. As inter-spousal communication increases, the odds of adopting sterilization decreases by an estimated 70 %.

Among the educational levels of the woman, only 'secondary' levels of education was significant, as at that level women have an estimated 50 % lower odds of adopting sterilization. Compared to women who were not working, women who were currently working had an estimated 1.4 times higher odds of adopting sterilization.

Relationship to household head was a strong predictor of adoption of female sterilization. A woman who was a daughter of the household head had 70 % lower odds of being a user, daughter-in-law had 60 % lower odds of being a user, others had 60 % lower odds and if she was the head herself, she had 70 % lower odds of use. Furuta and Salway (2006) have written extensively on this issue of intergenerational relationships in Nepal and Dasgupta (1996) had similar comments on the role of young women in hierarchical relationships in India.

In this model, compared to women from Terai area, those from Mountain areas had very low odds 90 % adopting female sterilization, and for Hill region it was 80 % lower.

Additionally, the model finds that compared to rural women, urban women had 1.8 times higher odds of adoption of sterilization. These differentials are in the expected directions.

In Table 3, we find that the adoption of female sterilization was significantly affected by socioeconomic status. In general, there was a gradient of increase in female sterilization when one progressed from worst wealth index to the best, except for the `richer' group who have lower odds of sterilization compared to their immediate worst group titled 'middle'. This finding is new to the study.

When women watched FP on TV, they had 1.5 times (95% CI:1.2 to 2.0) higher odds of adopting sterilization. When they visited a health facility in the last 12 months, women had 1.6 (95% CI:1.1 to 2.5) times higher odds of adopting sterilization. These results were in the expected direction. When a woman was visited by a FP worker in the last 12 months, she had lower probability of adoption of sterilization (OR=0.7,95% CI:0.5 to 0.8).It is possible that FP workers motivated the women to use other reversible methods, and explanation which has been valid for the Bangladesh situation (Kamal and Sloggett 1996).
Husband's education, woman's religion and decision making index were found to be insignificant predictors of use and were not included in the final model.

Role of husband's approval among those intending to use modern contraception in future
The frequency distribution of women used in this model is presented in Table 4. Only women who were currently not using any modern contraception and who were not infertile have been considered in this model. The outcome variable here is the 'intention

to use a modern contraception in future', coded 1 if yes,0 otherwise. Almost 70 % women answered that they had an intention to use a modern contraceptive within one year. Among them, 78.5 % perceived that their husbands favoured FP, while 21.5 % thought they did not.

In bivariate tests of association using chi square (not shown here), the following variables were found to have significant association with future intention to use modern contraception : age, woman's education, husband's education, husband's approval of FP, talks to husband about FP, urban/rural residence, ecological region of residence, number of living sons, number of living daughters, wealth index, relationship with household head, visited health centre in the last 12 months, watched FP on TV, visited by FP worker in the last 12 months. A final binary logistic regression of 'intention to use modern contraception in future' was investigated and the final parsimonious model is presented in Table 4. During previous regression runs, ecological region of residence and urban/rural region of residence were significant predictors of intention to use contraception in the future. However, these variables became insignificant in the presence of wealth index.

Bootstrapping with 200 samples was conducted to test the precision of the coefficients of the explanatory variables. All the predictors presented here were found to be significant in the bootstrapping runs. The final model is presented in Table 4.

The model in Table 4 finds that "Husband's approval of FP" is the most significant predictor of intention to use, when husbands approve of FP, there is an estimated 5.6 (95% CI:4.4 to 7.0) times higher odds of use for the woman. This is followed by the variable "talks to husband on FP" (OR=2.6, 95% CI:2.0 to 3.5).

Age of the woman showed nonlinear association with intention to use contraceptive methods in future. Linear splines were used to represent different age groups and three knots were placed at ages 20, 30 and 40. The graph of log odds of intention to use contraception with age of the woman is presented in Figure 4. When all other covariates are held constant, this figure shows that women have increased odds of contraceptive use (in future) during the adolescent ages 15 to 20, from 20 onwards there is a gradual decline in odds which remains constant until age 40, after which there is a further decline. However, in the presence of other confounders, the final model finds that this demographic factor is not a significant predictor of her intention to use in future.
(Figure 4 about here)

Women's education, husband's education were both positive predictors of use in this model, although "husband's education" was not a predictor of use in previous models of current use.

Number of living sons or daughters were no longer significant predictors of future use of contraception. Instead, wealth index is found to be significant . Model shows that women in poorest wealth quintile showed highest odds of intention to use in future. The odds were reduced when women went from poorest to richest wealth quintile.

Intergenerational relationships were found to be significant in this model, compared to wives, women who were daughter-in-laws or head herself were more likely to express intention for future use.

Among the exposure variables, only variable that was significant was the 'visit to the health centre in the last 12 months'. This showed positive association with intention to use (OR=1.6, 95% CI: 1.3 to 2.0), indicating the positive influence of health centres on the woman's future intention to use modern contraception.

DISCUSSION

This study finds that, among currently married women, women's perception of "husband's approval of FP" is a very strong predictor of use of both modern reversible methods and female sterilization. Additionally, among those intending to use any modern contraceptive method in the next year, "husband's approval of FP" plays the pivotal role.

For users of MRM, inter-spousal discussion on FP reduces the influence of husband's disapproval, probably by removing any gaps in aspirations and family size preferences that may differ between the two. However, for users of female sterilization, inter-spousal discussion has quite the opposite influence. It is likely that when couples have the relationship to discuss FP, they are more likely to use MRM and the reduced influence on female sterilization is explained.

Strong preference for a male child exists in Nepal and has been discussed extensively in the literature (Leone et al. 2003). However, this study finds that as the number of living sons increase, the odds of adopting female sterilization decreases. This is an unusual finding as one would expect the reverse (Kamal and Sloggett 1996). Stash (1999) mentions that in some remote areas of Nepal, sterilization is the only method available. Because of limited choice and fear of side effects, women do not adopt sterilization even when they have completed their desired family size. Another possible explanation for reduced association of female sterilization with the number of living sons is the fear of death of their living son (ibid). Both may explain the reduced odds of use of female sterilization with increase in number of living sons.

There seems to be a very high demand for a male child, as is exhibited in the estimated odds ratios for 'number of living sons' in the model on female sterilization. However, for users of MRM, the effect is less significant. For future intention to use, it is not significant at all, which means couples are more willing to use methods even when their desired sex composition has not been achieved.

For the demographic variable "age of the woman" linear splines were used in this analysis. This is unique to this study. For users of MRM, with other variables held constant, the odds of contraceptive use was found to be constant between 20-40, after which it declines. For adopters of sterilization, use is constant between 15 to 25, after which it declines. This is a fairly early decline and efforts should be made to keep the sterilization rates constant until further ages (40) is attained. For those who intend to use modern contraception in future, age is no longer an important covariate, which means women of all ages are willing to use in future. This is an encouraging finding.

Among indicators of autonomy, the variable 'women's current working status' had positive association with use in both models. For decision making index, they were predictive in case of MRM, women with more decision making power were more likely to be users. However, they were completely insignificant for the sterilization model and the model on future intention to use contraception.

The study finds that for both models, wealth index is a major predictor of use. For both models, use increases as the woman goes from the lowest wealth index score to the highest. However, in the model on future intention to use FP, poorest women have the highest odds of being a user. All other subgroups of wealth index have lower odds of use, compared to the poorest. This indicates that most of the future users would be from the lowest wealth quintile.

The study finds that urban women are more likely to be users of both MRM and sterilization. In fact, for the MRM model, this variable is a stronger predictor compared to educational levels of the woman. Similar directions were observed by Thapa and Friedman (1998). For future users, urban/rural differences are no longer significant.

The study also finds that the variation in method use varies according to a woman's ecological region. For use of MRM, compared to Terai women, women from Mountain or Hills have higher odds of use. For adoption of female sterilization it is exactly the reverse. One reason could be the higher preference for male sterilization in these areas (Nepal DHS 2006).

In this study women who visited the health centre in last 12 months, or were visited by a FP worker in the last 12 months, had higher likelihood of adopting MRM and higher likelihood of expressing intention for future use. For sterilization adopters, visit to health centre reduced her odds of use, while visits by FP worker increased her odds of use. It is possible that when women visit the health centre, she is more sensitized on the availability of other reversible methods and hence the lower odds of association with adoption of sterilization. Stash (1999) mentions that for those areas where health centres were absent, mobile clinics were set up to provide male and female sterilization only. Thapa and Friedman (1998) mention that half of all vasectomies and forty percent of all female sterilizations take place in one time camps. Thus, those who visited 'health centres' were the more fortunate ones as they had wider choices of both MRM and sterilization. The increased association of "visits to health centre" with adoption of modern methods lends supports to this situation prevalent in Nepal. However, for "visited by FP worker" there is a positive association with MRM and a negative one with adoption of sterilization. Studies in Bangladesh have suggested that when women are visited by FP workers they have more exposure to various reversible methods and this may explain the positive association with reversible methods and the negative association with adoption of sterilization. (Kamal and Sloggett 1996).

Husband's education, which was found to be an insignificant predictor of use in both MRM and female sterilization models, was found to be a significant predictor of use in the model on intention to use in future. Compared to women whose husbands had no

education, women whose husband's had primary or secondary education had higher likelihood of expressing desire to use in future. Men's role in future use of contraception is also working through this variable, education obviously having a positive influence on contraceptive use, although his opinion of FP remains the most significant as a predictor.

Women's level of education is insignificant for use of MRM. For female sterilization, it has negative association. Women with secondary education were less likely to adopt sterilization. In the model on future intention to use, women with secondary education showed higher odds of being a future user, which means women's education is working in the expected direction (Kamal 2000a).

CONCLUSION
Nepal has taken off in terms of use of modern contraceptive methods. A dramatic rise in use rates has occurred in the last decade and currently 44 percent couples are using some kind of modern method of contraception. This study finds, that husband's opinion of family planning has a major influence both on her current use and future use of any modern method. It also finds that the husband's education has an important role for future users, women with more educated husbands are more likely to be future users.

Previous studies have discussed the barriers to contraceptive uptake in Nepal and have mentioned both high sex preference and husband's opinion of family planning as important barriers to adoption of contraception (Leone et al. 2003; Kane et al. 1990). However, in neighbouring Bangladesh, where similar preference for a male child prevails (Arnold 1997) and husband's opinion of family planning had been found to be a major determinant of use of any method (Kamal 2000), contraceptive uptake has increased to almost 58 percent (BDHS 2007). Amin and Lloyd (2002) have investigated Bangladesh in details and comment that in spite of no significant improvement in women's status both Bangladesh and Egypt have achieved high contraceptive prevalence. They make a special case of Bangladesh commenting that "Considerable emphasis on reaching the rural poor and women and a strong reliance on nongovernmental institutions may have played a part in accelerating the transition in that environment". For Nepal, there is much to gain from the experiences of Bangladesh.

For example, although in Nepal, the mass media has been successfully utilized to air special programmes on FP, there is no couple targeting. In Bangladesh, the family planning programme used an approach called "uthan boithok" or group discussion to sensitize families (Amin et al. 1996). In Iran, the 'local mullahs' join hands with the government to "provide ethical guidance on family planning" (Hoodfar and Assadpour 2000). Their target group is essentially men who come to the mosques for their regular prayers. In Mardan, Pakistan outreach workers established an all-male organization twenty years ago to sensitize men on FP (Population Reference Bureau 1993) Experiences can be drawn from such projects and replicated in Nepal so that men do not feel that the responsibility of contraception is that of woman alone and many myths and superstitions about male sterilization, can be removed.

Studies in various parts of the developing world have found positive association of women's schooling with her contraceptive use (Kamal 2000a).This study also finds that more educated women (beyond primary level) are more likely to be future users. This finding supports promotion of girl child's education in Nepal. Bangladesh has achieved gender equality in school enrollment by introducing various incentive schemes for the education of the girl child. Similar incentives may be introduced in Nepal both through the government and also through various non governmental organizations.

This study finds that as future users, the ultra poor of Nepal are crying out for more attention. Radio and Television messages do sensitize a section of the population who can afford these gadgets. For those living at the subsistence level, home delivery of FP methods and creating mass media messages through "village drama", "miking" and various other innovative methods have been fruitful in Bangladesh. Credit groups in Bangladesh used their network to sensitize women on family planning (Amin et al. 2002).Various non-governmental organizations charted plans to create awareness and supply free FP methods in remote areas (Kamal 1994). Some or all these techniques could be easily incorporated into the Nepal family planning programme.

In many areas of Nepal, specially the mountain and hill regions, the modern reversible methods are more popular compared to female sterilization. In the past decade, in spite of increased emphasis by the government to provide sterilization through mobile camps, the increase in use has been 20 percent in female sterilization, while for male sterilization it has been nil (5 % in 1996 and 2006). In Bangladesh, during early stages of fertility decline, sterilization was often the only method available to rural, uneducated women in remote areas were serviced with the help of satellite clinics (Kamal 1994).When the national level family planning programme introduced the "cafeteria approach" which meant providing a wide range of modern reversible methods along with sterilization, the latter dropped and pills became more popular.

In Nepal, pill use is quite low. Currently, only 2.7 percent women reported use of pills, while this was reported to be only 1 percent in the 1996 DHS. In Bangladesh, 44 percent women are users of oral pills, which were initially supplied free to them by female field workers (Kamal 1994). In Nepal, mobile clinics which provide sterilization services in remote, rural areas could also include free supplies of oral pills and condoms. Popularizing pill and condom use and making them readily available in local pharmacies and corner stores have been one of the ways in which social marketing and distribution strategy became successful in Bangladesh. Currently in India, while overall use rates of condoms is only 5.2 %, the rural use rate is 9.8 % (IIPS and Macro Intnl 2007). Rural men in Nepal men may prefer using condoms if they are more readily available. To achieve this, further behaviour change communication programmes could be developed in the same direction. Moreover, depo holders can also be introduced for oral pills and condoms. In the last decade, in Nepal, there has been a thirty six % increase in use of modern reversible methods, which indicates that with increased availability there could be a higher uptake of modern reversible methods, specially in the Mountain and Hill region. Authors have found that very intensive FP programmes remove many differentials such as urban/rural, women's educational and socioeconomic status (Koenig

et al. 1992). This study finds that Nepal is on its way to such a situation where women's educational levels, her age, her sex preference for a male child, and urban/rural residences are no longer barriers to adoption of modern contraception. Further male targeting and improving supply of modern reversible methods in remote areas will certainly enhance the possibility of achieving the replacement level fertility on time or even earlier.

REFERENCES

Arnold F. 1997. Gender Preferences in Children. *DHS Comparative Studies No. 23.* Calverton, Maryland: Macro International, Inc.

Amin R, Li Y, Ahmed AU. 1996. Women's Credit Programme and Family Planning in rural Bangladesh. *International Family Planning Perspectives* **22**: 158-62.

Amin S, Lloyd CB. 2002. Women's Lives and rapid fertility decline: Some lessons from Bangladesh and Egypt. *Population Research and Policy Review* **21(4)**: 275-317.

Casterline JB, Sathar ZA, Haque M. 2001. Obstacles to Contraceptive Use in Pakistan: A study in Punjab. *Studies in Family Planning* **32(2)**: 95-110.

Cleland J, Kamal N, Sloggett A. 1996. Links between fertility regulation and the schooling and autonomy of women in Bangladesh. In: Jeffery R, Basu AM (ed). *Girls' Schooling, Women's Autonomy and Fertility Change in South Asia.* New Delhi: Sage Publications, p. 205-217.

Cleland J, Bernstein S, Ezeh A, Faundes A, Glasier A, Innis J. 2006. Family Planning: the unfinished agenda. In: *Sexual and Reproductive Health 3. Lancet* **368**: 1810-27.

Das Gupta M. 1996. Life Course Perspectives on Women's autonomy and health outcomes. *Health Transition Review* **Supplement 6**: 213-231.

Furuta M, Salway S. 2006. Women's position Within the Household as a Determinant of Maternal Health Care Use in Nepal. *International Family Planning Perspectives* **32(1)**: 17-27.

Hakim A, Salway S, Mumtaz Z. 2003. Women's Autonomy and Uptake of Contraception in Pakistan. *Asia Pacific Population Journal* **18(1)**: 63-82.

Homa H, Asaadpour S. 2000. The Politics of Population Policy in the Islamic Republic of Iran. *Studies in Family Planning* **31(1)**: 19-34.

International Institute for Population Sciences (IIPS) and Macro International. 2007. *National Family Health Survey (NFHS-3) 2005-06 Volume 1*. Mumbai, India: IIPS.

Kamal N. 1994. Role of Government Family Planning Workers and Health Centres as Determinants of Contraceptive Use in Bangladesh (Demographer's Notebook). *Asia Pacific Population Journal* **9(4)**: 59-65.

Kamal N. 2000. The influence of husbands on contraceptive use by Bangladeshi women. *Health Policy and Planning* **15(1)**: 43-51.

Kamal N. 2000a. Reproductive Medicine in developing countries – Role of education on use of contraception *Lancet* **Millenium supplement**.

Kamal N, Lim C, Omar RZ. 2007. Determinants of Contraceptive Use in the Urban Slums of Bangladesh. Presented at the 9th session of the Statistical Conference of Islamic Countries, Malaysia.

Kamal N, Sloggett A. *The influence of religiosity, mobility and decision making on contraceptive use: Secondary Analysis of BFS 1989 data*. Dhaka, Bangladesh: National Institute of Population Research and Training (NIPORT).

Kamal N, Sloggett A. 1996. The Effects of Female Family Planning Workers on use of modern contraception in Bangladesh *Asia Pacific Population Journal* **11:15-25**

Kane T, Farr G, Janowitz B. 1990. Initial Acceptability of Contraceptive Implants in Four Developing Countries *International Family Planning Perspectives* **16(2)**: 49-54.

Koenig M, Rob U, Khan MA, Chakraborty J, Fauveau V. 1992. Contraceptive Use in Matlab, Bangladesh in 1990: Levels,Trends, and Explanations. *Studies in Family Planning* **23(6)**: 352-364.

Leone T, Matthews Z, Zuanna GD. 2003 Impact and Determinants of Sex Preference in Nepal *International Family Planning Perspectives* **29(2)**: 69-75.

Ministry of |Health and Population (MOHP) [Nepal], New ERA, Macro International Inc. 2007. *Nepal Demographic and Health Survey 2006*. Kathmandu, Nepal: Ministry of Health and Population, New ERA and Macro International Inc.

Sharan M and Valente TW. 2002. Spousal communication and Family Planning Adoption: Effects of a Radio Drama Serial in Nepal. *International Family Planning Perspectives* **28(1)**: 16-25.

Stash S. 1999. Explanations of Unmet Need for Contraception in Chitwan, Nepal *Studies in Family Planning* **30(4)**: 267-287.

Stata Corporation. 1999. *Stata statistical software: release 6.0*. College Station, Texas: Stata Corporation.

Thapa S, Friedman M. 1998. Female Sterilization in Nepal: A Comparison of Two Types of Service Delivery *International Family Planning Perspectives* **24(2)**: 78-83.

Thapa S, Padhye SM. 2001. Induced Abortion in Urban Nepal. Research Note. *International Family Planning Perspectives* **27(3)**: 144-147 & 151.

Appendix A

Principal Component Analysis (PCA) is a statistical technique which can be applied to a set of highly correlated variables in order to construct a smaller set of uncorrelated components. These components can be used in place of the original variables in the interests of efficiency and parsimony. The technique identifies groups of variables which are highly correlated with each other, and constructs components based on these groups. The method can extract as many components as there are variables. That does not serve the purpose of variable reduction, and only components which explain a good proportion of overall variance and have an intuitive interpretation, are usually extracted for subsequent use in regression analysis (Kamal and Sloggett 1993).

Variables that could be possible indicators of decision making were subjected to PCAs and the results are presented in Table A.1

Variables	Factor 1
Decisions on health care	.793
Decisions on household purchases	.894
Decisions on daily needs	.864
Decisions on visiting relatives	.859
Decision on spending husband's earnings	.712

The component loadings were used as weights to construct the decision making score using the above mentioned variables. This variable was entered into the regression model as an independent variable. In the final regression model , this was regrouped into four categories, no decision making (taken as reference category), low, medium and high.

Appendix B

Linear splines enable the estimation of the relationship between the outcome variable and an explanatory variable as a piecewise linear function. This is a function composed of linear segments, arranged so that they join at points called knots.

In this study, the logistic regression model of MRM and sterilization on age and other explanatory variables was fitted using a piecewise linear function for age. The knots were placed at five-year intervals: 20, 25, 30, 35, 40 and 45 years.

Firstly, the variables age1, age2, …, age 7 were created to represent a linear spline of age with knots at 20, 25, 30, 35, 40 and 45 years. They were defined as:

$age1 = age$
$age2 = (age - 20)^+$
$age3 = (age - 25)^+$
$age4 = (age - 30)^+$
$age5 = (age - 35)^+$
$age6 = (age - 40)^+$
$age7 = (age - 45)^+$

where $(x)^+$ means that the term is equal to zero if $x \leq 0$.

The following logistic regression model was fitted:

$$\log\left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 age1 + \beta_2 age2 + \beta_3 age3 + \beta_4 age4 + \beta_5 age5 + \beta_6 age6 + \beta_7 age7 + ...$$

where π is the probability of adoption of MRM/sterilization.

The coefficients for age can be interpreted as:

$$\frac{dy}{dage} = \begin{cases} \beta_1 & \text{if age} < 20 \\ \beta_1 + \beta_2 & \text{if } 20 \leq \text{age} < 25 \\ \beta_1 + \beta_2 + \beta_3 & \text{if } 25 \leq \text{age} < 30 \\ \beta_1 + \beta_2 + \beta_3 + \beta_4 & \text{if } 30 \leq \text{age} < 35 \\ \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 & \text{if } 35 \leq \text{age} < 40 \\ \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 & \text{if } 40 \leq \text{age} < 45 \\ \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 & \text{if age} \geq 45 \end{cases}$$

where y is the log-odds of use of either method. Therefore, the coefficients are used to calculate the change in log-odds of MRM/sterilization for a one-year increase in age. The use of linear splines allows the slope to be different for different age groups.

A graphical representation of the relationship between the log-odds of MRM/sterilization and age was plotted, with the y-axis calculated as:

$$f(age) = \beta_1 age1 + \beta_2 age2 + \beta_3 age3 + \beta_4 age4 + \beta_5 age5 + \beta_6 age6 + \beta_7 age7$$

For the model on "Intention to use modern contraception in future" 3 knots were placed at ages 20,30 and 40.