UNIVERSITY OF SOUTHAMPTON

FACULTY OF LAW, ARTS & SOCIAL SCIENCES

School of Social Sciences

Contraceptive Discontinuation and Side Effects: Longitudinal Evidence from Southern Ghana

by

Claire Elizabeth Bailey

Introduction

When considering the issue of low levels of contraceptive prevalence many studies focus on the socio-economic, cultural and physical barriers women have to overcome in order to adopt a method of contraception. Somewhat less attention is given to what happens after a woman has overcome these barriers and adopted a method. The contraceptive dynamics of discontinuation, switching and failure among users all contribute significantly to the overall contraceptive prevalence rate (CPR) at any given point in time. In many sub-Saharan countries where the CPR has historically been very low and has only recently begun to rise, encouraging contraceptive continuation has been less of a priority than encouraging new adopters.

However the influence of contraceptive discontinuation on fertility will increase as the CPR increases and fertility falls. The effect of discontinuation and failure on unwanted fertility is then even greater. In a study of 15 developing countries based on Demographic and Health Survey data Blanc et al. (2002: 132) find that in 14 of those countries 'more than half of recent unwanted fertility was as a result of births that were preceded either by a contraceptive failure or by discontinuation of a method [for reasons other than a desire to get pregnant]'. The study concludes that family planning programs need to pay more attention to improving continuation rates and preventing contraceptive failure as fertility in a given area declines (Blanc et al., 2002).

So while encouraging new adopters of contraceptive methods is undoubtedly important, equally important is continuity of use among current users and studies are needed to determine the factors associated with contraceptive discontinuation (Parr, 2003). One obvious set of reasons given by women for contraceptive discontinuation is fertility related reasons, principally the desire to get pregnant. Other reasons for discontinuing may include a women reaching menopause or no longer being exposed to the risk of pregnancy for

example through a union dissolution or the husband living away. This category of reasons indicates the use of temporary contraceptive methods in their intended way, and does not reflect any areas of concern or a necessary area of intervention for family planning service providers. A second category of reasons for discontinuation are method related reasons which include supply side issues such as stock outs or prohibitive costs, method failure and side effects or health concerns. Previous literature has identified side effects or the fear of side effects as an important factor in the discontinuation of methods, particularly modern hormonal methods, (Ali & Cleland, 1995; Ali & Cleland, 1999; Curtis & Blanc, 1997; Bradley et al., 2009) and side effects may also influence method choice away from the high efficacy modern methods. Additionally past negative experiences with a method may influence the future contraceptive behaviour of users. It is this issue of the link between side effects and contraceptive behaviour which is the focus of this study.

This study is situated in Ghana, West Africa and uses data from the Cape Coast Social Learning, Social Influence and Fertility Control Survey (CCFCS) to explore the issue of contraceptive discontinuation and side effects. The overall CPR remains relatively low at 16.6% for modern method use among currently married women aged 15-49 in 2008 (Ghana Statistical Service et al, 2009). Women who used contraception in the past but are not currently doing so are becoming an increasingly important component of contraceptive nonusers in Ghana and lack of continuity of use is a significant explanatory factor for the still only modest CPR (Parr, 2003). There is also evidence of high levels of unmet need for contraception in Ghana. Using data from the 2003 Ghana Demographic and Health Survey (GDHS) Khan et al. (2007) showed that 22% of currently married women who want to delay further childbearing for two years or more and 12% who want to stop further childbearing were not using a method of contraception at the time of the survey. The same study also provides evidence of high discontinuation rates in Ghana. The study calculated the lifetime discontinuation rate for 18 sub-

Saharan African countries and found that the percentage of currently married women who had used a method of contraception in the past but were not using a method at the time of the 2003 GDHS survey was 54% (Khan et al., 2007).

Clinical evidence shows that physical side effects are mainly associated with modern hormonal methods, particularly the pill, injectable, implant, and hormone releasing IUD (CCP & WHO, 2007). The classification of side effects in the CCFCS data is broader than just physical side effects and also allows for psycho-social effects such as loss of sexual pleasure and marital disruption. However, these side effects are relatively rarely reported and as such this study will primarily focus on modern hormonal methods. Within this the focus will be mainly on pill and injectable use given the pertinence of side effects to those methods (see for example Fathonah, 2000; Leite & Gupta, 2007 & Laguna et al., 2000; Sambisa, 1996 & Mitra & Al-Sabir, 1996) and the small number of users of other modern hormonal methods in Ghana.

The choice of control variables will be informed by the existing body of literature in which studies have employed multivariate analysis in order to determine the socio-economic or demography predictors of discontinuation. Studies have shown that type of method, age and wanting no more children are strong predictors of discontinuation while other socio-economic characteristics such as education level and area of residence present mixed results (Bradley et al., 2009; Leite & Gupta, 2007; Ali & Cleland,1995). Cotton et al. (1992: 147) summed up this subject by stating that their ambiguous results 'might indicate that service providers cannot use social or demographic characteristics to predict whether clients are at higher risk for discontinuation'.

Another area of particular interest in this study is discussion and communication about family planning and its effects on episodes of use. It has been well established in many studies that communication about family

planning encourages method adoption (Bawah, 2002; Hornik& McAnany, 2001; Westoff & Bankole, 1997). For example a study using longitudinal data in Northern Ghana found that women who have been encouraged by their peers are almost three times as likely to subsequently adopt a method as those who have not been encouraged, and this rises to four times as likely when the encouragement comes from a health worker (Feyisetan, et al. 2003). The findings suggest that the majority of communication between spouses or friends in a close network was favourable and 'unfavourable communication may travel through less close networks' (Feyisetan, et al. 2003: 24). This is especially interesting given that in a study of discontinuation Porter (1984) found that discontinuation was significantly influenced by unfavourable communication from trusted sources or sources with expertise (past or current users). Communication of any type from unidentified sources (i.e. rumours) was found not to be a significant factor in discontinuation. This suggests that unfavourable communication within close networks is less common but significantly more influential than encouragement or discouragement from less close networks. There are currently no studies investigating the effect of this encouragement or discouragement to continue a method in the face of the experience of side effects.

Most of the studies mentioning side effects or fear of side effects are based on data from the calendar portion of one or more DHS's. The DHS calendar collects monthly information on contraceptive use or non-use retrospectively for five years along with the respondents stated reason for discontinuation in any month in which they end a period of continuous use of a particular method of contraception. Two of the possible reasons for discontinuation are side effects and health concerns which make it possible to use DHS data to study the rate of discontinuation due to side effects. However, the DHS calendar data presents some major limitations in the study of side effects, firstly that this data source is only available for countries implementing the model A core questionnaire which are considered high contraceptive

prevalence countries. Therefore calendar data for countries in sub-Saharan Africa is generally limited, and Ghana which is the focus of this study has not collected extended contraceptive calendar data. Additionally the calendar suffers problems of recall bias, due to the long recall period, and consequently can display serious heaping of data onto 6 or 12 month intervals (Bradley et al., 2009; Blanc & Curtis, 1997).

The major weakness of this type of study is that although a woman may give side effects as her reason for discontinuation the data does not reveal any information at all about the actual experience of side effects which caused her to discontinue. Additionally nothing is known about individuals who experience side effects but continue to persist with the method. Reason for discontinuing has been found in a study by Strickler et al. (1997) to be a relatively unreliable indicator and other authors have observed that a further limitation of the DHS calendar is that it only allows for the recording of one reason for discontinuation when in fact this is likely to be either a complex and multidimensional decision to stop using or a passive (non)decision not to obtain further supplies (Ali & Cleland, 1995). The CCFCS calendar data are designed to overcome these limitations by having a relatively short recall period between surveys and providing detailed monthly data on the experience of side effects.

Besides the important relationship between side effects and method discontinuation for the overall CPR, the response to side effects can also be seen as an indicator of quality of a family planning program and its service provision (Blanc et al., 2002). Ali and Cleland (1995) point out that "although willingness to persevere with a method does not necessarily imply satisfaction, high discontinuation rates are usually a sign of discontent with the method or the service" (Ali & Cleland, 1995: 92). Tolley et al. (2005) found that as a main effect counselling, or lack of counselling, did not predict discontinuation, which they felt raised questions about the content and quality of counselling on side effects. Some side effects, particularly

menstrual changes, are unpredictable and vary considerably from women to women. This uncertainty makes counselling on side effects a complicated task and more information on the potential for different side effects is not necessarily better. Tolley et al. (2005) found for instance that when being counselled regarding side effects users who were told they might not bleed became anxious when they did and vice versa. Cotton et al, (1992) also raised doubts about the quality of counselling and concluded that discontinuation was greatest among people who said they had not been adequately counselled on side effects and better staff training could increase client satisfaction

Aims of study

The conceptual framework of this study (figure 1) highlights three outcomes of an episode of contraceptive use, either the method is discontinued, the user switches to another method or the episode continues beyond the end of the study period. This study aims to establish if the experience of side effects is a significant predictor of discontinuation or switching. The study will also control for socio-economic, motivational and experiential variables.

Conceptual framework

Figure 1 is a diagrammatic representation of the conceptual framework of contraceptive use dynamics and side effects on which this study is based. Time one represents the adoption of a method and the beginning of a new episode, while time two represents the length of the episode and whether or not the user experiences any side effects of the method. Time three represents the ultimate state of the user once the episode of contraception is over, in the case of this study this may mean that the episode did not finish within the study period and the episode has ended by being right censored. The line between time 2 and time 3 represents the decision of the user to either discontinue their method or to switch to a different method. Again

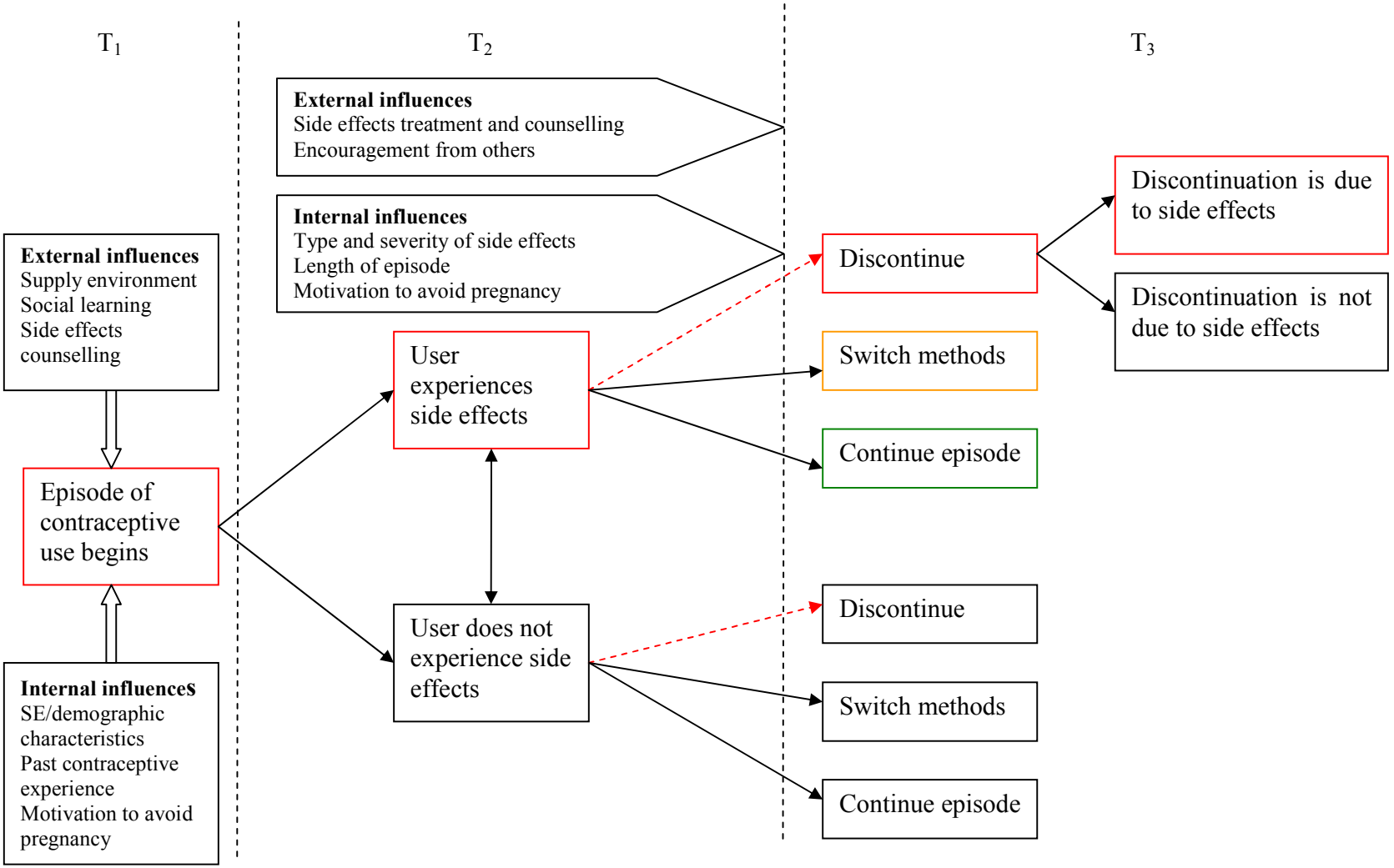
numerous factors may influence this decision and the central aim of this study is to determine if the experience of side effects is a significant determinate.

Limitations

The main limitation of this study is the limited representativeness of the CCFCS. A random probability sample (or complete census) was conducted within each of the six study communities so the data can be said to be representative of those six communities but extreme caution must be draw in making inferences to any wider population beyond this. The socio-economic context of Northern Ghana is sufficiently different to that represented by this data that the results cannot be said to be relevant to Ghana as a whole. The compensation for the limited generalizability of the data is its longitudinal design which allowed for the calendar data to be collected with minimal recall periods which is a significant improvement on other surveys collecting data of this type. One possible source of bias associated with longitudinal surveys is attrition bias. However, given the generally high retention rate in the women's survey it is not felt that this is a significant problem in this study. A final limitation related to the data is that the sample size is insufficient to allow for analysis to be conducted specialty on sub-groups, for example according to method.

A further limitation of this study relates to the chosen methodology in which left censored episodes are not able to be included in any analysis. This causes the loss of a significant amount of data and potentially leads to over estimates of discontinuation rates because long time users who use consistently throughout the entire observation period are excluded due to left censoring.

Figure 1: Conceptual Framework of Contraceptive Use Dynamics



Data and Methods

Data

This paper analyses data from the Cape Coast Social Learning, Social Influence and Fertility Control Survey (CCFCS). This is a longitudinal survey of women aged 18 to 50 at the time of the first interview which was conducted in six locations two in each of the Central, Western and Greater Accra regions of Southern Ghana. The communities are isolated from each other and were purposively selected to provide maximum heterogeneity in terms of ecological setting, economic activity, ethnicity, and kinship system (Casterline, 2007).

The study consisted of eight rounds of data collection between October 1998 and November 2003. A total of 1409 women were interviewed at round 1 along with 908 male partners. Questions regarding contraceptive use were only asked to women currently in union so that restricted the sample available for this study to roughly 900. Respondents were followed from one round to the next and the majority of respondents were observed for between 56 and 60 months (Aglobitse & Casterline, 2005). The average response rate was 95% and overall sample retention was excellent with about 85 percent of women remaining in the sample from Round 1 to Round 8. This is particularly exceptional in the West African setting where rates of residential and circular mobility are high (Casterline, 2007).

At each round of the panel interview, beginning at round 2, women were asked to provide monthly calendar data going back from the current month of interview to the month of the previous interview. The dataset used for this study was created out of the CCFCS by combining elements of both the calendar and panel portions of the data. The calendar is a person-month file containing observations for every individual for every month that they were observed. The CCFCS allowed for up to four simultaneous methods to be recorded each month so the primary method for the purpose of this study was chosen following a hierarchy of method effectiveness. Where more than

one method is recorded the method considered to have the greatest efficacy is chosen as the primary method. Hamil et al. (1990) conducted a study that concluded that this approach did not result in significant bias as the combined efficacy of multiple methods approximates that of the most effective one. This does have implications for the results of this study in terms of the prevalence of side effects, as the most effective methods are the hormonal methods which are also the most likely to have side effects. When the side effects were originally recorded in the calendar the side effect for each month was not linked in any way to the method for that month so after the collapsing of the methods data the side effect will then be attributed to whichever method was the most effective, even if it was actually caused by another less effective concurrent method. This will not affect estimates of the overall incidence of side effects; however it may affect somewhat the proportion of side effects which is attributed to each method. It is not felt that this is a serious problem given that the two most effective methods, pill and injectable, are also the most likely to cause side effects and are unlikely to be used together.

An episode of contraceptive use is defined as the continuous use of the same method reported for a period of 2 consecutive months or more. Each episode of use was identified and a person-period format dataset was created with each case representing one woman-month of use. Left censored (or left truncated) observations were removed from the dataset given that the duration of the episode is unknown due to the unknown start date. Right censored episodes however can be used on the basis that they are non-informative (i.e. independent of censoring mechanism) (Steele, 2005). What is known is that the episode lasted at least a certain duration of time up until the point that the observation period ended. So whilst no event is observed this episode can still be included in the denominator and contribute information to the models.

The outcome variable in this study is a binary variable which marks whether or not the episode of use has ended in an event or if it has been right censored. A discontinuation (an event) is coded 1 while no event (or a censored observation) is coded 0 for each month of an episode. A discontinuation in this case can be either a stopping of use altogether or switch to another method.

The final dataset contains 8937 women months of method use representing 732 episodes of use which are between 2 and 60 months duration. The data represents 476 individuals who each have between 1 and 6 episodes included in the dataset. Table 1 below shows the number of individuals who are contributing multiple episodes to the data.

Table 1: Number of Episodes Contributed by each Woman

Number of Episodes	Frequency (of individuals)	Percent
1	476	65
2	181	24.7
3	51	7.0
4	17	2.3
5	5	0.7
6	2	0.3

Overall 62% (295) of individuals contribute a single episode to the dataset while the remainder 181 (38%) contribute multiple episodes. Although the longest episode in the data set is 60 months duration the number of events (discontinuations or switches) occurring after 36 months is very small, leading any results for episodes of durations longer than 36 months to be unstable. In this case a total of 13 events occur after 36 months which represents 2.73% of all episodes or 2.76% of all events. Therefore any episodes in the data longer than 36 months are considered censored and are treated, along with all other censored cases, as episodes which did not end in a discontinuation or switch within the observation period. This is in line with similar studies which have also censored events after 36 months (Bradley et al 2009). Taking this into account table 2 shows the number of episodes

which end in either a discontinuation or a switch to another method or are right censored. Close to 63% of episodes in the data have an observed event while the remaining episodes are censored.

Table 2: Outcome of Episodes

Outcome	Frequency (of episodes)	Percent
Discontinuation	365	49.8
Switch	93	12.7
Censored	274	37.5

Covariate information was extracted from the panel data by matching the time at the start of each episode with the closest prior interview time. Some questions were only asked in the first interview so where this is the case the information for all episodes comes from the round 1 panel.

The main explanatory variable of interest in this study is the experience of side effects. This is collected in the contraceptive calendar and takes the form of monthly data which is coded as a binary variable where 1 represents any type of side effects in that month and 0 means no side effect in that month. A range of other explanatory variables are included in the regression model representing three main areas, firstly socio-economic and demographic characteristics of the women; secondly variables representing contraceptive use past and present and communication regarding family planning related to the episode; and finally variables which reflect the motivation of the women to avoid a pregnancy. None of these variables is allowed to vary over time at the episode level; therefore the values of these variables may be different for the same women at different episodes but are constant within episodes. The following variables were tested for inclusion in the model, Age at the first month of the episode, Community, Ethnicity, Education, Religion, Children ever born, Method of use for the episode, Respondent has discussed Family Planning with husband, Encouragement given by a health worker in any one or more months of the episode, Respondent has ever talked to anyone who encouraged/discouraged family planning, Respondent has ever

used pill/injection, Respondents' reproductive intentions, Ideal number of children and Ease of becoming pregnant

Methods

The analysis is conducted using a discrete time event history approach which treats the person-period, in this case women-month of method use, as the basic unit of analysis. Multilevel multiple logistic regression is used to determine the effect of side effects on the propensity to discontinue a method while controlling for covariate factors. A multilevel model is used to control for correlation between episodes caused by the fact that a woman can contribute more than one episode to the dataset.

Although the underlying process of discontinuation can theoretically occur at any time on a continuous scale, it is natural to use a discrete time approach, given that the data was collected in discrete time intervals. The discrete time approach also solves the problem that in continuous time models it is assumed that only one event can occur at a time and there can be problems with ties in the data where multiple events occur in the same time period (Jenkins, 2004). The data used is the person-period format, where each case represents one month of use within an episode. The model used is a logistic discrete-time hazards model where the log odds of an event versus no event in any given month are modelled as a function of duration of episode and covariates. The parameter estimates are the log odds ratios of a discontinuation for any given set of covariate characteristics and the exponential of the coefficients is the odds ratio, which is equal to one where X and Y are independent. The logit model is specified as:

$$\text{logit}(h_{it}) = \log\left(\frac{h_{it}}{1-h_{it}}\right) = \alpha(t) + \beta' x_{it}$$

Where the covariates X_{it} can be fixed or time varying and α(t) is the baseline logit-hazard which is a function of t. A step function is used to specify α(t) in this analysis. This is the most flexible form of α(t) and is achieved by treating t as a categorical variable and defining each category with a dummy variable. In this case dummies were created representing 0-6, 7-12, 13-24 and more than 24 months episode duration. This results in a piecewise-constant hazards model where the hazard is assumed constant within each of the categories of time and the baseline logit hazard takes the form: $\alpha(t) = \alpha + \alpha_2 D_2 + \alpha_3 D_3 + \alpha_4 D_4$ where α is the overall intercept and $D_{2\text{-}4}$ are the duration dummies minus a baseline category.

A main-effects model was selected based on the deviance in likelihood ratio test statistic after adding extra parameters to the model. Once the fixed effects were selected the model was further extended into a multi-level model or frailty model. Each episode of use in this data set is a repeatable event and it is possible for each individual to contribute more than one event. Therefore there may be unobservable individual specific factors which lead to correlation between the durations of episodes from the same individual. For example one would expect women who have difficultly with the use of a method to have shorter episodes and contribute multiple short episodes to the data whereas women with no difficulties may have longer continuous episodes of use and may contribute only one episode (Steele et al., 1996). Similarly individuals who are more sensitive to side effects (less tolerant) are more likely to report side effects and also more likely to discontinue, but this sensitivity is not usually observable. Failure to account for this unobserved heterogeneity will lead to biased estimates and underestimated standard errors resulting in overestimation of the significance of variables (Snijders & Bosker, 1999). A two level model is used to allow for the hierarchical structure arising from having repeated episodes nested within individuals. Level one is represented by each case in the person-period data and level two refers to each individual woman. The multi-level model is a simple extension

of the previous model including an extra term to represent variation at the woman level.

$$\text{logit}[h_{ijt}] = \alpha(t) + \beta x_{ijt} + u_j$$

Where u_j is a random effect for individual j which follows a normal distribution with mean 0 and variance σ_u^2. The random effect is interpreted as residual variance between individuals due to unobserved time-invariant characteristics. The random effects model is fitted following the same principles of selection as the fixed effects model by creating nested models. However, for a multi-level logistic model estimated using the quasi-likelihood approximation the likelihood ratio test is unreliable (Snijders & Bosker, 1999). The Wald test is used instead to test whether the random intercept parameters introduced to the model are significant.

Results are interpreted by calculating predicted probabilities of discontinuation in each time period for a given set of episode characteristics. The descriptive and main effects modelling were conducted in SPSS v. 16.0 and the random effects were added using MLwiN V. 2.02.

Results

Descriptive statistics

In total 605 months of side effects were experienced during the total 8937 months of use. Of these 605 months there were 59 months where two different side effects were reported in the same month (thus contributing 118 months of side effects to the total) and 1 month where 3 different side effects were reported (thus contributing 3 months to the overall total). Although the side effects variable in the model is coded as a binary variable it is possible to tell from the original data what type of side effect is experienced. Table 3 shows that the most frequently experienced side effect is irregular cycle which accounts for almost 23% of all months of side effects experienced. This is followed by headache, cramp, irregular heartbeat, dizziness and other which all contribute more than 10%.

Table 3: Number of Months Side Effects Experienced by Type of Side Effect

Type of side effect	Number of months reported	% of reported side effects
Dizziness	61	10.1
Weight gain	13	2.1
Weight loss	8	1.3
Headaches	89	14.7
Excessive bleeding	21	3.5
Irregular cycle	138	22.9
Painful period	4	0.7
Stomach pains/cramps	61	10.2
Irregular heart beat	84	13.8
Marital problems	5	0.8
Loss of pleasure	24	4.0
Loss of strength or ill health	20	3.3
Other	77	12.6
Total	605	100

Table 4 shows the characteristics of the respondents and shows that around 20% of respondents are from communities 2, 4 and 6 with slightly less from the remaining three communities and the proportion of respondents per community is roughly analogous to the proportion of episodes of use

contributed by each community. The majority of respondents are aged between 25 and 34, are of Fante ethnicity and have completed middle or junior secondary school. There is a relatively even distribution of respondents among religious groups with slightly more Pentecostals and less Protestants. Very few individuals (8.2%) have no children at the start of their first episode, while over 30% have 5 or more.

Injectables are the most commonly used method and account for 28% of all episodes, followed by the pill accounting for 23%. The next most commonly used modern method is condoms which contribute 13% of episodes. Given that traditional methods are not commonly associated with side effects, and the small number of episodes associated with the remaining modern methods, these will be grouped together to form an 'other' category for the rest of the analysis.

It would be expected that most individuals would have discussed family planning with their husbands given that all are current users of a method. The 23% of women who report they have not discussed with their husband may be engaged in the secret use of a method without their husband's knowledge. Encouragement by a health worker at some point during the episode is reported in over 40% of episodes, 70% of all individuals report ever being encouraged by someone to use family planning while only 31% report being discouraged. In around half of the episodes of pill use the user reports having used the pill before but this is only true for 40% of injectable episodes. In terms of motivation to avoid pregnancy table 4 shows that the majority of respondents want another child and feel that they can get pregnant quickly if they want to. The ideal number of children is 3 or 4 for almost 60% of respondents.

Table 4: Background Characteristics of Sample: Episodes and Individuals

Variable	Category	Individuals*	Episodes
		Frequency (%) n = 476	Frequency (%) n = 732
Socio-economic/demographic			
Community	1	73 (15.3)	116 (15.8)
	2	99 (20.8)	168 (23)
	3	66 (13.9)	100 (13.7)
	4	98 (20.6)	130 (17.8)
	5	48 (10.1)	62 (8.5)
	6	92 (19.3)	21.3 (21.3)
Age	16-24	146 (30.7)	216 (29.5)
	25-34	211 (44.3)	343 (46.9)
	35+	119 (25)	173 (23.6)
Ethnicity	Fante	198 (41.6)	296 (40.4)
	Ga - Adangbe	127 (26.7)	218 (29.8)
	Other/Denkyira/ Ahanta/ Ewe	151 (31.47)	218 (29.8)
Education	None	131 (27.5)	191 (26.1)
	Primary	128 (26.9)	212 (29)
	Middle/Junior	194 (40.8)	294 (40.2)
	Secondary/Higher	23 (4.8)	35 (4.8)
Religion	Catholic	88 (18.5)	129 (17.6)
	Protestant	84 (17.6)	121 (16.5)
	Moslem	112 (23.5)	185 (25.3)
	Pentecostal	132 (27.7)	214 (29.2)
	Other/none/traditional/Syncretic	60 (12.6)	83 (11.3)
Children ever born	None	39 (8.2)	53 (7.2)
	1-2	147 (30.9)	235 (32.1)
	3-4	135 (28.4)	212 (29)
	5+	155 (32.5)	232 (31.7)
Contraceptive Use and Communication			
Method	Pill	106 (22.3)	167 (22.8)
	Injectable	121 (25.4)	205 (28)
	Foam/diaphragm/jelly	13 (2.7)	19 (2.6)
	Condom	70 (14.7)	95 (13)
	IUD	11 (2.3)	14 (1.9)
	Rhythm	99 (20.8)	141 (19.3)
	Withdrawal	19 (4.0)	35 (4.8)
	Herbs	32 (6.7)	48 (6.6)
	Norplant	4 (0.8)	7 (1)
	Other	1 (0.2)	1 (0.1)
Respondent has discussed Family Planning with husband	No	108 (22.7)	141 (19.3)
	Yes	349 (73.3)	567 (77.5)
	Don't know	19 (4)	24 (3.3)

Table 4: Background Characteristics of Sample: Episodes and Individuals

Variable	Category	Individuals*	Episodes
		Frequency (%) n = 476	Frequency (%) n = 732
Encouragement given by a health worker in any one or more months of the episode	No	-	433 (59.2)
	Yes	-	299 (40.8)
Respondent has ever talked to anyone who encouraged family planning	No	147 (30.9)	209 (28.6)
	Yes	329 (69.1)	523 (71.4)
Respondent has ever talked to anyone who discouraged family planning	No	329 (69.1)	502 (68.6)
	Yes	147 (30.9)	230 (31.4)
Respondent has ever used pill (in the time before the observation period) current pill episodes only **n = 167**	No	-	86 (51.5)
	Yes	-	81 (48.5)
Respondent has ever used injection (in the time before the observation period) current injection episodes only **n = 205**	No	-	125 (61)
	Yes	-	80 (39)
Motivation to Avoid Pregnancy			
Respondents reproductive intentions	Wants a (another) child	266 (55.9)	408 (55.7)
	Wants no more (none)	177 (37.2)	272 (37.2)
	Cannot get pregnant/ Undecided/Don't Know	33 (6.9)	52 (7.1)
Ideal number of children	None, 1 or 2	48 (10.1)	86 (11.7)
	3 or 4	278 (58.4)	437 (59.7)
	5+	110 (23.1)	148 (20.2)
	Non-numerical response/don't know	40 (8.4)	61 (8.3)
Ease of becoming pregnant	Quickly	229 (48.1)	348 (47.5)
	Takes a long time	161 (33.8)	255 (34.8)
	Can no longer become pregnant/ Don't Know	86 (18.1)	129 (17.6)

*Individual data calculated using the first episode of use within the dataset for each individual

Multiple Multilevel Logistic Regression Results

The first stage in the model selection was to examine the relationship between the probability of discontinuation in any given month and the experience of side effects without controlling for background variables. Duration of episode is also included in the model to allow the baseline hazard to vary with time. The results of this model are presented as model 1 in table 5 below. Table 5 shows that as expected the odds of a discontinuation in any given month decrease significantly as the duration of the episode increases. The results also show that side effects are a significant predictor of discontinuation and the exponential of the coefficient shows that the odds of a discontinuation is almost three times higher if a side effect is experienced than if it isn't.

The next stage of the model selection is to control for other covariates and determine which are to be included in the model as main effects. The model at this stage contains main effects for, duration, side effects, method, being encouraged by a health worker and number of children ever born. The remaining covariates were not significant at the 5% level and were not included. The coefficients for the main effects model are shown as model 2 in table 5 and show that once the other variables are in the model the effect of duration on the odds of discontinuing is significantly attenuated and there is no longer a significant difference between episodes of 7-12 months duration and the baseline of 0-6 months. There is a significant difference between pill and injectable episodes with injectable users having lower odds of discontinuing than pill users. The odds of discontinuation decrease as number of children ever born increases, however the difference between 1 or 2 children and none is not significant. Those episodes in which encouragement was received from a health worker during the episode are almost 6 times less likely to end in a discontinuation than where no encouragement was given. Finally the odds ratio of discontinuation with side effects compared to without side effects remains significant and is slightly increased.

Table 5: Results of Regression Models 1-4

		Model 1				Model 2				Model 3				Model 4			
Variable	Category	β	SE(β)	Sig.	Exp(β)	β	SE(β)	Sig.	Exp(β)	β	SE(β)	Sig.	Exp(β)	β	SE(β)	t	Exp(β)
Episode Duration	0-6	0			1.00	0			1.00	0			1.00	0			1.00
	7-12	-.279	.118	.018	.757	-.153	.120	.202	.859	-.433	.149	.004	.648	-0.326	0.154	-2.12	0.72
	13-24	-.588	.127	.000	.556	-.320	.130	.014	.726	-.584	.168	.001	.558	-0.401	0.177	-2.27	0.67
	24+	-1.467	.222	.000	.231	-1.014	.227	.000	.363	-1.859	.392	.000	.156	-1.576	0.409	-3.85	0.21
Method	Pill					0			1.00	0			1.00	0			1.00
	Injection					-.623	.145	.000	.536	-.610	.146	.000	.543	-0.665	0.160	-4.16	0.51
	Condom					.282	.170	.097	1.326	.284	.171	.096	1.328	0.285	0.188	1.52	1.33
	Other					-.083	.132	.529	.920	-.042	.133	.749	.958	-0.060	0.147	-0.41	0.94
Children ever born	None					0			1.00	0			1.00	0			1.00
	1 or 2					-.165	.204	.421	.848	-.154	.205	.454	.858	-0.198	0.232	-0.85	0.82
	3 or 4					-.542	.208	.009	.581	-.501	.208	.016	.606	-0.564	0.236	-2.39	0.57
	5+					-.608	.211	.004	.545	-.586	.211	.006	.557	-0.655	0.240	-2.73	0.52
Side effect experienced	No	0			1.00	0			1.00	0			1.00	0			1.00
	Yes	1.095	.137	.000	2.990	1.250	.146	.000	3.490	.807	.235	.001	2.242	0.829	0.248	3.34	2.29
Encouragement by a health worker	No					0			1.00	0			1.00	0			1.00
	Yes					-.853	.114	.000	.426	-1.381	.206	.000	.251	-1.428	0.218	-6.55	0.24
Episode Duration * Side effect experienced	0-6 * yes									0			1.00	0			1.00
	7-12 * yes									.547	.354	.123	1.728	0.587	0.367	1.60	1.80
	13-24 * yes									.737	.354	.037	2.089	0.807	0.372	2.17	2.24
	24+* yes									2.409	.557	.000	11.123	2.467	0.585	4.22	11.79
Episode duration * Encouragement by a health worker	0-6 * yes									0			1.00	0			1.00
	7-12 * yes									.895	.285	.002	2.446	0.822	0.297	2.77	2.28
	13-24 * yes									.686	.300	.022	1.986	0.605	0.314	1.93	1.83
	24+* yes									1.248	.504	.013	3.484	1.138	0.528	2.16	3.12
Constant		-2.674	.073	.000	.069	-1.913	.216	.000	.148	-1.804	.217	.000	.165	-1.815	0.243	-7.47	0.16
Random intercept														0.191	0.082	2.33	1.21

The final stage in the fixed effects model is to include interaction terms to allow for differing relationships between the explanatory and outcome variables over time. Two interactions proved to be significant, duration of episode and side effects and duration of episode and encouragement from a health worker. A third interaction between duration of episode and number of children ever born also significantly improved the overall fit of the model however none of the individual parameters was significantly different from the baseline category. As the interpretation of this interaction is not intuitively strong and in the interest of parsimony this interaction is not included. The final fixed effects model results are shown as model 3 in table 5. The only major change in the model after the inclusion of the interaction terms is that the main effect for the experience of side effects is no longer significant. This coefficient does not retain any interpretation as a main effect so this variable will be interpreted only through calculating predicted probabilities which include the interaction terms.

The final step in the model selection is to include a random intercept term to the model to control for any unobserved correlation caused by the multiple episodes per women in the dataset. Model 4 in table 5 shows the model coefficients after the intercept has been allowed to vary randomly across women level. Although some of the coefficients vary slightly in magnitude there are no significant differences in the model after the random effect has been added. The random parameter itself is significant at the 5% level according to the rough Wald test value which is 2.33. This means that there is significant unexplained variation in the outcome at the individual level.

Model 4 is therefore the final model which included all main effects interactions and the random intercept terms. In Model 4 the effect of method on the likelihood of discontinuation can be interpreted as a main effect and shows that injection users are 50% less likely to discontinue the episode within 36 months than pill users. The coefficients estimated for condom and other methods are not significantly different from the baseline category of

pill use. Figure 2 shows the predicted probability of discontinuation by duration of episode for pill and injectable episodes. The graph shows that for both pill and injection the probability of discontinuation declines steadily as the duration of the episode increases.

Figure 2: Probability of Discontinuation by Method and Duration of Episode (all other variables held at baseline category)

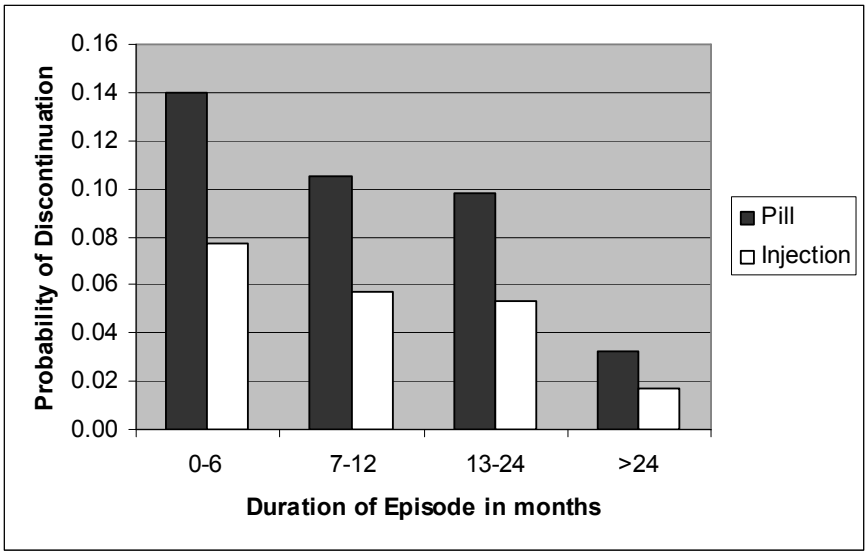


Figure 3 shows that as the number of children ever born increases the probability of discontinuation decreases but the difference becomes very small in episodes lasting longer than 24 months. This is what would be expected under the assumption that limiters will on average have longer episodes of use than spacers. Although the '1 or 2' category has a slightly higher probability of discontinuation than the 'none' category in episodes of duration longer than 12 months the difference between these two categories is not statistically significant.

Figure 3: Probability of Discontinuation by Number of Children Ever Born and Duration of Episode (all other variables held at baseline category)

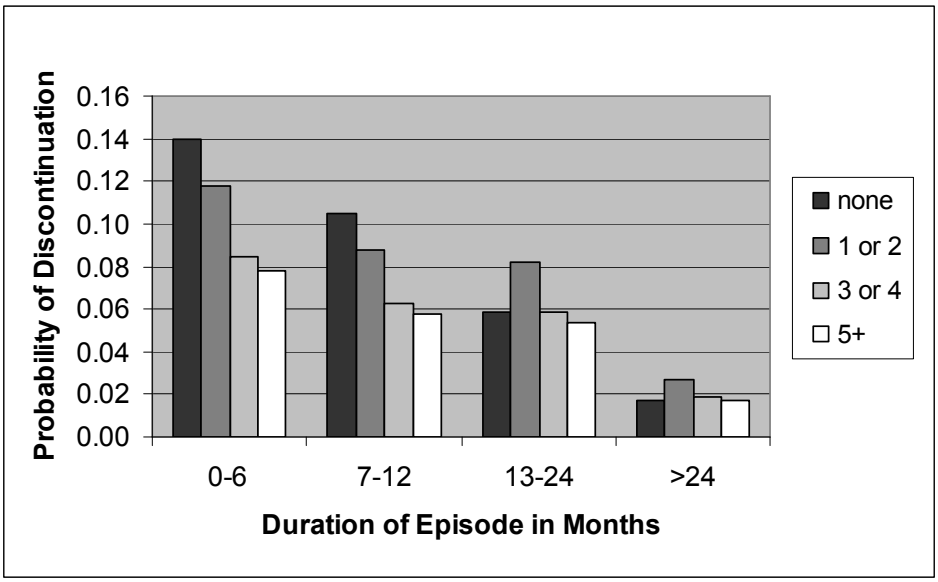


Figure 4 shows the interpretation of the interaction between the experience of side effects and the duration of the episode. It shows that where side effects are experienced the probability of discontinuation increases as the episode duration increases, while where side effects are not experienced the probability of discontinuation decreases as the episode gets longer.

Figure 4: Probability of Discontinuation by Experience of Side Effects and Duration of Episode (all other variables held at baseline category)

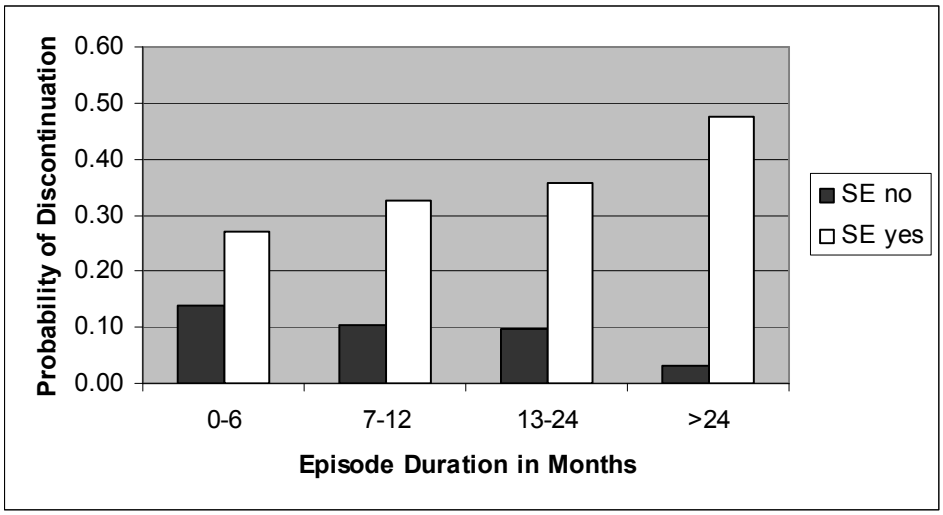
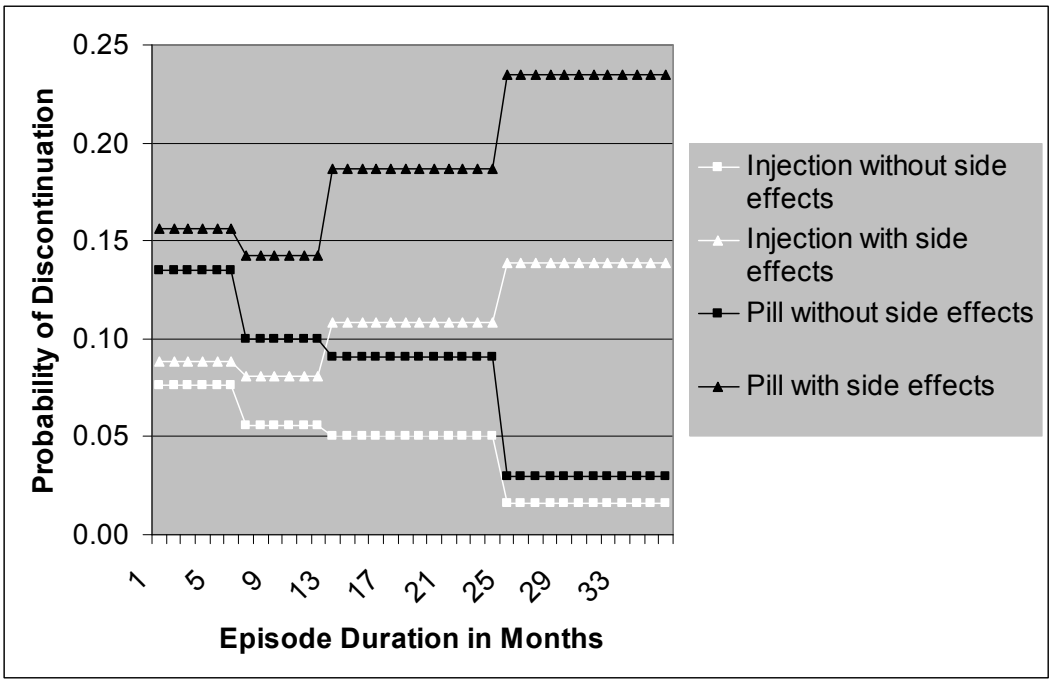


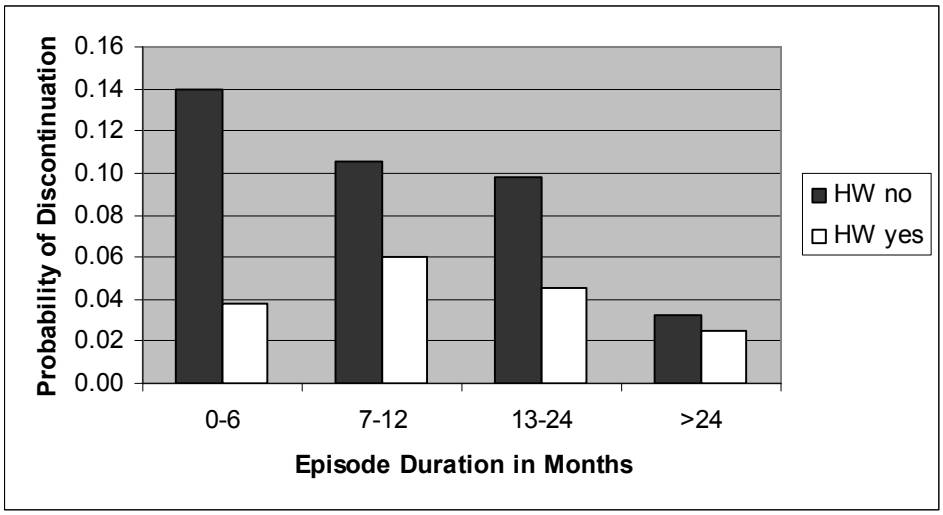
Figure 5 shows the same effect for both pill and injectable episodes and shows that the pattern is the same for both methods however the disparity between the probabilities of discontinuing with or without side effects is greater for pill users. It is also worth noting that the probability of discontinuing injection methods with side effects is still less than the probability of discontinuing pill episodes without side effects until 12 months duration.

Figure 5: Probability of Discontinuation by Method and Experience of Side effects over Duration of Episode (not encouraged by a health worker, 1 or 2 children ever born)



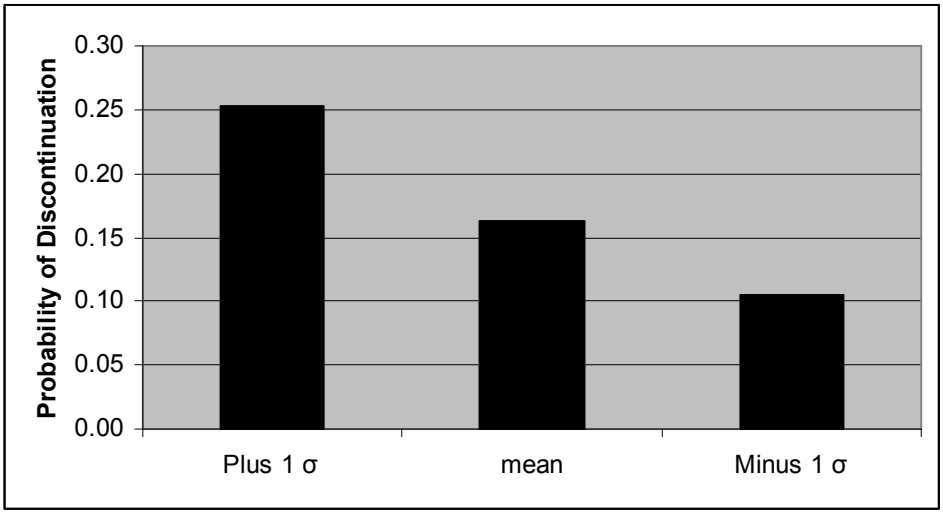
The final variable in the model is being encouraged by a health worker at some point during the episode. The interaction of this variable with episode duration is shown in figure 6 below. This graph shows that in all cases the probability of discontinuation is less for those who do receive encouragement from a health worker than for those who do not. However the magnitude of this effect diminishes with time. For those who do receive encouragement the probability of discontinuing goes up slightly for between 7 and 12 months duration but then decreases with time.

Figure 6: Probability of Discontinuation by Encouragement from a Health Worker and Duration of Episode (all other variables held at baseline category)



Finally figure 7 shows the effect of the random variance at level 2 of the model which is the individual woman. The graph shows the predicted probability of discontinuation for an average woman, labelled 'mean' and for women one standard deviation above and below average. This shows that the probability of discontinuation varies by 15% between women with different predispositions to discontinuing.

Figure 7: Probability of Discontinuation by Random Intercept Variance for minus 1 standard deviation, average and plus 1 Standard deviation. (All other variables held at baseline category)



Discussion and Conclusions

The results of this study concur with previous studies on the topic and have shown that there is indeed a significant relationship between the experience of side effects and the discontinuation of hormonal contraceptive methods. The importance of this relationship is reinforced by the finding of this study that side effects are relatively rarely reported in association with methods other than the pill and injectable, which together account for over 50% of all methods used in this population. Side effects are most commonly associated with episodes of injectable use which contribute 55% of all months of side effects compared to only 33% associated with pill episodes. This is due to the large contribution of months of the injectable episodes to the dataset by virtue of their longer duration. When looked at as a percentage of the total number of months of use for that method pill and injectable are roughly the same in respect to the reporting of side effects with 11.5% and 10.1% of months with side effects reported respectively.

Also in concurrence with previous studies by far the most frequently reported side effect was menstrual disruption, which accounted for 23% of all the months of side effects experienced. This finding reinforces the opinion of Tolley et al. (2005) that menstrual disruption is a side effect which can have important implication for continuation and should not be dismissed. Other commonly reported side effects were headache, cramp, irregular heartbeat, and dizziness which each contribute more than 10%. As would be expected menstrual disruption was most frequently associated with injectable use while headaches are the most common side effect for pill users.

In the logistic discrete-time hazards model the experience of side effects was shown to be a significant predictor of discontinuation but the relationship between the two varies with the duration of the episode. In general the probability of discontinuation decreases steadily with time, however where side effects are experienced the probability of discontinuation first declines after 6 months and then increases again after 12 months. At all times the probability of discontinuation is significantly greater if side effects are

experienced after controlling for all other variables in the model and unobserved factors at the woman level. The strength of motivation to use a method will vary considerably in episodes of short duration and it is accepted that side effects are more likely to occur in the beginning of an episode and that this leads to high rates of discontinuation in the first 6 months. Once episodes have survived to reach a certain length there is a selection effect whereby only highly motivated individuals are still using while the less highly motivated have already discontinued. The effect of side effects on discontinuation becomes increasingly significant as episode duration increases because those individuals still using after a long duration are highly motivated to use and do not have as many other reasons remaining to discontinue.

It was also investigated whether or not this may be reflecting some sort of cumulative effect whereby multiple months of side effects are experienced throughout a long episode and eventually a limit to the tolerance is reached. This was investigated by including in the model a cumulative measure of how many of the months in a given episode side effects were reported. This variable proved not to add anything significant to the model as there was no statistical difference between any of the coefficients except between having no side effects and having one month of side effects.

Although side effects proved to be very significant as a predictor of episode duration and discontinuation other hypothesized predictors were not all significant. The regression showed that the odds of discontinuing decrease steadily with the number of children ever born but other measures of motivation to avoid pregnancy such as fertility intentions were not significant. Similarly all of the socio-economic variables were insignificant as predictors of discontinuation. This supports the statement by Tolley et al. (2005) that it is not possible to identify high risk groups for discontinuation on the basis of socio-economic characteristics. Among the communication variables only one proved to be significant and that is receiving encouragement from a health worker. In contrast to what was found by Porter (1984) being discouraged from using a method seems to have no effect on discontinuation in this study.

Receiving encouragement from a health worker overall significantly decreases the odds of discontinuing but as with side effects this effect differs across time. The influence of encouragement by health workers on the probability of discontinuation is particularly great in the first six months and then declines proportionally over time.

Method choice does play a significant role in the probability of discontinuation and at all points throughout an episode the probability of discontinuing is lower for injectable users than for pill users. This reflects attributes of the method itself which may influence the likelihood of discontinuation. The pill is administered in a way in which is totally under the control of the user and which requires a conscious daily decision to continue. For this reason it is easy for users to discontinue the pill, either because they have a specific reason, or through ambivalence and inaction. In either scenario the user has the ability to discontinue immediately. The injectable on the other hand (and to an even greater extend, the IUD and implants) are not under the daily control of the user. This can be a benefit as the user does not have to make daily decisions regarding their contraceptive, however it also 'disempowers' women and places some of the control in the hands of the service provider. This leads to a lower probability of discontinuation overall and potentially to a more considered and drawn out process of discontinuation.

Policy Implications

This study emphasizes what others have found in that counselling from health workers is extremely important in minimizing discontinuation rates. The results show that health worker encouragement has the largest effect in the first 6 months but discontinuations with side effects still occur at longer episode durations. Therefore counselling and encouragement from health workers must be continued even once episode duration is long. Both pill and injection users should be given attention as both methods attract the same proportion of side effects however the average length of injection episodes is much longer suggesting that injection users are more likely to tolerate the side

effects. Given that menstrual disruption is the most likely side effect with injectable use this suggests that with sufficient motivation and counselling this is a side effect which does not have to lead to discontinuation. These results also show that once a method has been adopted negative communication has little role in discontinuation so efforts should be focused on overcoming fear of side effects as a barrier to the initial adoption. As pointed out by Ali & Cleland (1999) the process of contraceptive discontinuation is complex and multi dimensional and cannot be easily predicted based on the characteristics of the user of the episode. As such service providers should as far as possible treat each case as individual and have the flexibility to respond to the changing needs of users as they progress through each episode of use.

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