Influence of Family Planning Services on Contraceptive Failure: Evidence from the Kanchanaburi Demographic Surveillance System

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Introduction

Since Thailand's government officially adopted a policy of supporting voluntary family planning in early 1970, the contraceptive prevalence rate in Thailand has increased substantially from nearly 15 percent of currently married women in 1969 (Bennett et al.,1990) to 79.2 percent in 2001. This remarkably high percentage puts Thailand at the mature stage of contraceptive behavior.

Though Thailand has a high percentage of contraceptive use, a report from the Thai Health 2006 (Kanchanachitra, et al., 2006) indicates that 33% of pregnancies each year are unintended. Clearly not all unintended pregnancies are due to contraceptive failures, because unintended pregnancies can occur when no contraception is used. However, as shown from the Thai Health 2006, one in four women who had unintended pregnancies used contraceptives.

A pregnancy that occurs while a contraceptive method is being used is generally known as a contraceptive failure. This contraceptive failure implies the ineffectiveness of contraceptive use by women. Consider the method-specific contraceptive failure in Thailand during 1984-1986 and 1993-1996, as shown in table 1. Evidently, contraceptive failure is increasing for temporary methods such as pill and injections, except for IUD and condoms. Especially, when the most popular

contraceptive method for Thai is pill and injection is the third (Wilairat and Chetuwong, 2004). Hence, this increasing failure rate is of concern to those who want to practice birth spacing, because it may contribute to unwanted pregnancies resulting in induced abortions.

Table 1: Annual Cross-Sectional Failure Rate by Method, 1984-1986 and 1993-1996

Method	1984-1986	1993-1996
Pill	3.0	5.0
Injection	1.0	2.1
IUD	3.1	2.2
Condom	4.4	4.4
Norplant	0.0	0.4

Sources: 1. Wongboonsin, Thongthai, and Choe, 1993 Table 7, p.25
2. Chamratrithrirong et al, 1997, Table 7.1, p.54.

Unintended pregnancies are far more likely to terminate in an induced abortion (World Health Organization, 1998). It is reported in the Thai Health 2006 (Kanchanachitra et al., 2006) that women who do not want to get pregnant are 16 times more likely to have an induced abortion than women who want to get pregnant. Even though there is no accurate information on the actual number of abortions in Thailand, one indicator that might be used to evaluate trends in abortion is the rate of hospitalization for abortion complications per 1,000 live births. This rate increased from 40.0 in 1981 to 68.4 per 1,000 live births in 1999 (Gespradit, 2001).

These phenomena demonstrate that some women in Thailand using family planning are still inadequately protected from having unplanned pregnancies which can lead, in the case of Thailand where abortion is not legal, to illegal induced abortions. Therefore, efforts should be made to prevent contraceptive failure in order to prevent induced abortions.

Generally, there are three measures of contraceptive failure employed in the literature: method failure; use failure; and extended use failure[1]. Regardless of the reason for contraceptive failure is, failure rates are useful for clinical evaluation of contraceptive provision because high failure rates may indicate a weakness in the family planning program (such as providing information about the use of contraceptive methods). While policy makers have expressed concern over the increasing contraceptive failure rate among Thai women, little empirical evidence exits on the linkage between family planning programs and contraceptive failure (Curtis and Blanc, 1997; Steele, Curtis and Choe, 1999).

How does access to and quality of family planning service affect contraceptive behavior? This is subject to debate as well as a critical issue to developing country like Thailand, which must prioritize and allocate limited resources. The ability to quantify access to and quality of family planning services would allow health planners to identify trade-offs between increasing access by a certain quantity versus allocation of family planning resources and services.

This study, therefore, would like to assess the impacts of access to and quality of family planning service on contraceptive failure in the case of Thailand. The hypothesis is that women who have better geographic access to family planning services, and especially services of high quality, are less likely to experience contraceptive failure.

Material and Method

This study analyzes longitudinal data collected between January 1999 and June 2004 in the Kanchanaburi Demographic Surveillance System (KDSS)[2]. This system comprised 100 villages/census blocks in Kanchanaburi province.

Data on contraceptive failure is from the contraceptive calendar of the KDSS. The contraceptive calendar contains monthly contraceptive histories for the previous 6 years for all married women. For each month, respondents were required to indicate

their maternity status (whether they were pregnant or gave birth or terminated a pregnancy) or contraceptive use status (whether they were use or nonuse). If they did use contraception, the type of contraceptive method was specified. If the respondent stopped using contraception in that month, she was asked the reason for discontinuing. This contraceptive calendar helps to identify precisely the timing of events.

In addition, there are questions in the KDSS calendar asking whether pregnancies occurred while using a contraceptive method. This provides direct information on the occurrence of a contraceptive failure.

Ever-married women in reproductive age (15-49) (number 11,813 women) were the population in this study. In Thailand asking about contraceptive use and fertility is a sensitive issue for unmarried women. Hence, the analysis is based on episodes of contraceptive use and non-use among these 11,813 women, who collectively contribute 439 woman-months of contraceptive failure. Besides, episodes of sterilization are excluded.

The dependent variable is the hazard of contraceptive failure (defined as becoming pregnant while using contraception) among episodes of contraceptive use. Episodes of contraceptive use are classified according to five types of method: 1) Long-term reversible method: intrauterine device (IUD) and implant; 2) injectables; 3) pills; 4) condom; 5) others methods, such as natural and traditional method.

The explanatory variables of most interest in this study are those relating to family planning services. The objective in defining these variables was to include indicators of both spatial accesses to the nearest family planning service and the quality of family planning defined by Jain (1989)[3]. However data available on service quality are limited and the appropriate indicators for five of the six elements of Jain quality of care framework could not be identified. The only element of the quality of services that can be examined in this study is method choice potential.

All spatial accessibility variables are constructed using Geographical Information System (GIS) techniques. Weight-distance is used to calculate travel time to the nearest public health service facility, and Kernel Density is used to calculate density of service provider within 10 km. Details of service variables are given in appendix A and results of GIS techniques are shown in appendix B and C.

Service provision by historical calendar was obtained retrospectively via "the Contextual History Calendar". This information is used by a GIS technique called a Cost Allocation to measure availability of contraceptive method choice at the nearest family planning provider for each year during the observation period. Data derived from all GIS techniques are used as explanatory variables for each individual.

Statistical analysis

The main objective of this study is to determine whether the occurrence and timing of contraceptive failure depends on predictor variables. An appropriate statistical method for this purpose is the discrete-time hazard model. The discrete-time approach was appropriate for this analysis instead of the continuous-time approach for several reasons (Allison, 1982; Steele, 2005). First, the duration of each interval is recorded to the nearest whole month, which makes the measurement of time discrete. Second, the discrete-time approach can easily and flexibly incorporate time-varying covariates as explanatory variables. Third, tests revealed that the assumption of proportional hazards did not hold for the entire duration, which argues against employment of a simple Cox model, for example. Lastly, the discrete-time approach can accommodate, and properly adjust for, repeated events, which is important because some women experience more than one contraceptive episode during the observation period.

When time is expressed in discrete periods, the conditional hazard of event occurrence in each time period has a bounded nature, with the lower and upper limits of 0 and 1. Hazard rate (h_t) in discrete time is the probability that an event will occur at a

particular time to a particular individual, given that the individual is at risk at that time. Logistic regression is used to estimate the discrete-time hazard function .

More specifically, in an analysis in which the event of interest is represented by a dichotomous dependent variable (as is the case with contraceptive failure), the dependent variable for each person-period unit is

γ_{ti} = 1 if individual i experiences the event at time *t*

And 0 otherwise

Hence the discrete-time hazard (logistic) model for the odds of contraceptive failure during a given month *t* is expressed as*:*

$$\log\left[\frac{h_{ti}}{1-h_{ti}}\right] = \alpha_t + \beta x_{ti}'$$

Where h_{ti} is the probability of hazard of contraceptive failure for individual *i* at time t, given that the event has not occurred before time *t*; α_t is the baseline rate of contraceptive failure as a function of time; and x_{ti} is a set of possibly time-varying covariates with associated parameters β. In the analysis presented in this study, the hazard is represented by a quadratic function of time (woman-months), that is, $\alpha_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2$.

Results

We hypothesize that women who have better geographic access to family planning services of higher quality are less likely to experience contraceptive failure. To test this hypothesis, we apply the discrete-time approach to 181,735 months of contraceptive use, with each month characterized in terms of access to family planning services and a set of control variables. The results are presented in Table 1.

As already noted, duration-dependence is captured via linear and quadratic terms. Note that duration is measured as months since the beginning of the contraceptive episode. The logistic regression equation contains four terms ("Month 12", …, "Month 48") to control for a "seam effect" that is evident in these data, as is commonly the case in panel survey data. This is a tendency for the calendar data to show contraceptive transitions at the time of the annual round of interviewing; this is assumed to be reporting error, rather than a true pattern of behavior. The equation also contains one term ("Heaping_month_12") to control for noticeable heaping on duration twelve months into the episode. Finally, we include a variable to control for secular trend in contraceptive behavior ("Month"), assumed to be due to unmeasured factors.

Turning to the results of greatest interest, several indicators of the family planning service environment show no effect on contraceptive failure: travel time to the nearest public health facility, and density (within 10 kilometers) of public health facilities. One facet of the family planning service environment does show a statistically significant effect on contraceptive failure, namely the availability of methods or choices provided at the nearest public health facility (Table 2). Women who have 1-3 methods provided at the nearest public health center are 1.4 times more likely to experience failure than those who have more than three methods available at the nearest public health facility (OR=1.4). This is a substantial effect – roughly 40% increase in the risk of contraceptive failure.

Several socio-demographic variables are also significant predictors of contraceptive failure: One of these is age: older women experience a 9 percent decrease in the likelihood of contraceptive failure (OR=0.9). This is similar to findings from previous studies that older users have consistently lower rates of failure than younger women (Moreno, 1993; Entwisle and Sayed, 1991; Steele, Diamon and Wang, 1996; Grady, Billy and Klepinger, 2002). This result is as expected because as a woman grows older her fecundity decreases. Also, advancing age probably strengthens women's motivation to use permanent contraceptive methods, which lower the risk of failure.

The probability of contraceptive failure for Burmese women is not statistically difference from Thais. However, other minority groups, i.e., from Laos and Cambodia are more likely to experience failure when compared with Thais (OR=1.5). One explanation might because Burmese is the biggest minority group who have been living in Kanchanaburi for a long time. Therefore, when family planning promotions target minority groups, they might have a better chance of reaching a larger group like Burmese instead of other ethnic groups. With reduced promotion, the probability of contraceptive failure increased for other ethnic groups as compared with Thais.

Women who work in either the agricultural sector or in other occupations are less likely than women who were unemployed during the time of survey to experience contraceptive failure (OR=0.7 and 0.7 respectively). Generally, women who engage in work are more educated than women who are unemployed which make them become more reachable to family planning information. Besides, working condition may influence women to choose long term or semi-permanent method which make them less likely to experience contraceptive failure.

The estimates in Table 2 also show that women with fewer children are more likely to experience contraceptive failure as compared to women who have more than 3 children. In addition, women with no children are 65 percent more likely to experience contraceptive failure as compared to those who have more than 2 children (OR=1.7). For women with few children, the probability of contraceptive failure increases to 26 percent when compared to those who have more than 3 children.

This finding is confirmed by the effects of type of contraceptive method. Women who use long term reversible methods like IUDs or Norplant are less likely to experience contraceptive failure (OR= 0.3) as compared to those who use the pill. Meanwhile, those who use injections experienced a 60 percent decrease in the likelihood of contraceptive failure as compared to pill users (OR=0.4). Users of other contraceptive methods such as natural birth control methods are more likely to experience contraceptive failure (OR=1.7) than those who use pills.

Table 2: Discrete-time logit equation for contraceptive failure, Kanchanaburi DSS, 1999-2004.

Explanatory variables	Est.	Odd
Constant	-3.7***	
Duration	0.0	1.0
Duration ^{2}	0.0*	1.0
Month 12	0.4	1.4
Month 24	-0.6	0.5
Month 36	-2.0*	0.1
Month 48	-1.9	0.1
Heaping_month_12	-0.8	0.4
Month	-0.0***	1.0
Travel time to the nearest public health facility		
Less than 5 (ref.)		
5-30 mins.	0.1	1.0
More than 30 mins.	0.3	1.3
Density of public health facilities within 10 kilometers		
0 (ref.)		
1-2	0.1	1.1
3+	0.2	1.3
Available methods/ choices		
1-3	0.4*	1.4
More than 3 (ref.)		
Age	-0.1***	0.9
Ethnicity		
Thai (ref.)		
Burmese	0.4	1.4
Others	0.4*	1.5
Education		
None (ref.)		
Compulsory	0.1	1.1
Higher education	-0.2	0.9

Table 2: (Continued)

Explanatory variables	Est.	Odd
Occupation		
Unemployed (ref.)		
Agriculture sector	-0.3**	0.7
Other occupations	-0.3*	0.7
No. of living children		
0	0.5*	1.7
1-2	-0.3*	0.7
3+ (ref.)		
Method used		
Pill (ref.)		
IUD/Norplant	-1.1***	0.3
Injection	-0.9***	0.4
Condom	-0.7	0.5
Other methods	0.5*	1.7
Contraceptive intention		
Spacing (ref.)		
Limiting	0.0	1.0
- Log likelihood	-2895.46	
Pseudo R2	0.06	
Number of person years	181735	

* Significant at p<0.05; ** Significant at p<0.01; *** Significant at p<0.001

Conclusion and Discussion

This study provides evidence of effects of some facets of family planning services on contraceptive failure. Among variables measuring spatial accessibility and quality of family planning program, statistically significant associations were found only between the likelihood of contraceptive failure and the number of contraceptive methods provided at the nearest public health service facility.

After decades of expanding the quantity of services points, contraceptive use has become strongly established in Thai society. As a consequence, the mere geographic accessibility of services has declined in importance as a determinant of contraceptive behavior. Accordingly, most researchers and policy makers have shifted their focus to access to family planning services of high quality,

Access with quality is based on an availability of adequate contraceptive methods that couple can choose. In the Program of Action of the UN International Conference on Population and Development (ICPD) in 1994, family planning is represented as a basic human right: couples and individuals should be able to decide freely and responsibly the number and spacing of their children, and to have the information and means to do so (Wilairat and Chetuwong, 2004). To reach this gold milestone, family planning program must provide "good quality family planning services" – couples and individuals should be informed of their choices and should have available a full range of safe and effective methods.

As availability of contraceptive methods is a proxy for quality of care, the results of this study suggest that the recent emphasis on increasing the diversity of methods available in the family planning program should result in a decrease in contraceptive failure rates. Therefore, findings from this study support the view that Thai women need good quality family planning services.

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Notes

1 *Method failure* refers to pregnancies that are directly attribute to the limitations of the method; *use failure* includes all pregnancies that occur while a woman and her partner consider themselves users of method; *extended-use failure* includes pregnancies that occur both during use and during any period subsequent to discontinuation before another method is adopt. (Bairagi and Rahman, 1996).

2 The KDSS was implemented by Institute for Population and Social Research (IPSR), Mahidol University, Thailand.

3 According to Jain's framework, it defines quality of care in term of six fundamental elements: choice of methods, technical competence of provider, and information given to clients, interpersonal relations, mechanisms to ensure follow-up and continuity, and an appropriate constellation of services.

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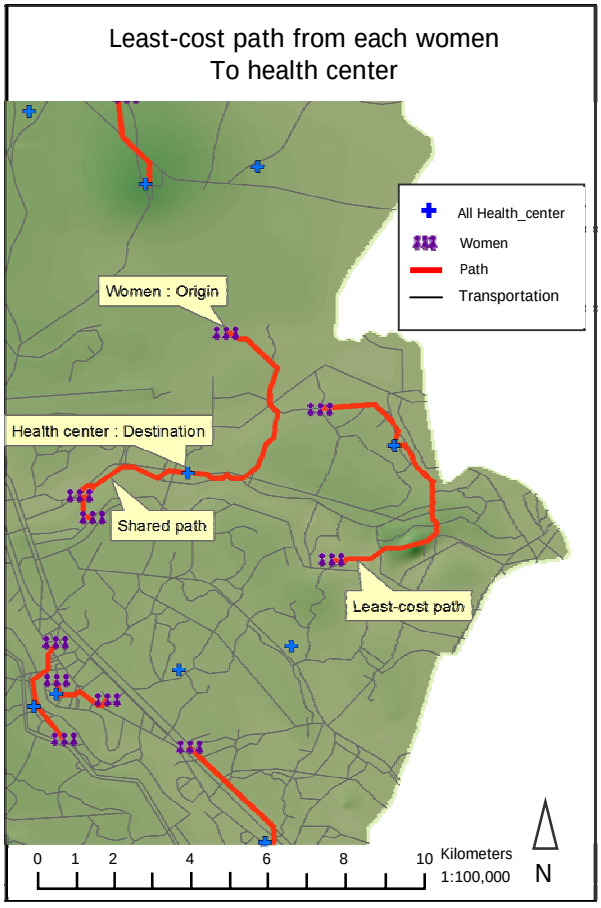
Appendix A

Explanatory variables included in the analysis

Variables	Definition
Service factors:	
Travel time to public service provider	Travel time to the nearest public health service Less than 5 minute (ref.), 5-30 minutes, More than 30 minutes
Density of health service provider	Density of public health service within 10 km. Density <1 (ref.), 1-2, >2
Availability of contraceptive method provision	Time varying variable (yearly) of family planning provision provided at the nearest public health service. Available at least 3 methods, Available more than 3 methods (ref.)
Demographic factors:	
Women's Age	Time varying variable (monthly) of women's age at start episode.
Ethnicity	Women's ethnicity Thais (ref.), Burmese ,Others
Socioeconomic factors:	
Education	Time varying variable(yearly) indicated the highest education level women's attended No education (ref.), compulsory education, higher than compulsory, Other educations.
Employment status	Time varying variable (yearly) indicated women's employment status. Unemployed (ref.), working in agriculture sector, working in other sectors.
Fertility factors:	
Number of living children	Time varying variable (monthly) of number of living children 0 (ref.) , 1-2, 3-4, 5+
Fertility intention	Time varying variable (yearly) indicated women's purpose for fertility intention. Want no more children (ref.) or want more children.
Method factors	
Method use	Time varying variable (monthly) of contraceptive method women used Pill(ref.), Injection, IUD or Norplant, Condom, Others.

Appendix B

The least-cost path from each woman to public health center derived from cost weight distance



Appendix C

Density of Family Planning Outlet during 1999-2004