Asian Population Studies

ISSN: 1744-1730 (Print) 1744-1749 (Online) Journal homepage: http://www.tandfonline.com/loi/raps20

The effects of setting up a National Family Planning Program in local communities on women's contraceptive experiences and fertility in rural Thailand

Adriaan Kalwij

To cite this article: Adriaan Kalwij (2016) The effects of setting up a National Family Planning Program in local communities on women's contraceptive experiences and fertility in rural Thailand, Asian Population Studies, 12:2, 156-176, DOI: 10.1080/17441730.2016.1142796

To link to this article: http://dx.doi.org/10.1080/17441730.2016.1142796

Published online: 15 Apr 2016.

ASIAN POPULATION STUDIES, 2016
VOL. 12, NO. 2, 156–176
http://dx.doi.org/10.1080/17441730.2016.1142796

Routledge
Taylor & Francis Group

The effects of setting up a National Family Planning Program in local communities on women's contraceptive experiences and fertility in rural Thailand

Adriaan Kalwij

School of Economics, Utrecht University, P.O. Box 80125, 3508 TC Utrecht, The Netherlands

ABSTRACT
It is widely documented that Thailand's National Family Planning Program (NFPP) has been successful in increasing contraceptive prevalence and reducing fertility. In this paper, we investigate to what extent setting up the NFPP between the mid 1960s and the early 1990s in local communities per se has added to this success. For this, we use data from the 1992/93 Survey on the Status of Women and Fertility in Thailand (SWAFT). We find that presence of the NFPP in a community is associated with less than two percentage points higher proportion of women with contraceptive experience at ages 15–19, to about six percentage points higher proportion at ages 35–39, and with about a 3 per cent lower completed fertility. Although these associations are relatively small, they are significant and may suggest that setting up the NFPP in local communities per se has been important for a small group of hard-to-reach women with unmet contraceptive needs.

KEYWORDS
Household Behavior; survey data; inequity; family planning program; contraception; fertility

1. Introduction

The introduction of birth control methods like the 'pill' and societal changes like female empowerment are widely believed to have caused women's widespread adoption of contraceptive technology, which in turn was instrumental in the global decline in total fertility rates during the second half of the twentieth century (Lee, 2003). As female's actual adoption of contraceptive technology makes it more likely that couples can achieve their desired number of children (Bongaarts, 2001; Oppenheim-Mason & Smith, 2000), providing women control over their fertility is an important aim for policymakers. In particular, such control improves the economic well-being of both the women and their families through, for instance, higher female labor force participation and increased investment in children's health and education (Baily, 2006; Bongaarts, Cleland, Townsend, Bertrand, & Das Gupta, 2012; Goldin & Katz, 2002; Grönqvist, 2008; Knodel & Wongsith, 1991; Rosenzweig & Schultz, 1985, 1987; Schultz, 2005). A frequently used policy tool from about the mid1960s onward to help women achieve this control over their fertility is a (voluntary) family planning program that provides contraceptive information, services, and technology.[1] A publication commissioned by the World Bank (Bongaarts et al., 2012) discusses

CONTACT Adriaan Kalwij a.s.kalwij@uu.nl

the (renewed) increased interest in family planning programs over the last few years and makes a strong and convincing case that the top priority for the twenty-first century international agenda on population policy should be to reduce inequities in women's access to and use of contraceptive methods linked to such factors as poverty, age, and cultural background. Doing so would allow all women to have the number of children they desire and one way to achieve contraceptive services and technology to be provided to hard-to-reach women with unmet contraceptive needs is to set up family planning programs in local communities.

According to the empirical evidence from developing countries, family planning programs are by and large successful in reducing fertility (Bongaarts et al., 2012; Robinson & Ross, 2007). The evidence on the size of this reduction, however, is rather mixed, ranging from an insignificant impact to one that explains most of the historical decline in the total fertility rate (TFR). Tsui (2001), for example, in an overview of family planning programs in the second half of the twentieth century, concludes based on a cross-national analysis that family planning programs have impacted TFR from a small 2 per cent increase in Africa up to a 30 per cent decline in Asia. For Thailand specifically, Schultz (1997) finds about 44 per cent decline in the number of children under the age of five per woman and credits most of the historical decline in Thailand's TFR to the country's national family planning program. Hermalin and Khar (1996), in contrast, based on their overview of micro level studies, conclude that community level access to family planning programs has no strong influence on woman's fertility decisions. Miller (2010), exploiting a quasi-experimental setting, finds that only about 10 per cent of the decline in fertility during Colombia's demographic transition can be attributed to a community-based family planning program, while Sinha (2005) shows that among low-income households in rural Bangladesh, a community-based family planning program reduces lifetime fertility by about 13 per cent.[2]

With regards to the impact of a family planning program on contraceptive prevalence, Sharma, Pratap, and Ghimire (2011), using data from Nepal, demonstrate that exposure to family planning messages increases the odds of using (modern) contraceptives. Desai and Tarozzi (2011), in contrast, find that a community-based family planning program in rural Ethiopia has no significant impact on contraceptive use, an outcome they explain by the mismatch between the contraceptive methods women demand and what the program supplies. Weaver et al. (2013) observe a similar lack of effect on contraceptive prevalence for Indonesia.[3] For Indonesia, Gertler and Molyneaux (1994, 2000) investigate the impact of family planning programs on fertility and one of their findings most relevant to our study is that increased contraceptive use was primarily through economic development, improved education and economic opportunities for females, rather than through family planning programs. This increased contraceptive use explains 75 per cent of the fertility decline in Indonesia over the 1982–1987 period. The results of Gertler and Molyneaux (1994) may explain that the studies referred to above of Hermalin and Khar (1996), Miller (2010), and Sinha (2005) find small impacts of family planning programs on fertility. In Thailand, however, early research seems to suggest that the 1976 introduction of a free pill policy did lead to an increase in pill users (Knodel, Bennett, & Panyadilok, 1984), while living closer to a family planning outlet increased contraceptive prevalence by about five to eight percentage points (Entwisle, Hermalin, Kamnuansilpa, & Chamratrithirong, 1984).

The main contribution we make to the existing empirical literature is that we quantify for Thailand the associations of setting up a family planning program in a community with contraceptive experiences and through these, fertility outcomes. To specify, we do not aim to evaluate Thailand's family planning program, as it has been widely documented to be a great success (see next section), but aim to estimate the additional effects on contraceptive experiences and fertility of setting up such a family planning program in the local community per se. The main idea behind setting up a family planning program close to the people in their communities, is that in this way contraceptive technology and services are also provided to hard-to-reach women with unmet needs for contraception, and inequities in women's access to and use of contraceptive methods are reduced (Bongaarts et al., 2012, p. 52). Unmet need for contraception is influenced by factors such as living in rural areas, cultural background, and health concerns (Bongaarts & Bruce, 1995). For our analysis we estimate an empirical model of lifetime birth and contraceptive decisions using individual-level data from rural Thailand.

Investigating Thailand's experience with a family planning program is of particular interest because as early as the mid-1960s (and up to the early 1990s) the country began introducing a National Family Planning Program (NFPP) into local communities that is generally considered to exemplify best practice. Hence, Thailand's experience can provide policymakers with empirical evidence on the extent to which, as argued in Bongaarts et al. (2012), setting up a family planning program in local communities can achieve a reduction in inequities in women's access to and use of contraceptive methods by delivering these methods also to hard-to-reach women and, as a result, more women having control over their fertility. The data for our analysis are taken from the Survey on the Status of Women and Fertility in Thailand (SWAFT), conducted in 1992/93 among married women to gather, apart from background characteristics such as education and ethnicity, retrospective information on when the women have given birth and when they started using contraceptive methods. This latter information is used to construct a variable (having had) contraceptive experience. To this end, SWAFT recorded various aspects of these women's reproductive histories during the period in which Thailand was implementing the NFPP in the respondents' local communities. While these data are gathered already over 20 years ago, they allow us to empirically investigate policymakers' belief that a community-based family planning program affects women's completed fertility through their contraceptive decisions. Such an investigation requires longitudinal information on both the contraceptive and the fertility decisions of the survey respondents over their lifetimes and over a period during which a family planning program has been introduced in their communities.

2. Background

Over the past half century, Thailand has gone through a demographic transition which mirrors that of most industrialized countries (Lee, 2003; Prachuabmoh & Mithranon, 2003). Until the mid-1960s, the nation's TFR was above six, and at that time, the strong population growth forecast for the decades to come raised concerns among policymakers who feared a Malthusian style catastrophe. In 1964, and with strong support from the United Nations, Thailand's government began developing what became its national family planning program (NFPP) (Rosenfield, Bennett, Varakamin, & Lauro, 1982). The

NFPP's goal is to make contraceptive services and methods available to all women in Thailand under the assumption that adoption of contraceptive methods reduces TFR (Shevasunt, Hogan, & Thaithong, 1978).

Thailand's NFPP began with a pilot study in the district of Potharam over the 1964–1966 period, with a follow-up in 1969 (Vimuktanon & Rosenfield, 1971). In its baseline survey, this study revealed that only about three per cent of the women were using contraceptive methods, indicating a strong unmet demand. By providing family planning services in Potharam over an 18-month period, the program increased contraceptive use to about 33 per cent of (married) women. In 1965, four hospitals in Bangkok opened family planning clinics. After the opening of the IUD (intra-uterine device) clinic at Chulalongkorn Medical School (Bangkok) – the first time a public hospital had offered a free, simple, and reversible method of birth control – women from other provinces began wearing the device as well. Within the first year of operation, women from 54 of Thailand's 71 provinces were wearing an IUD obtained from this clinic (Fawcett, Somboonsuk, & Khaisang, 1967), and within three years, this number grew to 65 provinces (Hemachidha & Rosenfield, 1975). This example implies a strong willingness of women to travel long distances to obtain the contraceptive services they desire. Yet interestingly, at that time, there was no public information about this clinic, and information about family planning services passed mainly by word-of-mouth. In 1967, the Thai government initiated the Family Health Research project, which provided family planning training to all rural doctors, nurses, and midwives and at least one physician and one nurse from each of the 84 provincial hospitals (Hemachidha & Rosenfield, 1975). In 1970, this project was officially renamed the National Family Planning Program (NFPP), and in 1972, nationwide campaigns were begun to inform the public about family planning services. Advances like the availability of electricity in a community, are likely to have contributed to the success of these campaigns as a 1977 survey shows that about half of all Thais were receiving their family planning information from radio and television (Population Institute, 1991).

By using physicians and nurses at public and private health clinics and hospitals, the NFPP expanded over the next two decades to a nationwide coverage whose successful implementation has in large part been credited to the Community-Based Family Planning Services initiated in 1974. This agency typically offers locally adapted services at the community level using trained local residents (Krannich & Krannich, 1980), thereby enabling the NFPP to empower communities by disseminating contraceptive information, technology, and services locally. Many health clinics were newly set up in (remote) rural communities for this purpose. Although most contraceptive supplies come from the government (through hospitals and health clinics), some are also provided by drugstores and other commercial organizations (Chamratrithirong, Kamnuansilpa, & Knodel, 1986). Hence, in principle, contraceptive services and methods are available to all families at a relatively low cost.

If the success of Thailand's NFPP is measured by the reduction in TFR and increased contraceptive use, it must be considered a great success: Thailand's current TFR is below two (Prachuabmoh & Mithranon, 2003) and contraceptive prevalence increased during the 1970s and 1980s from about 15 to 68 per cent among 'ever married' women (Knodel & Chayovan, 1990). The success of the NFPP was also confirmed by the original pilot study and other experiences discussed above. Between 1970 and

1975, the TFR reduction was driven primarily by an increase in oral contraceptive use (from about 4 to 15 per cent), and between 1976 and 1984, by a 23 per cent increase in female sterilization. By the 1990s, most Thai women had contraceptive knowledge, and the unmet contraceptive need among married women was down to about 5 per cent (Population Institute, 1991). This ability of Thailand's NFPP to increase contraceptive prevalence and reduce TFR is generally attributed to a combination of a strong demand for contraceptives from the start of the program (Krannich & Krannich, 1980) and a strong government commitment to support the NFPP from its inception (Bennett, Frisen, Kamnuansilpa, & McWilliam, 1990).[4,5]

Yet, even though the studies cited above provide convincing empirical evidence of the NFPP's success, other societal changes may also have affected the TFR and the adoption of contraceptive methods. For example, in recent years, Thailand has experienced a strong growth in the manufacturing and service sectors, one that has increased the demand for skilled labor (Siriprachai, 2009). This increase has improved investment opportunities in the human capital of children and, correspondingly, augmented the incentive for parents to so invest. Such increases, however, have also raised the cost of children and may have caused a parental shift toward child quality and away from quantity (Becker, 1981), an assumption empirically supported by Knodel and Wongsith (1991). In addition, over the same period, education levels and the labor force participation of women have increased and are likely to have had their own impact on fertility (Jain, 1981; Richter, Podhisita, Chamratrithirong, & Soonthorndhada, 1994). Nevertheless, it has been argued by some others such as, Bongaarts and Sinding (2009) that these economic explanations are not sufficient to warrant dismissal of the overwhelming evidence on the success of (voluntary) family planning programs.

Further discussion on Thailand's fertility transition and how various factors, including the NFPP, may have influenced this transition is provided in an excellent qualitative analysis by Knodel, Havanon, and Pramualratana (1984).

Overall, the literature reviewed above provides sufficient evidence that NFPP is likely to have been instrumental to women's adoption of contraceptive technology and the strong reduction in Thailand's TFR during the second half of the last century. Hence, the research question we seek to answer in the remainder of this paper is what effect the presence of the NFPP in local communities per se has had on women's contraceptive experiences and completed fertility during Thailand's demographic transition.

3. Data and empirical model

The analytic data are taken from the Survey on the Status of Women and Fertility in Thailand (SWAFT; Smith, Ghuman, Lee, & Oppenheim Mason, 2000), conducted in 1992/1993 using a representative sample of 2800 women aged 15–44 who were married (registered or non-registered) at the time of interview.[6] We include women born between 1950 and 1969 (2310 women). The reasons for this selection are that the younger cohorts may still be in education, albeit that in our sample only 0.5 per cent of the woman are in education after age 20, and that women from these cohorts were at least 23 years old at the time of survey and by that age in 1992 most Thai women were married.[7] As information on when the NFPP was implemented is only available for rural communities, we also exclude 690

women living in urban areas. Finally, three women whose religious affiliation is other than Buddhism or Islam are excluded. The final sample, therefore, consists of 1617 married women aged 23–42 from rural Thailand.

Using retrospective information, we are able to determine at which ages women gave birth to their children and when they started using contraceptive methods. This latter variable we refer to as 'having had contraceptive experience'.[8] Level of education, illiteracy, and whether or not the woman can speak Central Thai are included in the analysis as previous studies have shown that higher educated women postpone childbearing (e.g. Gustafsson & Kalwij, 2006) which may be a result of higher opportunity costs of childbearing and better labor market opportunities for higher educated women. Religious and ethnic affiliations are included as Chamratrithirong et al. (1986) find, for instance, that contraceptive use is lower and fertility levels and preferences are higher among Muslims than among Buddhists. They also report regional variation in family size and contraceptive use and we also control for this. Year of birth is included in the analysis as societal changes may, as discussed in section 2, have caused a parental shift toward child quality and away from quantity (Becker, 1981; Knodel & Wongsith, 1991).

Finally, we have the year in which the NFPP was implemented in the respondent's community (*amphoe*[9]) of residence, making it possible to identify every woman's age at that time. This variable, designated 'NFPP in the community,' takes the value zero before that age and one from that age onward; it necessarily varies across ages and communities.

As Table 1 shows, 58 per cent of the women in our sample can speak Central Thai, 83 per cent are of Thai ethnicity, 89 per cent are Buddhists, and 88 per cent have completed at most primary school. Panel A of the table outlines the distribution of the women over the North, North-East, Central, and South regions, and panel B summarizes the gradual implementation of the NFPP over the years covered by our data. Table 2 then shows that with progressively later birth years, there is a strong decrease in the percentage of women that are totally uneducated or illiterate (panel A), a decrease in the number of children, and a decrease in the average age of first contraceptive experience (panel B). Specifically, according to panel A, as education level increases, women have, on average, fewer children and have their first contraceptive experience at a younger age. In addition, as shown in panel B, the more recent cohorts are more likely to have had NFPP in their local community when they were young.

3.1. Empirical model

Our empirical model is similar to those used in some studies discussed in the introduction (e.g. Rosenzweig & Schultz, 1985). The first part of our empirical model relates a woman's contraceptive experiences to her lifetime fertility decisions. The second part, estimated jointly with the first, assesses the relation between a family planning program in a woman's community and her actual experiences of adopting contraceptive technology. These two parts together provide empirical evidence on the effects of setting up a family planning program in a local community on women's completed fertility through their contraceptive decisions.

Table 1 Sample characteristics of 1617 women at the time of interview (1992/3).

Panel A Variable	Categories	%
Birth cohort	1950–1954	22.02
	1955–1959	25.79
	1960–1964	28.32
	1965–1969	23.87
Region	North	25.36
	North-East	23.75
	Central	25.42
	South	25.48
Language	Cannot speak Central Thai	42.30
	Can speak Central Thai	57.70
Ethnicity	Thai	83.49
	Chinese	8.66
	Other	7.85
Religion	Buddhism	88.56
	Islam	11.44
Education level	1. No education/illiterate	40.01
	2. Primary education (grade 1–7)	47.99
	3. Secondary/lower vocational education	6.74
	4. Higher vocational/bachelor/graduate education	5.26
Panel B		**Frequency**
Year NFPP set up in community[a]	1968	1
	1972	3
	1973	1
	1975	1
	1978	2
	1979	2
	1982	1
	1983	6
	1984	3
	1985	3
	1986	1
	1987	2
	1988	4
	1990	1
	1991	1

[a]32 rural communities; NFPP = National Family Planning Program.

More formally, we jointly model women's probabilities of giving birth and having had contraceptive experience at each age from age 15 onward up until the age at time of interview using the following bivariate probit model:

$$B_{it} = I\left(\lambda_1(t;\alpha) + \sum_{p=1}^{5} \beta_1^p I(K_{it} = p)X_i + \sum_{p=1}^{5} \gamma_1^p I(K_{it} = p)C_{it} + \varepsilon_{1,it} > 0\right), \tag{1}$$

$$C_{it} = I\left(\lambda_2(t;\alpha) + \sum_{p=1}^{5} \beta_2^p I(K_{it} = p)X_i + \sum_{p=1}^{5} \gamma_2^p I(K_{it} = p)NFPP_{it} + \varepsilon_{2,it} > 0\right). \tag{2}$$

In this model, estimated by maximum likelihood, a woman is indexed by i, her age is denoted by t, $\varepsilon_{1,it}$ and$\varepsilon_{2,it}$ are bivariate normally distributed error terms, and $I(.)$ is an indicator function. B_{it} is equal to one if woman i gave birth to a child at age t, and zero otherwise.[10] C_{it} is equal to one if woman i has already used contraceptives by age t or starts using contraceptives at age t (i.e., has contraceptive experience by age t), and zero

Table 2 Education, number of children, contraceptive experience, and NFPP exposure by birth cohort.

Panel A Birth cohort	No education /illiterate	Primary education (grade 1–7)	Secondary/lower vocational education	Higher vocational/bachelor/ graduate education
	%	%	%	%
1950–1954	53.93	42.98	1.12	1.97
1955–1959	42.93	48.68	4.32	4.08
1960–1964	40.61	42.36	9.17	7.86
1965–1969	23.32	58.55	11.66	6.48
Average number of children at the time of interview (1993)	2.75	2.31	1.66	1.42
Average age at first contraceptive experience	21.10	19.75	18.81	18.88

Panel B Birth cohort	Number of children at the time of interview	Age at first contraceptive experience	NFPP in the community before age 15 (%)	Age when NFPP set up in community
	Average	*Average*	%	*Average*
1950–1954	3.28	23.70	0.84	29.87
1955–1959	2.67	20.83	11.03	25.07
1960–1964	2.19	19.17	20.31	21.04
1965–1969	1.53	17.47	39.12	17.67
1950–1969	2.40	20.16	18.12	23.22

otherwise. The main reason for using such a bivariate probit model is that it takes into account the possible endogeneity of contraceptive experience when estimating its effect on giving birth. Essentially, we employ an instrumental variables estimator to identify the effect of contraceptive experience on fertility outcomes using presence of the NFPP in a local community as an instrument. The age dependencies of both outcomes, given by $\lambda_2(t;\alpha)$and $\lambda_2(t;\alpha)$, are modeled using dummy variables for each age. The covariates education and year of birth, which capture societal changes, are in X_i and may have their own impact on fertility (see Section 2).[11] As discussed above, X_i also includes woman's religious affiliation and ethnicity and whether or not she can speak Central Thai. The variable $NFPP_{it}$ is equal to one if the NFPP is present in woman i's community at age t, and zero otherwise. We include as well community-level fixed effects, thereby controlling for possible non-random allocation of NFPP across communities as some (time constant) characteristics of a community may be related to both NFPP allocation and fertility or contraceptive behavior (Angeles, Guilkey, & Mroz, 1998). This inclusion also ensures that, as mentioned in the introduction, the effects of presence of the NFPP in a community on contraceptive decisions is identified from setting up the NFPP in a community during the years covered by our sample.

In line with the large body of literature demonstrating a stronger effect of education on the timing of first births than later births, we allow the effects of education and birth cohort to differ by birth parity, p. To do so, we distinguish five parities (no children, one child, two, three, and more than three children), and use variable K_{it} to denote the number of children a woman has at age t (excluding birth/conception at age t). We also allow the effects of contraceptive experience and the NFPP on birth and contraceptive experience, respectively, to differ by parity, allowing us to identify two dynamics: (i) whether contraceptive methods are associated with the postponement of births and/or lower completed fertility and (ii) what role community-based NFPP plays in this relation at each parity (Joshi & Schultz, 2013).

4. Empirical findings

Table 3 presents the main results of our model, which are summarized completely in the online Appendix Table A. Here, the correlation coefficient (below panel B) indicates a significant negative correlation between contraceptive experience and birth, underscoring the importance of modeling the probabilities of having had contraceptive experience and giving birth simultaneously. The effects of the NFPP presence in the community on having had contraceptive experience at all parities are jointly significant (p-value = 0, not shown here), which is required for model identification. The test statistics at the bottoms of panels A and B show that homogenous effects (across parities) is rejected and confirm the importance of allowing for interactions between the explanatory variables and birth parity. Finally, the community fixed effects are jointly significant in both equations. Our main findings remain unchanged, however, when (in unreported estimations) these community effects are modeled as random effects, which may suggest random allocation in NFPP implementation across communities.

The results in Table 3 are organized by birth parity (columns). The reference women are those with no children (parity 0), born in 1950–1954, and with a level 1 education (illiterate/no education). The dominant picture that emerges from panel A is that, in line with

Table 3 Parameter estimates of equations (1) and (2), with childless women born in 1950–1954 who have level 1 education as the reference category[a].

Parity	No children		One child		Two children		Three children		Four or more children	
Panel A Dependent variable: *Having had contraceptive experience*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*
Intercept (reference)	0.00		0.89	15.23	1.63	26.86	1.65	23.64	1.84	23.67
Birth cohort 1950–1954	0.00		0.00		0.00		0.00		0.00	
Birth cohort 1955–1959	0.42	9.89	0.70	13.64	0.43	8.19	0.37	5.60	0.48	6.47
Birth cohort 1960–1964	0.71	16.13	1.04	19.21	0.87	13.36	0.65	7.37	0.42	3.86
Birth cohort 1965–1969	1.03	21.10	1.67	23.80	1.19	11.55	1.00	6.11	0.00	−0.01
Education level 1	0.00		0.00		0.00		0.00		0.00	
Education level 2	0.17	5.17	0.08	1.91	−0.10	−2.17	0.16	2.71	−0.11	−1.79
Education level 3[b]	0.60	11.44	0.17	1.86	0.21	1.35	0.42	1.76		
Education level 4[b]	0.54	10.32	0.22	1.96	0.16	0.86	−0.95	−4.00		
Family planning program in community	0.09	2.28	0.15	3.18	0.20	3.76	0.30	4.58	0.33	4.60
Joint significance community fixed effects (*p*-value)	0.00									
Test homogenous birth cohort effects (*p*-value)	0.00									
Test homogenous education effects (*p*-value)	0.00									
Test homogenous family planning program effect (*p*-value)	0.00									
Panel B Dependent variable: *Birth*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*
Intercept (reference)	0.00		0.43	6.89	0.08	1.01	−0.04	−0.41	0.08	0.77
Birth cohort 1950–1954	0.00		0.00		0.00		0.00		0.00	
Birth cohort 1955–1959	−0.02	−0.38	−0.03	−0.47	−0.12	−2.04	−0.13	−1.67	−0.06	−0.66
Birth cohort 1960–1964	0.00	0.05	−0.17	−2.75	−0.22	−3.21	−0.22	−2.25	−0.17	−1.38
Birth cohort 1965–1969	0.00	0.06	−0.36	−4.49	−0.23	−2.27	−0.65	−3.23	−0.27	−0.84
Education level 1	0.00		0.00		0.00		0.00		0.00	
Education level 2	−0.04	−1.06	−0.05	−1.19	−0.05	−0.92	0.09	1.29	0.04	0.57
Education level 3[b]	−0.27	−4.00	−0.24	−2.70	0.07	0.51	0.20	0.92		
Education level 4[b]	−0.47	−6.48	−0.08	−0.74	−0.03	−0.16	−0.27	−0.64		
Having had contraceptive experience (0–1)	0.14	1.28	−0.32	−2.90	−0.46	−3.92	−0.55	−4.30	−0.67	−5.35
Joint significance community fixed effects (*p*-value)	0.00									
Test homogenous birth cohort effects (*p*-value)	0.00									
Test homogenous education effects (*p*-value)	0.00									

(*Continued*)

Table 3 Continued.

Panel B Dependent variable*: Birth*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*	*parameter estimate*	*z-value*
Test homogenous effect of having had contraceptive experience (*p*-value)	0.00									
Correlation coefficient	−0.16	−2.67								
Value log-likelihood function	−23581									
Number of women	1617									

[a]Additional controls are age specific dummy variables, community fixed effects (reference is a rural community in central Thailand), religious affiliation (Buddhism as a reference, or Islam), if the woman can speak Central Thai, and ethnicity (Thai = reference vs. Chinese or other). All estimation results are in the online Appendix Table A.

[b]The categories for three or more children are merged because the sample contains only seven observations of women with education levels 3 and 4 who have more than three children (at the time of interview).

Knodel and Chayovan (1990), the probability of having had contraceptive experience, increases with higher birth parity. This panel also illustrates that the probability of having had contraceptive experience increases with later birth cohorts at every parity and with higher levels of education for childless women but less so for women with children. Panel B reveals that, for women with children, the probability of giving subsequent birth decreases with later birth cohorts, but educational level appears to mainly decrease the probability of a first birth. Panel A further indicates that having the NFPP in the community has the largest impact on the probability of having had contraceptive experience at higher parities, while panel B shows that having had contraceptive experience is not significantly associated with the probability of first birth but is significantly associated with lower probabilities of subsequent births. In other words, presence of the NFPP in a community is mostly associated with women who have fewer children as the strongest associations are for women who already have children.

4.1. Predictions

Tables 4 and 5 provide quantitative insights into the predicted effects, based on the Table 3 estimations, of education and birth cohort on the number of children and the probability of having had contraceptive experience by a certain age.[12] For the baseline predictions, our reference is women born in 1950–1954, with a level 1 education (no education/illiterate), who can speak Central Thai, are Buddhist, have Thai ethnicity, and live in a rural community in central Thailand with no NFPP in place. The first columns in both tables give the predictions for baseline (reference) women, about 8 per cent of whom have had contraceptive experience at ages 15–19. By ages 35–39, this percentage increases to about 84 and the women have on average just over three children. This latter prediction is close to the census statistic reported in Hirschman, Tan, Chamratrithirong, and Guest (1994) for a similar group of women.

We then examine how these predictions change if we vary one characteristic at a time holding the other characteristics constant. The remaining columns of Table 4, therefore, show the differences between women with baseline characteristics (education level 1) and women with higher levels of education. The dominant trend is that as educational level rises, there is a strong increase of about 32–42 percentage points in the probability of having had contraceptive experience at ages 15–19 and about a 10–12 percentage point increase in the probability of having had contraceptive experience at ages 35–39. Completed fertility (the number of children at ages 35–39) decreases by almost one child for women with a primary-level education up to almost 1.5 children for women with the highest level of education. This prediction is in line with aggregated census statistics in Hirschman et al. (1994) for all types of women, which show about a 1.8 difference in TFR in 1981/83 and around a difference of 1 in 1988/89 between women with no education and those that are most highly educated. In general, this table shows that the largest differences in contraceptive experience and number of children occur between women with no education (including illiterate women) and women with at least a primary education.

In Table 5, we make no predictions for some age categories because these would be out of sample predictions. The dominant pattern from this table is a strong increase in having had contraceptive experience at all ages with later birth cohorts. Similarly, the number of

Table 4 Predicted probabilities of having had contraceptive experience and number of births by education level.

Educational attainment	Baseline[a]		Difference from the baseline					
	No education/illiterate		Primary education (grade 1–7)		Secondary/lower vocational education		Higher vocational/ bachelor/graduate education	
	estimate	*z-value*	*estimate*	*z-value*	*estimate*	*z-value*	*estimate*	*z-value*
Having had contraceptive experience	*%*		*%-points*		*%-points*		*%-points*	
15–19	7.85	8.27	32.13	14.26	45.36	17.68	42.07	14.98
20–24	30.60	11.10	38.76	19.45	41.62	18.31	36.50	16.19
25–29	60.30	19.54	28.79	13.65	28.82	12.28	24.48	11.70
30–34	75.87	29.34	19.03	9.21	19.03	8.96	15.74	8.50
35–39	84.32	36.59	12.50	6.20	12.76	6.36	10.17	5.63
Number of children	*average*		*average*		*average*		*average*	
15–19	0.28	8.58	−0.03	−1.41	−0.11	−4.13	−0.16	−6.43
20–24	1.35	11.76	−0.31	−4.74	−0.56	−6.62	−0.69	−8.47
25–29	2.39	14.31	−0.66	−7.34	−0.97	−8.09	−1.13	−9.25
30–34	2.97	15.55	−0.87	−8.38	−1.17	−8.08	−1.34	−9.03
35–39	3.26	15.82	−0.98	−8.54	−1.26	−7.66	−1.43	−8.64

[a]Women's baseline characteristics: birth cohort 1950–1954, education level 1 (no education/illiterate), can speak Central Thai, is a Buddhist, has Thai ethnicity, and lives in a rural community in central Thailand with no NFPP presence.

Table 5 Predicted probabilities of having had contraceptive experience and number of births by birth cohort.

Birth cohort	Baseline[a]		Difference from the baseline					
	1950–1954		1955–1959		1960–1964		1965–1969	
	estimate	*z-value*	*estimate*	*z-value*	*estimate*	*z-value*	*estimate*	*z-value*
Having had contraceptive experience	*%*		*%-points*		*%-points*		*%-points*	
15–19	7.85	8.27	8.61	10.88	16.32	13.14	27.09	15.09
20–24	30.60	11.10	14.84	10.47	25.64	14.51	37.17	19.76
25–29	60.30	19.54	13.81	9.56	21.52	13.10	28.57	14.99
30–34	75.87	29.34	10.58	8.32	14.83	8.99		
35–39	84.32	36.59	7.77	7.08				
Number of children	*average*		*average*		*average*		*average*	
15–19	0.28	8.58	−0.01	−0.47	−0.01	−0.53	−0.02	−0.80
20–24	1.35	11.76	−0.10	−1.50	−0.17	−2.72	−0.26	−4.14
25–29	2.39	14.31	−0.23	−2.89	−0.41	−4.91	−0.59	−6.74
30–34	2.97	15.55	−0.33	−3.69	−0.57	−6.02		
35–39	3.26	15.82	−0.38	−4.02				

[a]Women's baseline characteristics: birth cohort 1950–1954, education level 1 (no education/illiterate), can speak Central Thai, is a Buddhist, has Thai ethnicity, and lives in a rural community in central Thailand with no NFPP presence.

children decreases the later the birth cohort, although this decrease is much smaller than the almost one-child decline in TFR in one generation reported in Hirschman et al. (1994) based on census data. This difference may well result from the fact that in Table 5, we hold other factors (e.g., education level) constant.

Next, we predict the impact of presence of the NFPP in a community on contraceptive experience and, through this factor, number of births. Again, the first column of Table 6 gives the predictions for reference women who live in a community with no NFPP, while the second column predicts the outcomes when the NFPP is present in the community from age 15 onward. The most notable pattern is that presence of the NFPP in a community is associated with a less than two percentage points higher proportion of women with contraceptive experience at ages 15–19 to about a six percentage points higher proportion at ages 35–39. This higher contraceptive use in turn results in 0.10 fewer children at ages 35–39, representing a 3 per cent lower completed fertility.

Although it is difficult to validly compare results across studies, this estimated 3 per cent lower completed fertility is below the 10 per cent reported for Colombia (Miller, 2010) and the 13–17 per cent for Bangladesh (Sinha, 2005; Joshi & Schultz, 2013). Our estimated six percentage points effect of presence of the NFPP in a community on the probability of having had contraceptive experience for women aged 35–39, however, is rather similar to the five to six percentage points increase in contraceptive prevalence reported by Entwisle et al. (1984) for Thai women living close to a family planning outlet.

The third and fourth columns of Table 6 quantify the impact of having had contraceptive experience on the number of children. For this estimation, we consider two extreme situations for the group of reference women. The first, reported in column three, as having had no contraceptive experience throughout life; the second, shown in column four, as having had contraceptive experience from the age of 15 onward. The difference between these two sets of results shows a rather large impact of having had contraceptive experience: this latter reduces the number of children at ages 35–39 by more than one child on average [0.86−(−0.31)], representing an almost 30 per cent reduction in completed fertility. This finding is in line with, for instance, Gertler and Molyneaux (1994) for Indonesia (discussed above), and Cheng (2011) who finds for Taiwan that contraceptive knowledge reduces fertility, and underscores the importance of women's adoption of contraceptive technology for reducing completed fertility (Lee, 2003).

5. Summary and discussion

In line with the widely accepted notion that women's adoption of contraceptive technology has been instrumental to the global decline in TFRs, we identify a strong impact on fertility in Thailand of women having had contraceptive experience. Specifically, women aged 40 who have had contraceptive experience from an early age, have about two-thirds the number of children as 40-year-old women who have had no contraceptive experience.

In the Thai case, as discussed in section 2, it has widely been documented that the NFPP has been instrumental to the adoption of contraceptive technology and thus impacted fertility outcomes. Our investigation for Thailand contributes to the existing empirical literature by estimating the associations of setting up the NFPP throughout Thailand in local communities per se with contraceptive experiences and through these, fertility outcomes.

Table 6 Predicted probabilities of having had contraceptive experience and number of births by contraceptive regime and the presence of a national family planning program.

	Baseline[a]		Difference from the baseline					
	No family planning program in the community		Family planning program in the community from age 15 onward		Having had no contraceptive experience throughout life		Having had contraceptive experience from age 15 onward	
	estimate	*z-value*	*estimate*	*z-value*	*estimate*	*z-value*	*estimate*	*z-value*
Having had contraceptive experience	%		*%-points*					
15–19	7.85	8.27	1.66	3.63				
20–24	30.60	11.10	5.10	5.71				
25–29	60.30	19.54	7.74	6.34				
30–34	75.87	29.34	7.27	5.56				
35–39	84.32	36.59	5.83	4.53				
Number of children	*average*		*average*		*average*		*average*	
15–19	0.28	8.58	0.00	−0.34	0.00	0.61	0.05	0.83
20–24	1.35	11.76	−0.02	−1.91	0.09	2.19	0.00	0.02
25–29	2.39	14.31	−0.05	−2.46	0.36	2.87	−0.16	−0.82
30–34	2.97	15.55	−0.08	−2.73	0.66	3.26	−0.27	−1.35
35–39	3.26	15.82	−0.10	−2.89	0.86	3.51	−0.31	−1.61

[a]Women's baseline characteristics: birth cohort 1950–1954, education level 1 (no education/illiterate), can speak Central Thai, is a Buddhist, has Thai ethnicity, and lives in a rural community in central Thailand with no NFPP presence.

That is, once we control for societal changes modeled through birth cohort effects and (increased) female educational attainment, which have resulted in a strong increase in women's contraceptive experience and a strong decrease in completed fertility,[13] we find that the associations of having the NFPP in a community with the proportion of women with contraceptive experience are rather small. Specifically, presence of the NFPP in a community per se is associated with a less than two percentage points higher proportion of women with contraceptive experience at ages 15–19 to about a six percentage points higher proportion at ages 30–34, and with about a 3 per cent lower completed fertility. These small associations suggest that contraceptive technology has been adopted by most women (with contraceptive needs) in Thailand largely regardless of setting up the NFPP in local communities. That is, our small estimated association of the presence of the NFPP in a local community with contraceptive experience is likely to be the result of the NFPP's contraceptive information and services having reached many women through different channels, including television and word-of-mouth (see section 2), even before the NFPP was actually set up in their communities.

A possible explanation for these small but nevertheless significant associations of setting up the NFPP in local communities with contraceptive experience and completed fertility is the existence of a small group of hard-to-reach women with unmet contraceptive needs who benefit significantly from NFPP's presence. Such an explanation speaks to the reduction of age-, poverty-, culture-, and geography-based inequities in access to and use of contraceptive methods that Bongaarts et al. (2012) suggest should be a top priority for population policy in the twenty-first century. In Thailand, the NFPP, with the help of other agencies like the Planned Parenthood Association of Thailand, has in fact now shifted its focus to identifying and targeting such hard-to-reach women. Admittedly, achieving this aim is likely to remain a challenging task for many years to come; however, our empirical results may suggest that setting up family planning programs in local communities is a viable means of meeting these women's contraceptive needs and reducing related inequities so all women can have control over their fertility. Taking a somewhat broader view, our findings suggest that offering health services in local communities can reduce health inequities in general, and in particular reduce inequities in maternal and HIV related health conditions; issues that are highly relevant for current public health in Thailand and likely to demand public health services close to the people.

A limitation of our study that should be addressed in future research concerns heterogeneous effects. Due to a relatively small sample we only differentiate by parity but one would like to show in more detail what the characteristics are of the women that are most affected by presence of the NFPP in their community. One could then more directly investigate if women with unmet contraceptive needs are reached by setting up NFPP in a community.

Another limitation of our study is related to the issue of causality. An assumption we need to make for a causal interpretation of the effect of contraceptive experience on the birth probability is that once contraceptive experience is controlled for, presence of the NFPP in a local community affects fertility decisions only through contraceptive experience and not directly, i.e. NFPP is a valid instrument for contraceptive experience in the birth equation (Eq. 1; section 3). This dynamic, which policymakers have in mind when implementing family planning services, is amply supported in the literature, including

that for Thailand, which clearly identifies the NFPP's main function in the decades covered by our sample as '[diffusing] basic knowledge about a new and innovative technology of birth control' and, often at a later stage, '[providing] a routine service and source of subsidized contraceptives to an informed and receptive public' (Schultz, 1997, p.4). This function conforms to the definition given by Simmons (1986): 'Family planning programs are organized efforts to assure that couples who want to limit their family size and space their children have access to contraceptive information and services and are encouraged to use them as needed' (p.175). It may, therefore, be reasonable to interpret the estimated effects of contraceptive experiences on fertility outcomes as causal effects.

The interpretation of the effects of presence of the NFPP in a local community on contraceptive and fertility decisions, however, requires much more caution (Eq. 2; section 3). In order to interpret this effect as a causal effect, we need to assume that the decision to set up a family planning program in a community is exogenous in the sense that it should not depend on characteristics of a community that are as well related to the fertility and contraceptive behavior. To capture such community characteristics, we include as mentioned in section 3, community-level fixed effects, thereby aiming to control for possible non-random allocation of the NFPP across communities. Nevertheless, this is not a perfect control as we cannot exclude the possibility that there are confounding time-varying community characteristics such as, for instance, economic opportunities for women (Angeles et al., 1998; Gertler & Molyneaux, 1994, 2000). Additionally, we need to assume that when a family planning program is set up in a community, it only provides contraceptive services and not other (health) services that may influence contraceptive behavior. In the situation of the NFPP, this is unlikely to be the case as often a health worker comes with it (Shevasunt et al., 1978). We are, therefore, of the opinion that these two assumptions are unlikely to hold and that the effect of presence of the NFPP in a community on contraceptive experience has to be interpreted as an association and, therefore, also its effect on fertility outcomes. Of course, most empirical studies referred to in the introduction have similar limitations concerning the causal interpretations of their findings. To identify the causal effects of presence of the NFPP in a community on contraceptive and fertility decisions is regarded as an important topic for future research.

Notes

1. I refer to Robinson and Ross (2007) for an overview of family planning policies and programs in many countries during the second half of the twentieth century.
2. An evaluation of the same program by Joshi and Schultz (2013), which reports that it provides both contraceptive *and* health services, identifies a decline in fertility of about 17 per cent.
3. These authors do find an impact on the method choice in Indonesia. Likewise, Brown, Bohua, and Padmadas (2010) show that a client-focused approach to family planning services in China increases the extent to which women make their own choices about contraceptive method (rather than using those provided by the government's one-child policy program).
4. The dominant religion in Thailand is Buddhism (95 per cent of the population) with no strong objections against family planning. In fact, Buddhist scripture preaches 'many children make you poor.'
5. Policymakers have successfully conveyed the (economic) urgency to control population growth and thereby secured acceptance of NFPP by the (national) government and financing from donor countries.

6. About 53 per cent have their marriage registered at a municipality. Non-registered marriages include, for instance, religious marriages. The survey phrased the definition of a marriage to capture non-registered marriages as 'the couple is "living and eating" together'.
7. About 90 per cent of the women in our sample married before age 23. Including women under age 23 in our analysis does not affect this paper's main findings.
8. The corresponding survey question asks women about when they first started using contraceptives (if ever) and is framed in terms of when they married and gave birth, which ensures a correct timeline of events.
9. An *amphoe*, usually translated as 'district,' is a second level administrative subdivision of Thailand. There are about 800 *amphoe* in Thailand, and 32 of these are covered by our sample.
10. To address the possible importance for the birth/contraception relation of conception occurring nine months before birth, we use a conception rather than a birth date. Because the data are yearly, we designate it as one year rather than nine months previously. Nevertheless, because still births are excluded, the term 'births' seems most appropriate.
11. While we treat all variables in as time constant, the level of education may change over time. Taking this into account by allowing a separate effect for when a woman was in education does not change any of the main findings of this paper. One explanation for this is that less than 7 per cent of the women in our sample have been in education after age 15 and less than 0.5 per cent after age 20.
12. When estimating the model and making predictions, we also tried controlling for whether or not a woman is in school; however, doing so did not change any of our conclusions.
13. It could perhaps be argued that the NFPP affects educational attainment; however, excluding educational attainment from the analysis does not change our main conclusions.

Disclosure Statement

No potential conflict of interest was reported by the authors.

References

Angeles, G., Guilkey, D. K., & Mroz, T. A. (1998). Purpose program placement and the estimation of family planning program effects in Tanzania. *Journal of the American Statistical Association*, *93* (443), 884–899.

Baily, M. J. (2006). More power to the pill: The impact of contraceptive freedom on women's life cycle labor supply. *Quarterly Journal of Economics*, *126*(1), 289–320.

Becker, G. S. (1981). *A treatise on the family* (1993 ed.). Cambridge, MA: Harvard University Press.

Bennett, A., Frisen, C., Kamnuansilpa, P., & McWilliam, J. (1990). How Thailand's family planning program reached replacement level fertility: Lessons learned. Population Technical Assistance Project Occasional Paper, No. 4; Project No. 936–3024, International Science and Technology Institute/Dual and Associates, Arlington, Virginia.

Bongaarts, J. (2001). Fertility and reproductive preferences in post-transitional societies. *Population and Development Review*, *27*, Supplement: Global fertility transition, 260–281.

Bongaarts, J., & Bruce, J. (1995). The causes of unmet need for contraception and the social content of services. *Studies in Family Planning*, *26*(2), 57–75.

Bongaarts, J., Cleland, J., Townsend, J. W., Bertrand, J. T., & Das Gupta, M. (2012). *Family planning programs for the 21st century: Rationale and design*. New York: Population Council.

Bongaarts, J., & Sinding, S. W. (2009). A response to critics of family planning programs. *International Perspectives on Sexual and Reproductive Health*, *35*(1), 39–44.

Brown, J. J., Bohua, L., & Padmadas, S. S. (2010). A multilevel analysis of the effects of a reproductive health programme that encouraged informed choice of contraceptive method rather than use of officially preferred methods, China 2003–2005. *Population Studies: A Journal of Demography*, *64*(2), 105–115.

Chamratrithirong, A., Kamnuansilpa, P., & Knodel, J. (1986). Contraceptive practice and fertility in Thailand: Results of the Third Contraceptive Prevalence Survey. *Studies in Family Planning*, *17*(6), 278–287.

Cheng, K.-W. (2011). The effect of contraceptive knowledge on fertility: The roles of mass media and social networks. *Journal of Family and Economic Issues*, *32*(2), 257–267.

Desai, J., & Tarozzi, A. (2011). Microcredit, family planning programs, and contraceptive behavior: Evidence from a field experiment in Ethiopia. *Demography*, *48*, 749–782.

Entwisle, B., Hermalin, A., Kamnuansilpa, P., & Chamratrithirong, A. (1984). A multilevel model of family planning availability and contraceptive use in rural Thailand. *Demography*, *21*(4), 559–574.

Fawcett, J. T., Somboonsuk, A., & Khaisang, S. (1967). Thailand: An analysis of time and distance factors at an IUD clinic in Bangkok. *Studies in Family Planning*, *1*(19), 8–12.

Gertler, P. J., & Molyneaux, J. W. (1994). How economic development and family planning programs combined to reduce Indonesian fertility. *Demography*, *31*(1), 33–63.

Gertler, P. J., & Molyneaux, J. W. (2000). The impact of targeted family planning programs in Indonesia. *Population and Development Review*, *26* Supplement: Population and Economic Change in East Asia, 61–85.

Goldin, C., & Katz, L. F. (2002). The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of Political Economy*, *110*(4), 730–770.

Grönqvist, H. (2008). *Subsidized birth control and women's outcomes: Evidence from regional policy changes* (Working paper). Sweden: Uppsala University.

Gustafsson, S., & Kalwij, A. (2006). *Education and postponement of maternity*. European Studies of Population, Vol.15. Dordrecht, The Netherlands: Springer.

Hemachidha, C., & Rosenfield, A. (1975). National health services in family planning: Thailand, a case study. *American Journal of Public Health*, *65*, 864–871.

Hermalin, A. & Khar, Z. (1996). The impact of family planning programs on fertility: A selective assessment of the evidence (Unpublished paper, the EVALUATION project). Carolina Population Center, University of North Carolina, Chapel Hill.

Hirschman, C. J., Tan, E., Chamratrithirong, A., & Guest, P. (1994). The path to below replacement-level fertility in Thailand. *International Family Planning Perspectives*, *20*, 82–87. 107.

Jain, A. K. (1981). The effect of female education on fertility: A simple explanation. *Demography*, *18*(4), 577–595.

Joshi, S., & Schultz, P. (2013). Family planning and women's and children's health: Long-term consequences of an outreach program in Matlab, Bangladesh. *Demography*, *50*, 149–180.

Knodel, J., Bennett, T., & Panyadilok, S. (1984a). Do free pills make a difference? Thailand's experience. *International Family Planning Perspectives*, *10*(3), 93–97.

Knodel, J., & Chayovan, N. (1990). Contraceptive initiation patterns in Thailand. *Population Studies*, *44*, 257–271.

Knodel, J., Havanon, N., & Pramualratana, A. (1984b). Fertility transition in Thailand: A qualitative analysis. *Population and Development Review*, *10*(2), 297–328.

Knodel, J., & Wongsith, M. (1991). Family size and children's education in Thailand: Evidence from a national sample. *Demography*, *28*(1), 119–131.

Krannich, C. R., & Krannich, R. L. (1980). Family planning policy and community-based innovations in Thailand. *Asian Survey*, *20*(10), 1023–1037.

Lee, R. (2003). The demographic transition: Three centuries of fundamental change. *Journal of Economic Perspectives*, *17*, 167–190.

Miller, G. (2010). Contraception as development? New evidence from family planning in Colombia. *The Economic Journal*, *120*(545), 709–736.

Oppenheim-Mason, K., & Smith, H. L. (2000). Husbands' versus wives' fertility goals and use of contraception: The influence of gender context in five Asian countries. *Demography*, *37*(3), 299–311.

Population Institute. (1991, September). Five levels of family planning progress: Lessons from Thailand. *Asia-Pacific Population & Policy*, No. 18. Retrieved from http://www.eastwestcenter.org/fileadmin/stored/pdfs/p&p018.pdf

Prachuabmoh, V., & Mithranon, P. (2003). Below-replacement fertility in Thailand and its policy implications. *Journal of Population Research*, *20*(1), 35–50.

Richter, K., Podhisita, C., Chamratrithirong, A., & Soonthorndhada, K. (1994). The impact of child care on fertility in urban Thailand. *Demography*, *31*(4), 651–662.

Robinson, W. C., & Ross, J. A. (2007). *The global family planning revolution: Three decades of population policies and programs*. Washington, USA: The World Bank.

Rosenfield, A., Bennett, A., Varakamin, S., & Lauro, D. (1982). Thailand's family planning program: An Asian success story. *International Family Planning Perspectives*, *8*(2), 43–51.

Rosenzweig, M. R., & Schultz, T. P. (1985). The demand for and supply of births: Fertility and its life cycle consequences. *American Economic Review*, *75*(53), 992–1015.

Rosenzweig, M. R., & Schultz, T. P. (1987). Fertility and investment in human capital: Estimates of the consequence of imperfect fertility control in Malaysia. *Journal of Econometrics*, *36*, 163–184.

Schultz, T. P. (1997). *Diminishing returns to scale in family planning expenditures: Thailand, 1976–1981* (Working paper). New Haven, Connecticut, USA: Yale University.

Schultz, T. P. (2005). *Effects of fertility decline on family well-being: Opportunities for evaluating population programs* (Working paper). New Haven, Connecticut, USA: Yale University.

Sharma, S. K., Pratap, N., & Ghimire, D. R. (2011). Ethnic differentials of the impact of the family planning program on contraceptive use in Nepal. *Demographic Research*, *25*, 837–868.

Shevasunt, S., Hogan, D. P., & Thaithong, K. (1978). Fertility and family planning in rural Northern Thailand. *Studies in Family Planning*, *9*(8), 212–221.

Simmons, G. (1986). Family planning programs. In J. Menken (Ed.), *World population and U.S. policy: The choices ahead* (pp. 175–206). New York: W.W. Norton.

Sinha, N. (2005). Fertility, child work, and schooling consequences of family planning program. *Economic Development and Cultural Change*, *54*(1), 97–128.

Siriprachai, S. (2009). The Thai economy: Structural changes and challenges ahead. *Thammasat Economic Journal*, *27*(1), 149–229.

Smith, H. L., Ghuman, S. J., Lee, H. J., & Oppenheim Mason, K. (2000). Status of women and fertility. Machine-readable data file. Retrieved from http://swaf.pop.upenn.edu/

Tsui, A. O. (2001). Population policies, family planning programs, and fertility: The record. *Population and Development Review*, *27*, 184–204.

Vimuktanon, S., & Rosenfield, A. G. (1971). An IUD follow-up study in Potharam, Thailand. *Studies in Family Planning*, *2*(8), 166–170.

Weaver, E. H., Frankenberg, E., Fried, B. J., Thomas, D., Wheeler, S. B., & Paul, J. E. (2013). Effect of village midwife program on contraceptive prevalence and method choice in Indonesia. *Studies in Family Planning*, *44*(4), 389–409.