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FAMILY PLANNING: PROGRAM EFFECTS

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ABSTRACT

This paper reviews empirical evidence on the micro-level consequences of family planning programs in middle- and low-income countries. In doing so, it focuses on fertility outcomes (the number and timing of births), women's health and socio-economic outcomes (mortality, human capital, and labor force participation), and children's health and socio-economic outcomes throughout the life cycle. Although effect sizes are heterogeneous, long-term studies imply that in practice, family planning programs may only explain a modest share of fertility decline in real-world settings (explaining 4-20% of fertility decline among studies finding significant effects). Family planning programs may also have quantitatively modest - but practically meaningful - effects on the socio-economic welfare of individuals and families.

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1. Introduction

The twentieth century witnessed the birth of modern 'family planning' and its evolution from an early target of anti-obscenity laws (Comstock, 1873) to a focus of global efforts to improve human welfare (Cleland et al., 2006).[1] Many observers date the modern family planning movement to the famous 1916 opening of New York City's first birth control clinic. Mid-century, the International Planned Parenthood Federation and the Population Council were instrumental in both the development of modern contraceptive technologies (including the first oral contraceptive, Enovid, and plastic intrauterine devices) and, along with aid agencies and international organizations, promoting their widespread distribution – ushering in the 'modern' era of fertility control.

Heightened concern about world's unprecedented rate of population growth (and its potential macroeconomic and environmental consequences) also arose mid-century (Coale and Hoover (1959) – and Neo-Malthusian alarm grew in tenor with Paul Ehrlich's publication of *The Population Bomb* in 1968. In response, aid agencies supported the establishment of large-scale family planning programs around the world. Global funding for family planning tripled during the 1970s and early 1980s – and by the mid-1990s, large-scale family planning programs were active in 115 countries (Cleland et al., 2006). Remarkably, the total fertility rate in developing countries also fell by more than half over this period (Sinding, 2007).

[1] For the purposes of this review, we consider family planning to be the use of modern methods of birth control to attain the desired number of children and timing of births. We consider a 'family planning program' to be any formalized program designed to promote, distribute, or subsidize modern contraceptives.

Academics have long debated the primary forces responsible for global fertility decline – and in particular, the contribution made by family planning programs. One view largely credits family planning programs directly (Bongaarts et al., 2012, Bongaarts et al., 1990, Casterline and Sinding, 2000, Robey et al., 1993). Others give them less credit, arguing that fertility decline largely reflects reductions in the demand for children, even if aided by family planning programs (Pritchett, 1994a). These demand-side factors include economic development, gains in education, industrialization, and an increase in the opportunity cost of time generally (and for women in particular) (Breierova and Duflo, 2004, Galor and Weil, 2000, Lavy and Zablotsky, 2011, Schultz, 1985); the price of child 'quality' (Becker, 1960, Becker, 1991, Davis, 1967, Voigtlander and Voth, 2013); expectations about future labor market conditions and relative income (Easterlin, 1968, Easterlin, 1975, Macunovich, 1998); and falling infant and child mortality rates (Angeles, 2010, Cleland, 2001, Kalemli-Ozcan, 2002, Mason, 1997, Palloni and Rafalimanana, 1999, Schultz, 1985).[2] A third view, promoted in part by the European Fertility Project, emphasizes the importance of social networks in facilitating the diffusion of 'cultural innovations,' including the social acceptability of small families (Coale and Watkins, 1986, Cleland and Wilson, 1987).[3]

As dire predictions about Malthusian demographic catastrophe failed to materialize (Lam, 2011), the rationale for population policy became more nuanced during

[2] These factors are not independent of each other – for example, the opportunity cost of women's time is related to women's intra-household bargaining power (Lundberg and Pollak, 1996, Rasul, 2008), and the mortality environment creates incentives for human capital investments (Jayachandran and Lleras-Muney, 2009)

[3] The European Fertility Project's methodology and central findings have also been called into question (Brown and Guinnane, 2003).

the 1980s and 1990s (Kelley, 2003).[4] Stances on the relationship between population growth and economic development became more neutral (Finkle and Crane, 1985, NAS, 1986), emphasizing the centrality of mediating institutions.[5] At the 1994 International Conference on Population and Development in Cairo, feminist, rights-based rationales supplemented modern macroeconomic justifications for population policy (see Birdsall et al. (2001). Family planning programs increasingly emphasized individual needs and desires, stressing socio-economic and health benefits for women and their families (Glasier et al., 2006).[6]

In the spirit of contemporary emphasis on a wide range of individual-level benefits of family planning programs, this chapter reviews existing empirical evidence on their consequences for women and children in low- and middle-income countries. In doing so, it focuses on three types of outcomes: (1) fertility outcomes (the number and timing of births), (2) women's health and socio-economic outcomes (mortality, human capital, and labor force participation), and (3) children's health and socio-economic outcomes throughout the life cycle. We exclude studies that simply relate family

[4] Many scholars question whether or not alarmism over population growth is justified generally. Some argue that population growth strengthens incentives for technological progress capable of averting Malthusian calamity (Boserup, 1965, Simon, 1981). A famous wager between Paul Ehrlich and Julian Simon illustrates this point. In 1980, Simon bet Ehrlich that the price of any five commodity metals chosen by Ehrlich (chromium, copper, nickel, tin, and tungsten) would decline over the subsequent decade (rather than rise). Commodity metals exist in fixed supply, while population growth raises demand for them, all else equal – exerting upward pressure on prices. However, in response to rising prices, technological progress (in industrial processes, etc.) also leads to substitution away from them, placing downward pressure on prices. By 1990, the inflation-adjusted price of all five metals had fallen.

[5] Institutions have been proposed to play a central role in a population's ability to earn a 'demographic dividend' – for example, see Bloom and Williamson (1998), Bloom, Canning et al. (2003), and Bloom and Canning (2009).

[6] As the definition of reproductive health expanded, so did the scope of family planning programs – growing to encompass safe delivery, prevention and treatment of sexually-transmitted infections, safe abortion, and violence against women (Greene and Merrick, 2005).

planning programs to contraceptive use or knowledge without directly estimating their effect on these outcomes.[7]

The remainder of this review is organized as follows. Section 2 summarizes background debate about the relative importance of supply- vs. demand-side factors in explaining fertility decline. The third section reviews empirical studies of the relationship between family planning programs and fertility outcomes, while the fourth covers program effects on health and socio-economic outcomes among women and their children. Pooling across studies, the fifth section concludes by summarizing ranges of estimates that emerge from the empirical literature.

2. Background Controversy: Supply vs. Demand and the Pritchett (1994) Critique

Among the competing explanations for fertility decline, an important distinction emerges between demand- and supply-side factors. While there is little debate about the association between use of modern contraceptives and fertility, the underlying determinants of contraceptive use are controversial. The crux of the debate pits the relative importance of changes in the demand for children (and for contraceptives) against changes in the availability and price of contraceptives (generally accomplished through family planning programs).[8] Before reviewing empirical studies of family planning in Sections 3 and 4, we first summarize this controversy.

[7] Many studies estimate the impact of family planning programs on contraceptive use and knowledge, but because modern contraceptives may substitute for traditional methods of birth control (prolonged breastfeeding, rhythm, and postpartum abstinence, for example), inferences by these studies about the net effect of family planning on fertility and socio-economic outcomes are difficult (Schultz, 1992). Our review also excludes a large literature relating the number, timing, and spacing of births to downstream socioeconomic benefits without directly estimating the role of family planning programs on these outcomes (for a review, see Schultz (2010)).

[8] This distinction is not always clean. For example, some studies that we reviewed analyze family planning programs that include information or reproductive health education campaigns. These programs

Lant Pritchett's 1994 article entitled "Desired Fertility and the Impact of Population Policies" published in *Population and Development Review* is a landmark paper in this debate. Specifically, it argues that because contraceptive prevalence (or use) is jointly determined by both supply and demand (and not by supply alone),[9] the close relationship between a country's contraceptive prevalence rate and its total fertility rate fails to isolate the importance of either. In doing so, the paper challenged conventional wisdom about the centrality of contraceptive supply in determining total fertility rates in developing countries (Bongaarts et al., 1990).

To disentangle the effect of demand from that of supply (and to address specific concerns that survey measures of demand may reflect *ex post* rationalization or may depend on contraceptive supply), Pritchett uses two different instrumental variables (IV) estimation strategies.[10] In doing so, the paper finds a nearly one-to-one correspondence between a country's total fertility rate and the number of children that women report wanting.[11] Pritchett therefore concludes that women are largely able to have the number

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simultaneously aim to increase both the availability of contraceptives and demand for them. Examples include programs in Zimbabwe and Tanzania (Rogers et al., 1999), Rwanda (Westoff, 2013), and China (Hesketh and Zhu, 1997). The debate also distinguishes "distal" and "proximate" causes of fertility decline. We do not emphasize this distinction because behaviors that change when a key constraint to reproductive behavior is relaxed are by definition "proximate," regardless of whether they reflect demand or supply.

[9] Except in the unlikely case that demand is perfectly price elastic

[10] Specifically, Pritchett addresses concerns about *ex post* rationalization and about the dependence of desired fertility on contraceptive availability using two related instrumental variables (IV) methodologies. First, he uses the proportion of women with four children who desire no more (a forward-looking statistic free of ex-post rationalization) to instrument for a retrospective measure of the demand for children fertility (DTFR). Second, he uses a retrospective measure of demand (DTFR) to instrument for a forward-looking measure (WTFR).

[11] Pritchett (1994) uses three measures of desired fertility contained in the Demographic and Health Surveys (DHS): Average Ideal Number of Children (AINC), which is calculated directly from survey questions about women's ideal family size; the Desired Total Fertility Rate (DTFR), which is calculated from "age-specific birth rates after subtracting from the number of actual births those prior births that exceed each woman's reported desired family size;" and the Wanted Total Fertility Rate (WTFR), which is calculated using age-specific birth rates after subtracting births determined to be unwanted according to reported desire for future children .

of children that they want – and that contraceptive supply can at best explain 10% of the cross-country variation in fertility rates.[12]

Pritchett's findings are controversial (Bongaarts, 1994, Knowles et al., 1994, Pritchett, 1994b), and his econometric strategy requires two important assumptions that we highlight.[13] The first is that the share of women in a country who have a given number of children and report not wanting more is unrelated to the country's total fertility rate – except through desired fertility (demand). In answering questions about wanting more children, if women have in mind the costs of fertility control that they face in practice (despite survey instructions to the contrary), this assumption would be violated.[14] These costs may be difficult for respondents to disregard – the interpersonal costs that women face in bargaining over fertility with their partners, for example. The second related assumption is that past and current/future costs of fertility control are uncorrelated. Because such a correlation is plausible, current/future costs of fertility control could in fact be related to past fertility decisions. Ultimately, these assumptions are not directly testable.

On a more general level, Pritchett argues that the financial cost of modern contraceptives is too small relative to the importance of fertility decisions to exert meaningful influence. However, these costs may nonetheless be prohibitive for poor

[12] This relationship is generally robust to controlling for contraceptive prevalence (coefficient estimates for DTFR and WTFR decrease from 0.89 to 0.74 and from 0.91 to 0.77, respectively). The rationale for controlling for contraceptive prevalence is unclear, however, given that it captures demand as well as supply. Although Pritchett argues women are largely able to have the number of children that they want to have, the presence of a positive intercept term in his regression results indicates some level of persistent unwanted fertility.

[13] These two related assumptions are required for the IV strategy's necessary 'exclusion restriction' to be met (Angrist and Krueger, 1991).

[14] Pritchett (1994) argues that all female DHS respondents should have costless fertility control in mind; all that the IV strategy really requires is that women have the same cost of fertility control in mind (regardless of their magnitude).

households facing tight credit or liquidity constraints, and importantly, the total cost of fertility control extends far beyond the financial cost of contraceptives – bargaining with spouses over fertility and direct disutility from using of contraceptive devices, for example. Some empirical evidence suggests that these costs may be substantial.[15]

More generally, critics of Pritchett's analysis argue that although reductions in the demand for children may be an important determinant in fertility decline, changes in demand alone are not generally sufficient. Instead, they contend that modern family planning is necessary for preventing increases in unwanted fertility as wanted fertility declines (and for reducing unwanted fertility independent of changes in wanted fertility) (Bongaarts 1994). [16] In practice, few studies examine large, plausibly 'exogenous' declines in the demand for children in environments lacking modern contraceptives, making it difficult to assess this claim empirically.[17] Related work using two decades of additional data also argues that changes in wanted total fertility rates explain about half of changes in Total Fertility Rates in more recent decades, implying that reductions in unwanted fertility (and by extension, family planning – although not directly measured) have played a more important role (Gunther and Harttgen, 2013, Lam, 2011).

[15] On bargaining, Ashraf et al. (2014) show that among the subset of couples in their sample with different fertility preferences, offering vouchers for contraceptives to women privately is reduces fertility more than offering vouchers to them in the presence of their husbands (reducing unwanted births by 57%). On the direct disutility of modern contraceptives, research on commercial sex markets suggests that men are willing to pay 23% more for sex without a condom (and double that for unprotected sex with attractive commercial sex workers) (Gertler et al., 2005). See also Casterline and Sinding (2000) for a discussion of the full cost of contraception.

[16] Some studies emphasize meeting an otherwise 'unmet need' for contraceptive services (for discussions of 'unmet need,' see Bongaarts et al., 2012; Bradley and Casterline, 2014; Casterline and Sinding, 2000). Both the concept and measurement of 'unmet need' is controversial (Westoff, 1988; Bradley et al. 2012; Pritchett 1996)

[17] This contrasts with scholarship on sustained fertility declines observed in Europe and other industrialized countries prior to the availability of modern contraception. See Coale and Watkins (1986) for a summary.

Despite some unresolved concerns with Pritchett's (1994) analysis, its overarching point – that the demand for children may be more important than supply-side factors (including contraceptive supply) in determining fertility – may nonetheless stand.

3. Family Planning Programs and the Number, Timing, and Spacing of Births

The empirical literature on family planning is vast. To aid in our review, we used a strategy akin to the 'systematic review' methodology in the biomedical sciences, although we emphasize that we did not undertake a formal systematic review. Using explicit criteria to search four major databases of indexed journals (together with a 'snowball' approach), our initial search yielded 9,501 studies for consideration. We then reviewed abstracts, applying inclusion criteria for: methodological rigor,[18] direct analysis of family planning program effects in developing countries, and an explicit focus on at least one of our three types of primary outcomes. Our final list includes 30 studies meeting these criteria[19] (studies estimating the relationship between family planning and fertility are summarized in Table 1).

[18] For non-experimental (observational) studies, we restricted our review to those using commonly-accepted methodologies for addressing the role of confounding factors and endogenous program placement/intensity. These include (but are not limited to) conventional panel data techniques, difference-in-difference estimation, and instrumental variables strategies using plausibly exogenous instruments.

[19] We searched four major databases: PubMed, CAB Global Health, SCOPUS, and POPLINE. See the accompanying electronic appendix (at the time of writing, available at https://people.stanford.edu/ngmiller/) for details. Our review is limited to microdata studies of family planning programs in middle- and low-income countries; for examples of cross-country studies, many of which use an index of family planning 'effort' at the national level, see Schultz (1994), Tsui (2001), Jain and Ross (2012) and Kohler (2012). Specific inclusion criteria were: (1) a focus on middle- and low-income countries, (2) a quantitative evaluation of one or more family planning programs using microdata, and (3) analysis of at least one fertility, health, or socioeconomic outcome (rather than just contraceptive use or knowledge, for example). For non-experimental (observational) studies, we restricted our review to those using commonly-accepted methodologies for addressing the role of confounding factors and endogenous program placement/intensity. These include (but are not limited to) conventional panel data techniques, difference-in-difference estimation, and instrumental variables estimation using plausibly exogenous instruments (and admittedly subjective criterion).

Randomized Controlled Trials

Arguably the most prominent study of family planning conducted to date is the famous Matlab family planning experiment. Beginning in 1977, the experiment randomly assigned 141 areas in Matlab, Bangladesh to either the study's 'treatment' arm (70) or a control arm (71). In treatment areas, female reproductive health workers visited the homes of married women of childbearing age every two weeks to educate women about reproductive health, provide nutrition counseling, and offer modern contraceptives free of charge. Maternal and child health services were integrated into the experimental treatment in 1982 (Muhuri, 1995), and safe motherhood services followed (Chowdhury et al., 2009).[20]

The Matlab experiment has produced a large volume of academic papers. Early papers report a 25% reduction in the general fertility rate (GFR) over the first two years of the experiment (Phillips et al., 1982), and these reductions lasted throughout the 1980s (Foster and Roy, 1997, Koenig et al., 1992). Longer term follow-up suggests that these fertility effects persisted for at least 20 years, reducing the number of children ever born by 1-1.5 children and extending birth intervals by 8-13 months (Joshi and Schultz, 2007). Estimates of implied lifetime fertility reductions range from 13% (Sinha, 2005) to 23% (Joshi and Schultz, 2013).

The Matlab experiment has also generated debate. First, critics note that the intensity and expense of the program would be unrealistic on a large scale. In its first 10 years, program costs were approximately $180 per birth averted (120% of Bangladesh's

[20] These maternal and child health services included, tetanus immunizations for pregnant women, and in the 1980s, Vitamin A supplements, other childhood vaccinations, nutritional interventions, and diarrhea treatment. The safe motherhood program distributed safe home delivery kits and iron supplements to pregnant women, increased the supply of community midwives, provided free transportation to emergency obstetric facilities for women with birth complications, and promoted institutional delivery generally.

GDP per capita in 1987) (Simmons et al., 1991) – nearly 10 times more than mean family planning spending in developing countries at the time (Pritchett, 1994a). Second, bundling child health services into the family planning treatment effectively reduced the 'price' of child survival – and could have therefore exerted independent influence on fertility (Becker, 1991, Caldwell, 1976, Sah, 1991). Third, Schultz (2009) suggests possible deviations from true randomization in the experiment's implementation.

There are few other randomized controlled trials of family planning services. The Navrongo experiment in Ghana studied 37 communities randomized across four treatment arms (Binka et al., 1995, Phillips et al., 2006). Although balance across arms was not achieved, treatment arms combining family planning service training and community outreach were associated with a 15% reduction in the total fertility rate among married women (Debpuur et al., 2002). Effects on parity progression persisted for 15 years (and have largely been attributed to the promotion of contraceptive use through community organizations) but have declined over time (Phillips et al., 2006, Phillips et al., 2012). Two other experiments integrated family planning services into existing programs: a microcredit program in Ethiopia (Desai and Tarozzi, 2011) and an HIV treatment program in Kenya (Kosgei et al., 2011). Both experiments find null results in the first few years following implementation.

Observational studies

Two influential observational studies analyze contemporaneous effects of Indonesian National Family Planning Coordinating Board's programs during the late 1970s and 1980s. Gertler and Molyneaux (1994) combine birth history data with community-level information about family planning program activity to study program

effects on community-level birth hazards between 1982 and 1987. Accounting for changes in the demand for children and community fixed effects, the authors show that taken together, family planning program inputs explain only 4-8% of Indonesia's decline in fertility (a 2% reduction in the quarterly birth hazard) during the study period (Gertler and Molyneaux, 1994).[21] Relatedly, using both survey and population census data and explicitly modeling village-level family planning program placement, (Pitt et al., 1993) fail to find that the program had any significant effect on fertility between 1976 and 1986.

Also estimating short-run program effects, two additional studies use strategies that exploit program variation due to idiosyncratic public finance rules governing local government resource allocation. Specifically, Molyneaux and Gertler (2000) find that in conjunction, family planning subsidies, clinics, and village distribution centers were associated with 17% lower quarterly birth hazards in Indonesia between 1985 and 1994. Studying family planning in Ethiopia, Portner, Beegle, and Christiaensen (2011) find that among uneducated women, the presence of a family planning program in a woman's 1990 district of residence was associated with roughly one fewer child ever born in the 1994 Ethiopian population census (a reduction of about 20% in this sub-group).

Other studies examine the cumulative effects of family planning programs over longer periods of time. To study the long-run effects of PROFAMILIA, Colombia's predominant family planning provider from 1965 until the 1980s, Miller (2010) combines 1985 and 1993 population census data with information about its staggered geographic expansion across the country to estimate changes in fertility outcomes associated with age-specific program exposure. Controlling for cohort and birth area fixed effects as well

[21] Gertler and Molyneaux (1994) show that factors associated with economic development drove reductions in fertility primarily through increased demand for modern contraceptives, noting the role of family planning programs in allowing couples to achieve demand-driven reductions in their desired fertility.

as area-specific time trends, he finds that the presence of family planning services explains about 6-7% of Colombia's fertility decline over this period (postponing first births and reducing completed fertility by approximately 0.25-0.33 children).[22]

Three studies by Angeles, Guilkey, and Mroz also use spatial and temporal variation in program exposure to estimate long-run effects on cumulative fertility. In Tanzania and Peru, the authors use random effects models to estimate the relationship between community-level program placement and individual birth hazards over two decades. They find 25-35% reductions in children ever born in Peru (Angeles et al., 2005a) and 10-20% reductions in Tanzania, reporting that half of these effects is linked to program exposure during adolescence (Angeles et al., 1998). In Indonesia, the authors model both indirect and direct pathways through which family planning might influence a woman's lifetime fertility. Jointly estimating equations for educational attainment, marriage, and fertility, they find that the long term presence of family planning programs is associated with a 20% reduction in completed fertility (or about one child) (Angeles et al., 2005b).

Another set of studies examines the role of family planning in Iran's striking fertility decline during the 1980s and 1990s (as Iran's total fertility rate declined from over 7 births per woman to about 2 (Hashemi and Salehi-Isfahani, 2013). Family planning was banned at the time of the Islamic Revolution, but in 1989, Iran abruptly legalized modern contraceptives and launched family planning programs through its large, pre-existing cadre of community health workers (Behvarz). Salehi-Isfahani (2010) combine data from the Iranian Ministry of Health with population census records from

[22] These effect sizes are similar to the reductions of 0.1-0.33 children ever born reported by Angeles and coauthors, who study of family planning programs in 11 African, Asian, and Latin American countries (Angeles et al., 2001).

1986 and 1996; using a difference-in-difference approach to study variation in the timing and location of community health worker activity, they find a 4% decline in the child to woman ratio associated with program activity, explaining 8-20% of the decline during the study period. Analyzing age-specific program exposure among cohorts of women in the 2006 Iranian census, Modrek and Ghobadi (2011) find an 18% reduction in children ever born among women first exposed to family planning between ages 20 and 34 as well as a 28% reduction among women first exposed between ages 15 and 19. Using a similar approach, Hashemi and Salehi-Isfahani (2013) report that the presence of a program was associated with a 5-7% increase in birth spacing.

Additionally, a recent group of studies examines the short-run consequences of unanticipated 'shocks' to family planning programs. We note that the interpretation of these papers' estimates is complex because longer-term fertility behavior (which may offset the consequences of short-lived shocks) is not observed. In Eastern Europe, where abortion was historically the predominant form of fertility regulation, many countries limited or banned abortion during the 1980s and 1990s.[23] Examining the abrupt end of Romania's ban on abortion and family planning in 1989, Pop-Eleches (2010) uses survey data on births among reproductive age women two years before and after the end of the ban to employ a single difference approach (akin to a regression discontinuity design). The author finds that lifting the ban was associated with a 30% decline in fertility – and conducting simulations using his estimates, he suggests that the cumulative effect of the abortion ban was an increase of approximately 0.5 children (a 25% increase) among women who spent all of their reproductive years under the ban (Pop-Eleches, 2010).

[23] Levine and Staiger (2004) conduct a cross-country study of these abortion policy changes, finding that on average, restrictive policies led to a 17% higher birth rate (compared to a liberal policy).

Studying disruptions in the supply of free condoms to Filipino provinces due to supply chain irregularities, Salas (2013) finds that a 6% reduction in contraceptive supply is associated with a 15% increase in short-run birth hazard. Similarly, analyzing fluctuations in contraceptive supply in Ghana due to the instatement and repeal of the United States' 'Mexico City Policy,' Jones (2013) finds that the policy led to a 10% increase in pregnancies (or a 0.2 percentage point increase in the monthly pregnancy hazard) among rural women and women with little education.[24]

Finally, several studies examine the consequences of population policy in China. Although there is substantial heterogeneity across all family planning programs included in this review, we emphasize that these studies are distinct in estimating program effects associated with compulsory (rather than voluntary) programs.[25] One recent unpublished paper uses retrospective fertility history records from China's "2-per-thousand" fertility survey to study the staggered introduction of China's early family planning campaign (*Wan Xi Shao*, or "Later, Longer, Fewer") across provinces during the 1970s (Babiarz et al., 2016). In an event study framework, the authors find large reductions in third and higher parity births associated with the campaign; for example, birth hazards at third and fourth parity declined by 35% and 76%, respectively. Given the smaller (and declining) share of births occurring at higher parities, however, these estimates explain 22-32% of China's Total Fertility Rate decline during the 1970s.

Studying the famous One-Child policy (enacted around 1980) that followed the *Wan Xi Shao* campaign, Li et al. (2005) uses variation in the legal birth limits across

[24] Although complete data is not available for all study years, Jones also reports that the policy was associated with an immediate decline of roughly 40% in family planning funding and a 13% reduction in contraceptive supply.

[25] Accounts of abuse under China's compulsory fertility policy, while anecdotal, report cases of forced or coerced abortions and sterilizations, threats of violence and excessive fines.

ethnic groups to estimate the changes in the probability of having a second birth associated with the policy. With data from the 1% sample of the 1990 Chinese Population Census, the authors find an 11% reduction in the probability of a second birth - a decline of about 13% relative to 1982.[26]

4. Family Planning Programs and Health and Socio-Economic Outcomes among Women and Children

Beyond their impact on fertility, family planning programs may also have important health and socioeconomic benefits for mothers and their children (Canning and Schultz, 2012). Intuitively, these benefits could stem from changes in the number, timing, and spacing of births or from changes in sibship size and composition – but isolating the specific mechanisms or pathways through which they are produced is often not possible. Studying these benefits is also difficult because some do not emerge for many years, requiring long study periods.[27]

Benefits among Mothers

Given high maternal mortality rates in many low- and middle-income countries, reductions in the number of births may have an important effect on maternal mortality rates simply by reducing the number of times women are at risk of maternity-related death (Rahman and Menken, 2012). However, if family planning programs also selectively reduce the relative incidence of riskier pregnancies (such as higher parity

[26] Age-specific effects among 30-34 year olds are as high as 22% in the general population and over 30% in urban areas (a 25% decline relative to 1982) (Li et al. 2005).

[27] A large literature in development economics studies the relationship between these dimensions of fertility and the well-being of women and children (see Schultz, 2007a and Schultz, 2007b). We restrict our review to direct analyses of family planning programs. See the accompanying electronic appendix (at the time of writing this review, available at https://people.stanford.edu/ngmiller/) for details.

births), they may also reduce the maternal mortality ratio (Cleland et al., 2012, Jain, 2011, Winikoff and Sullivan, 1987).[28]

Few studies analyze the direct relationship between family planning programs and maternal mortality. One exception is an early study of the Matlab experiment reporting that the maternal mortality rate in treatment areas declined to about half of the rate in control areas between 1976 and 1985 (Koenig et al., 1988). This effect was attributed to relative reductions in fertility and a corresponding decline in lifetime exposure to maternal mortality risk. However, there was no change in the maternal mortality *ratio* (and hence no change in average mortality risk conditional on pregnancy).

Among surviving women, long-term studies of the Matlab experiment find anthropometric gains associated with the treatment.[29] Canning and Schultz (2012) report that in 1996, reproductive-age women in treatment areas had a 1 kg/m^2 higher Body Mass Index (BMI) than women in control areas. Adjusting for characteristics of women and their households, Joshi and Schultz (2013) find that this BMI advantage among women in treatment villages is only present at older ages. However, they also find that women in treatment areas are roughly 2kg heavier on average and are less likely to be underweight (defined as BMI<18 kg/m^2).[30] (Al, 2012) In interpreting these findings, we emphasize

[28] The maternal mortality rate measures the number of maternal deaths per 100,000 women of reproductive-age; the maternal mortality ratio measures the number of maternal deaths per 100,000 live births. The medical literature suggests that nulliparous and grand multiparous births (first births and births of parity higher than four) may be riskier (Bai et al. 2002, Ezegwui et al., 2013, for example). The evidence on elevated risk associated with 'unwanted' births, births to younger mothers, and short interval births is more tenuous (see Tsui et al. (2010), DaVanzo, Razzaque et al. (2005), and Conde-Agudelo and Belizan (2000) for example).

[29] Selective mortality may bias anthropometric estimates downwards if marginal survivors are weaker (or have lower anthropometric indicators) than the average woman.

[30] These BMI and weight differences could potentially imply differences in future survival; studying Matlab, Menken, Duffy et al. (2003) report that a one point increase in BMI is associated with a 17% decline in mortality hazard.

that improvements in women's health could be due to bundling of women's health services into the family planning 'treatment' beginning in 1982.

By allowing women greater control over the number, timing, and spacing of births, family planning programs may also influence their educational attainment, labor force participation, and lifetime earnings (Greene and Merrick, 2005).[31] Studying Colombia, Miller (2010) reports that the presence of a local family planning program early in women's reproductive years is associated with a 1% increase in educational attainment (0.05 years of schooling) and a 4-7% increase in the likelihood formal sector employment (1-2 percentage points).[32] Using simulations, Angeles and coauthors (2005b) report larger effects on educational attainment in Indonesia, suggesting that lifetime exposure to family planning programs is associated with gains of 25-27% (or an additional 1.3 years of schooling).

Benefits among Children

Family planning programs could also influence children's health and socio-economic outcomes through a variety of mechanisms (through changes in birth spacing and sibship size or through gains in women's educational attainment, for example). Although a large literature links various dimensions of fertility decline to improved child welfare, including increases in parental investments per child (and child 'quality') (DaVanzo et al., 2005, Li et al., 2008, Molyneaux and Gertler, 2000, Rosenzweig and Wolpin, 1980, Rutstein, 2005), few studies focus directly on family planning programs.

[31] Although not well-developed theoretically or empirically, some authors suggest that family planning programs could potentially influence women's bargaining power within households and the status of women generally. For example, one study finds that home visits by family planning service providers may enhance women's social standing (Phillips and Hossain, 2003).

[32] Although beyond the scope of this review, studies of the United States mid-century find a relationship between the availability of modern contraceptives and both women's educational attainment and earnings (Goldin and Katz, 2002, Bailey, 2006, Bailey et al., 2012).

Studying child survival, two experiments find that family planning programs are associated with substantial reductions in child mortality under the age of five (decreases between 30% and 50%) (Joshi and Schultz, 2007, Joshi and Schultz, 2013, Phillips et al., 2006). However, we emphasize that these programs bundled family planning services together with other health services – and in particular, ones targeting infant and child health, making it difficult to isolate the contribution of family planning services *per se*.[33] Focusing more directly on family planning services alone, Miller (2010) and Portner, Beegle, and Christiaensen (2011) report no significant program effects on infant and child mortality.

Several other studies examine anthropometric measures of child health.[34] Joshi and Schultz (2007) report that girls in Matlab's treatment villages have BMI z-scores that are 0.4 standard deviations larger on average than those of their control village counterparts. Studying children in the Philippines, Rosenzweig and Wolpin (1986) use longitudinal data to estimate within-child changes in anthropometrics associated with the share of a child's life for which family planning services were available (accounting for both regional and family characteristics potentially correlated with birth spacing). They find that lifetime exposure to family planning is associated with a 7% gain in child height and a 12% gain in child weight.

Beyond child health, family planning may benefit children in other ways throughout their lifetime, too – by increasing parents' investments in their education, for example (Becker, 1991). Evidence on the direct relationship between family planning

[33] Some research suggests that much of the reduction in child mortality in both Bangladesh and Ghana may have been due to child health and vaccinations programs (Koenig et al., 1990, Phillips et al., 2006).
[34] As with maternal anthropometrics, mortality effects of family planning may bias anthropometric estimates downwards if marginal survivors are weaker (or have lower anthropometric indicators) than the average child.

programs and children's educational attainment is again thin, however, and limited to long-term studies of the Matlab experiment. Foster and Roy (1997) report that the Matlab treatment increased both girls' and boys' years of completed schooling (by 6-15% and 5-12%, respectively), an effect they link to reductions in sibship size. Joshi and Schultz (2007) find that relative to their peers in control villages, gains in educational attainment of 0.5 standard deviations persisted among boys (but not girls) in treatment villages.

Finally, a study of Romania's 1966 ban of abortion and family planning services compares cohorts born just after the ban (which include additional 'unwanted' children) with cohorts born just before it (Pop-Eleches, 2006). Controlling for family characteristics, children born after the ban were less likely to complete either high school or college (by 1.7% and 1.4%, respectively) and were instead 2.1% more likely to complete a lower-return vocational degree. The paper attributes these changes in educational outcomes not only to the 'wantedness' of children, but also to crowding in schools among post-ban birth cohorts (the role of sibship size is not explicitly studied) (Pop-Eleches, 2006).

5. Conclusion

This chapter reviews empirical studies of family planning programs in developing countries, focusing on fertility as well as on the health and socio-economic welfare of women and children. Because the family planning literature is vast, we used an informal approach akin to the 'systematic review' methodology in the biomedical sciences in an effort both to be comprehensive and to explicitly define our focus.

Pooling across studies, we propose several generalizations about family planning program effects. First, we find that program effects on fertility vary substantially, ranging between 5% and 35% fewer children ever born and 5-7% longer birth intervals (see Table 1 for a summary). Estimates from the famous Matlab experiment generally fall in the upper-end of this range – but we note that the experimental intervention was likely too intensive to be replicated at scale, limiting the generalizability of these results (and also presumably reflecting reductions attributable to other health services bundled into the experimental treatment). Findings from compulsory programs in China also fall into the upper-end of this range and may reflect an upper-bound on what can be achieved through real-world programs at scale. Long-term studies of voluntary real-world programs yield more modest effect sizes, implying that in practice, family planning programs may explain only about 4-20% of fertility decline in real-world settings (with three studies finding no effects). Although not all major family planning programs have been studied with adequate rigor, we believe that based on existing evidence, it is difficult to argue that family planning programs alone explain a large share of the fertility decline in developing countries over the past half-century. Demand-side factors may instead play a more important role (Gertler and Molyneaux, 1994, Pritchett, 1994a)

Second, we find evidence that family planning programs may have quantitatively modest – but practically meaningful – effects on the socio-economic welfare of individuals and families. We believe that existing evidence on the relationship between family planning programs and maternal and child health outcomes is insufficient to draw firm conclusions. However, long-term studies of socio-economic outcomes suggest that family planning programs may raise educational attainment among women (by 1%-30%)

and among children (by 5-18%). Although socio-economic effects in the lower end of these ranges appear small, we note that they are not dissimilar in magnitude to gains associated with programs explicitly aiming to boost educational attainment.

Finally, we conclude by highlighting the considerable heterogeneity in the magnitude of program effects in the family planning literature. Although explaining variation in effect sizes is beyond the scope of this review, more research on the importance of programmatic attributes, contextual factors, and local institutions is needed. Explaining this variation is important for the design of better family planning programs and policies.

Table 1: Estimates of the effect of family planning programs on fertility outcomes

Country	*Study Period*	*Measure of Family Planning*	*Fertility measure*	***Marginal or Incremental Effect Size***	*Relative Effect Size*	***Background Fertility Change During Study Period (where possible)***	*Percent Change Explained (where possible)*	*Citation*	*Notes*
Bangladesh	1974-1980	Program exposure	General fertility rate	1.8	25%			Phillips et al., 1982	
Bangladesh	1967-1990	Program exposure	Number of children 0-8	0.41	25%	25%		Foster and Roy, 1997	
Bangladesh	1974-1996	Program exposure	Children ever born	1-1.5	15%			Joshi and Schultz, 2007	
Bangladesh	1974-1996	Program exposure	Lifetime fertility	0.5	13%	40%	33%	Sinha, 2005	Background fertility change is calculated roughly as the difference in lifetime fertility among women in treatment areas before and after treatment (7.21 vs 4.29)
Bangladesh	1974-1996	Program exposure	Child to woman ratio	0.12	17%	46%	37%	Joshi and Schultz, 2007	Relative effect size is calculated roughly as the average change in fertility scaled by 1974 fertility level
Bangladesh	1974-1996	Program exposure	Children ever born	1	23%*			Joshi and Schultz, 2013	Relative effect size is calculated as the marginal change in children ever born/overall sample mean children ever born
China	1970-1979	Program exposure	Yearly birth hazard (third and higher parity)	.12-.16	35-78%				Relative effect sizes shown occurr among third and higher parity births
China	1980-1990	Policy binding	Probability of having a second child	0.11	13%			Li et al., 2005	Effect size shows large heterogeneity across urbanicity and education levels.
Colombia	1965-1993	Years of program exposure	Children ever born	.25-.33	5%	51%	6-7%	Miller, 2010	
Ethiopia	2003-2006	Program exposure	Total births during study period	-	-	-	-	Desai and Tarozzi, 2011	Results on total births during the 3 year study period are mixed, and in some cases point estimates are positive.
Ethiopia	1990-2005	Program exposure	Children ever born	0-.9*	0-20%			Portner et al., 2011	Effect size varies by educational attainment with effects concentrated among uneducated mothers
Ghana	1996-2003	Program exposure	Total fertility rate	1	15%			Debpuur et al., 2002, Phillips et al., 2006	
Ghana	1995-2010	Period of program exposure	Total fertility rate	0.42	42%			Phillips et al., 2012	
Indonesia	1970-1993	Lifetime program exposure	Children ever born	0.9	18%			Angeles et al., 2005b	Simulation results shown
Indonesia	1982-1987	Family planning program inputs (mobile family planning visits, clinics and fieldworkers per 1000)	Quarterly birth hazard	0.0002	1.9%	25%	4.2-7.8%*	Gertler and Molyneaux, 1994	Range of effect sizes reflects the results of a structural proximate determinants model showing program inputs account for about 4.2% of fertility decline, and a reduced form model showing program inputs account for about 7.8% of fertility decline. Marginal and relative effect sizes shown are from reduced form specifications.
Indonesia	1986-1994	Family planning program inputs (contraceptive subsidies, village distribution centers and family planning clinics)	Quarterly birth hazard	-0.0174	17%			Molyneaux and Gertler, 2000	Results shown are the combined net effects of each program input estimated (calculated by scaling regression coefficients with mean input values, and suming across family planning program inputs). Values are approximate given approximated sample mean values and baseline quarterly birth hazards. Reduced form estimates for
Indonesia	1976-1986	Proportion of households with family planning clinic	Children ever born	-	-	-	-	Pitt et al. 1993	
Iran	1986-1996	Family planning service availability; length of exposure	Child to woman ratio	0.04-.08	4-8%	46%	8%-20%*	Salehi-Isfahani et al., 2010	Share of fertility decline explained calculated using the overall mean child to woman ratio in 1986 (0.95) and 1996 (0.51)
Iran	1970-2004	Years of program exposure	Children ever born	.63-.99*	18-28%			Modrek and Ghobadi, 2011	Marginal effect size calculted roughly using overall mean children ever born
Iran	1970-2000	Family planning service availability	Yearly birth hazard	.02-.05				Hashemi and Salehi-Isfahani, 2013	Marginal effect size observed for higher parity births
Kenya	2005-2009	Program exposure	Incident pregnancy	-	-	-	-	Kosgei et al., 2011	
Peru	1972-1991	Dispensary and pharmacy placement wihtin community	Children ever born	.93-1.3*	25-35%			Angeles et al., 2005a	Marginal effect size, as meaured through simulations, varies depending on educational attainment
Romania	1988-1992	Contraceptive availability	Yearly birth hazard	0.07				Pop-Eleches, 2010	
Romania	1988-1992	Contraceptive availability	Total fertility rate	.39-1.1*	28-34%			Pop-Eleches, 2010	Marginal effect size varies depending on educational attainment
Tanzania	1970-1991	Lifetime program exposure	Children ever born	0.57	10-20%*			Angeles et al., 1998	Range of effect sizes, as measured through simulation, correspond to placement of family planning dispensaries, hospitals and health centers.

Column 4 reports the change in fertility associated with a one unit change in the relevant measure of family planning program, Column 5 gives the effect size relative to fertility level at baseline, Column 6 reports the overall change in fertility observed during the period of study, and Column 7 reports the implied percent of the overall fertility decline explained by family planning.

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Appendix 1: Search Methodology

To identify the universe of relevant studies, we developed explicit search criteria for three key databases: PubMed, CAB Global Health, SCOPUS, and POPLINE. Search criteria are detailed below. This initial search returned 9,501 results. We narrowed our initial results to studies that (1) focused on middle- and low-income countries, (2) that undertook a micro-level quantitative evaluation of one or more family planning programs, and (3) that studied at least one fertility, health or socioeconomic outcome (rather than just contraceptive prevalence, for example). For non-experimental (observational) studies, we restricted our review to those using commonly-accepted methodologies for addressing the role of confounding factors and endogenous program placement/intensity. These include (but are not limited to) conventional panel data techniques, difference-in-difference estimation, and instrumental variables strategies using plausibly exogenous instruments.

As we proceeded with our review, we also used a 'snowball' method to identify additional studies not returned by our original search but that otherwise met our inclusion criteria. We emphasize that our review should not be considered a formal systematic review. Our specific search criteria for each database are as follows:

<u>SCOPUS</u>

(TITLE-ABS-KEY("family planning" AND "effect" AND "fertility") AND TITLE-ABS-KEY(effects)) AND SUBJAREA(mult OR agri OR bioc OR immu OR neur OR phar OR mult OR medi OR nurs OR vete OR dent OR heal OR mult OR arts OR busi OR deci OR econ OR psyc OR soci) AND (LIMIT-TO(DOCTYPE, "ar")) AND (LIMIT-TO(LANGUAGE, "English")) AND (EXCLUDE(SUBJAREA, "BIOC") OR EXCLUDE(SUBJAREA, "PSYC") OR EXCLUDE(SUBJAREA, "AGRI") OR EXCLUDE(SUBJAREA, "ENVI") OR EXCLUDE(SUBJAREA, "NURS") OR EXCLUDE(SUBJAREA, "PHAR") OR EXCLUDE(SUBJAREA, "EART")) AND (EXCLUDE(SUBJAREA, "MULT") OR EXCLUDE(SUBJAREA, "ARTS") OR EXCLUDE(SUBJAREA, "VETE") OR EXCLUDE(SUBJAREA, "MATH")) .

<u>CAB: Global health</u>

(TI=(("family planning" OR contraception OR "planned pregnanc*" OR "reproductive health program*" OR "birth control" OR abortion OR "abortion ban")) AND TI=(("birth intervals" OR "birth spacing" OR "maternal health" OR "maternal mortality" OR "child health" OR "infant mortality" OR "neonatal mortality" OR educat* OR "labor market"

OR education* OR "Population Control" OR "birth rate" OR "fertility rate" OR "excess fertility" OR "contraceptive use" OR "demand for children" OR "fertility decline" OR "birth interval" OR impact* OR outcome* OR change* OR analys*)))
(BD=developing countries AND DE=family planning) Language=(English) Research Areas=(PSYCHOLOGY OR WOMEN S STUDIES OR BUSINESS ECONOMICS OR DEMOGRAPHY OR SOCIOLOGY OR PUBLIC ADMINISTRATION OR GOVERNMENT LAW OR SOCIAL SCIENCES OTHER TOPICS OR EDUCATION EDUCATIONAL RESEARCH OR PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH OR COMMUNICATION) Document Types=(JOURNAL ARTICLE OR JOURNAL ISSUE OR MISCELLANEOUS OR BOOK CHAPTER OR THESIS OR BOOK OR BULLETIN OR ANNUAL REPORT)

PUBMED

("Contraception"[mesh] OR "Family Planning Services"[mesh] OR "reproductive health services"[mesh:noexp] OR "Family planning"[ti] OR contraception[ti] OR "reproductive health programs"[tiab] OR "reproductive health program"[tiab]) AND ("Models, theoretical" OR "Statistics as topic" OR "Utilization"[sh] OR "Predictive Value of Tests"[mesh] AND "Cross-Sectional Studies"[mesh] OR "Epidemiologic Studies"[mesh] OR "Motivation"[mesh] OR "Demography"[mesh] OR "Health Services Research" OR "Research Support, Non-U.S. Gov't"[Publication Type] OR "Research Support, U.S. Government"[Publication Type] OR "Outcome and Process Assessment (Health Care)"[Mesh:noexp] OR "Outcome Assessment (Health Care)"[Mesh:noexp] OR Evaluat*[ti] OR Impact*[ti] OR Effect*[ti] OR Outcome*[ti] OR Analys*[ti] OR Evidenc*[ti]) AND ("Birth Rate"[mesh] OR “educational status” [mesh] OR “socioeconomic factors” [mesh:noexp] OR "Contraception behavior"[mesh] OR "Population Control"[mesh] OR "birth rate"[ti] OR "fertility rate"[ti] OR "excess fertility"[tiab] OR "contraceptive use"[ti] OR "demand for children"[tiab] OR "fertility decline"[tiab] OR "birth interval"[ti] OR "birth intervals"[ti] OR "birth spacing"[ti] OR "maternal health"[ti] OR "maternal mortality"[ti] OR "child health"[ti] OR "infant mortality"[ti] OR "neonatal mortality"[ti] OR educat*[ti] OR "labor market"[tiab]) NOT ("europe"[mesh] OR "australia" [mesh] OR "united states"[mesh] OR "canada"[mesh]) NOT (letter [pt] OR editorial [pt]) NOT ("animals" [mesh] NOT "humans" [mesh]) NOT ("qualitative research" [mesh])

POPLINE

For POPLINE, we made use of hierarchical indexing, searching publications indexed under subheadings Family Planning Program Evaluation, Evaluation, Program Effectiveness, Fertility, Program Evaluations, Fertility Changes, Socioeconomic Status, Maternal Health, Child Health, Birth Spacing, Parity and Mortality, each indexed more broadly under: Family Planning Programs > Program Monitoring, Evaluations, Indicators > Developing Countries