Causes and Consequences of Teen Childbearing: Evidence from a Reproductive Health Intervention in South Africa

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Abstract:
We use a natural experiment to estimate the causal impact of a public health intervention aimed at reducing teenage childbearing. The geographic and timing variation in the rollout of the South African National Adolescent Friendly Clinic Initiative (NAFCI) in the early 2000s provided a plausibly exogenous increase in reproductive health knowledge and clinical access for teens. We investigate the causal pathway from the intervention's initial impact on early-teen childbearing to subsequent consequences for later-life outcomes of prime policy interest — education, employment and child health. Our empirical strategy uses GPS data from the National Income Dynamics Study to geolink women's location of residence during adolescence to the location and timing of the rollout. Our results show that living near a NAFCI clinic during adolescence delayed childbearing by 1.2 years on average with the greatest impacts on women who would otherwise have given birth by age 17. We estimate that adolescents who had access to NAFCI completed more years of schooling and, consistent with increased human capital investments, earn substantially higher wages as young adults. Finally, children born to women who had access to youth-friendly services as teens show substantial health advantages, indicating a strong intergenerational benefit of delaying early teen childbearing in a developing country context.

Keywords: teenage childbearing, maternal and child outcomes, youth friendly reproductive health services

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I. Introduction

Teen childbearing is seen as a serious social problem because women who give birth as teens tend to have worse economic outcomes than those who delay first births. But whether this association is due to fertility timing or some joint determinant of teen pregnancy and lower human capital investment and employment prospects is hotly debated and empirically difficult to disentangle. In the extensive US literature on the topic, studies that are able to control convincingly for economic circumstances such as family background find that the negative association is greatly diminished or even reversed.[1] The literature on the impacts of early childbearing in developing economies is much smaller and newer. The findings are, so far, quite different. In South Africa, for example, there is growing evidence using a variety of identification strategies that consistently finds a substantial and significant negative causal relationship between early childbearing and later outcomes including mother's education (Ranchhod et al. 2011, Ardington et al. 2015) and child health (Branson et al. 2015). Research by Lang and Weinstein (2015) suggests a way to reconcile the seemingly contradictory findings in the US and South African contexts. They point out that the consensus debunking the negative consequences of teen motherhood in the US is based on the analysis of teen births that occurred *after* contraceptive access became widespread in the US. Analyzing an earlier period when family planning was not easily accessible to minors—as was the case in South Africa in the early 2000s - they estimate negative causal impacts of teen motherhood.

The impact of family planning policies on fertility is another causal pathway that is notoriously difficult to identify. Bongaarts (1994) argues that the increased supply of contraception provided by family planning interventions drive down fertility. Pritchett (1994)

[1] Hoffman (1998) provides a review of this literature.

counters that while increased contraceptive use is *coincident* with falling fertility, reduced demand for children drives fertility decline, and the causal impact of family planning interventions is small. As in any market where we only observe the amount consumed, separating the role of supply and demand drivers is a challenge. In the case of adolescent fertility there are often frictions on both the demand and supply sides. Lack of sex education can break the link between desire to prevent pregnancy and contraceptive use. Social stigma can be a barrier between contraceptive supply and teen access.

In early post-apartheid South Africa, the supply of family planning was technically unconstrained. The Apartheid regime's goal of controlling the non-white population resulted in widespread free availability of contraception, and the new democratic government elected in 1994 ushered in some of the most progressive reproductive health laws in the world (Cooper et al. 2004). The 1998 South African Demographic and Health Survey reported that 80 to 90 percent of 20 to 30 year olds had ever used a modern contraceptive (DHS 1998). However, among the 30 percent of all South African women under 20 who already had at least one child, 79% reported they did "not want" their last pregnancy.[2] This clear evidence of an unsatisfied desire among teens to delay pregnancy would be defined by family planning advocates as unmet need—a supply problem. South African public health researchers and advocates believed that high rates of unintended teen pregnancy which coincided with soaring rates of HIV among young women pointed to a knowledge gap and social and institutional barriers to adolescent access to reproductive health services. Thus, evidence on both the supply and demand side pointed to a more optimal outcome, but informational and social frictions drove a wedge

[2] Mothers under the age of 20 regarding their last pregnancy in the last 3 years: 20% wanted pregnancy then, 66% wanted later,13% did not want the pregnancy.

between unmet demand to control fertility and untapped supply of family planning. The National Adolescent Friendly Clinic Initiative (NAFCI) aimed to tackle this wedge.

NAFCI involved intensive clinic accreditation, education and community outreach. Based on interviews with stakeholders, a series of controls, and evidence of a trend break in service provision, we argue that the timing and geographic variation of the rollout led to an exogenous increase in adolescent access to reproductive health knowledge and clinical services. Our analysis is based on geo-linking data from several sources to construct a measure of proximity to NAFCI clinics for South African women. Since an individual's exposure to NAFCI was determined both by the timing and location of the rollout and whether she was in the applicable age range—12 to 17 years old—we use a difference-in-differences strategy to measure the impact of the initiative. We combine differences in outcomes for women who lived near NAFCI clinics compared to those who did not, with differences across cohorts who were adolescents versus adults during the NAFCI rollout. We estimate that NAFCI substantially reduced the likelihood of early teen childbearing. Given this delay in age at first birth we study later life outcomes and find that access to NAFCI increased average years of schooling, though did not increase the likelihood of completing matric. While we find no impact of NAFCI on employment we do find evidence of increased wages among women who are employed in early adulthood. Finally, we estimate substantial positive impacts on the health and health care of children born to women who had access to NAFCI during adolescence.

Our results show that delayed childbearing is associated with increased schooling, higher earnings and improved child outcomes and corroborate and extend the growing evidence on the detrimental impacts of teen childbearing in South Africa and other developing economies. The main contribution of this paper is to put these findings in the context of a policy initiative

specifically aimed at tackling early childbearing. Our methodology and the longitudinal nature of NIDS allows us to trace the causal pathway from increased access to reproductive health in adolescence to delayed childbearing and finally to subsequent outcomes in adulthood. Using the NAFCI rollout as a natural experiment, we provide the first quasi-experimental evidence on the causal relationship between early childbearing and later life outcomes.

This paper also contributes to the public health literature on youth-friendly health services (YFHS). In the past decade the World Health Organization has put a strong emphasis on using YFHS to fill the gap between pediatric and adult health services for youth who, due to initiation of sexual activity, are particularly vulnerable to unintended pregnancy and sexually transmitted diseases (WHO 2003). While initiatives like NAFCI have proliferated, there is limited evidence about the impact of these programs on youth access and usage of reproductive health services and almost no evidence about the impact of YFHS on health outcomes.

The remainder of the paper proceeds as follows: Section II provides background, a discussion of existing evidence on early childbearing and youth friendly services, and a description of NAFCI, Section III describes the data and empirical strategy, Section IV presents results and Section V concludes.

II. Background and Description of the National Adolescent Friendly Clinic Initiative

II.A Fertility Timing and Contraceptive Access in Early Post-Apartheid South Africa

The 1998 South African Demographic and Health Survey (DHS) provides context for the early post-Apartheid contraceptive and fertility patterns that motivated the National Adolescent Friendly Clinic Initiative.[3] Thirty-five percent of 19 year-olds (and 25 percent of 18 year olds)

[3] Apartheid was a system of strictly enforced racial segregation in South Africa. Apartheid officially ended with multi-racial democratic elections in 1994. While laws no longer classify citizens by the color of their skin, the

reported ever being pregnant (DHS 2002).[4] While this rate of adolescent childbearing is low compared to other sub-Saharan countries[5], teen childbearing in South Africa is more likely to be non-marital, rather than the result of early marriage (Macleod and Tracey 2010, United Nations Population Fund 2003). Only 1.2 percent of South African 15-19 year olds were married in 1998 (DHS 1998). There was also evidence of "widespread" and "endemic" gender violence and coercive sex experienced by teenage girls in South Africa (Wood et al. 1998).[6] And rates of unintended pregnancy among South African teens were high--78 percent of women under the age of 20 reported that their last birth was not wanted or wanted later (DHS 1998).

The Apartheid regime's plan to control the non-white population led to relatively high contraceptive prevalence in South Africa compared to other sub-Saharan countries (Cooper et al. 2004). Contraceptives were widely available at no cost at public clinics, hospitals and through mobile service provision.[7] However, the high rate of unintended pregnancy among teens suggests that South African adolescents had a substantial unmet "need" for family planning.

Based on birth histories from the 2012 wave of the National Income Dynamics Study (NIDS)[8], Figure 1 shows patterns of age-at-first-birth by cohort, and Figure 2 shows children-ever-born by age-at-first-birth across cohorts. Figure 1 shows that after a decrease in the early-

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classifications of White, Coloured, Black African, and Indian are still used in everyday conversation and are designations in surveys including the South African Census.

[4] Among 19 year-olds, 30.2 percent report being a mother and among 18 year olds, 19.8 percent report being a mother.

[5] The adolescent birth rate in South Africa between 2005-2010 was 54 per 1,000 women aged 15 to 19, while the average for Sub-Saharan African was 117. The rate in Uganda was 159 and Zambia 151(UN Population Fund 2003).

[6] A qualitative study in an African township in peri-urban Cape Town in the mid-1990s found that over 60% of female respondents aged 14-18 reported having sex against their will, and 59% reported having been beaten by a male partner (Wood et al. 1998). Note, however, that rates of physical abuse by teenage girls in DHS 1998 are significantly lower. According to Human Rights Watch, in 1995 South Africa had the highest recorded per capita rate of rape for a country not at war.

[7] Long-acting injectable contraception was, and remains, the most common contraceptive method used (DHS 1998, DHIS 2013).

[8] More details about NIDS are provided in Section 3.3A.

teen birth rate between the 1960 and 1970 birth cohorts, the proportion of 18 and 19 year olds who had given birth remains nearly constant for the 1970, 1980 and 1990 cohorts. At the same time, Figure 2 shows that among women born between 1980 and 1990, who were adolescents in the early post-apartheid era, a teen birth was much more likely to be followed by a substantial space before the next birth than for earlier cohorts. This implies that completed fertility is converging for women having early versus late first births in the post-apartheid period (Timæus and Moultrie 2008). The pattern of falling overall fertility in South Africa combined with little change in age at first birth is consistent with teen mothers only starting to use contraception *after* a first birth.

Why were sexually active teens who did not want to get pregnant not using contraceptives when they were widely available for free? Qualitative studies in various South African regions aimed to address this question (Ehlers 2003, Jewkes et al. 2001, Mfono 1998, Wood and Jewkes 2006, Abdool et al. 1992). The findings pointed to social barriers for adolescents accessing family planning. First, teens seemed to lack accurate sexual and contraceptive knowledge. For example, there were widespread fears stoked by religious leaders and even nurses that hormone-based contraceptive use by adolescents could cause permanent infertility.[9] Next, stigmatization of adolescent sex by health care providers often made clinics inhospitable. Teens reported scolding and even physically abusive behavior by staff and nurses at public clinics and hospitals when they sought contraceptives, and in some cases were even refused access to contraceptives.

[9] Jewkes, et al. (2001, p.734) report that teen "mothers often indicate that teenage pregnancy is infinitely preferable to the possibility of infertility caused by contraceptive use … This is widely perceived by women and family planning nurses to be a side-effect of progesterone based injectable contraceptives, particularly Depo-Provera." This notion was also espoused by "preachers at local African churches" (Wood and Jewkes 2006, p.111).

Concerns among health advocates and the Department of Health about these barriers to adolescent access to reproductive health services were also driven by the increasing prevalence of HIV among youth, particularly teenage girls. Department of Health surveys found that in 1998 and 1999, approximately 20% of pregnant 15-19 year olds were HIV positive (substantially higher in some regions such as KwaZulu Natal) (Allen et al. 2009, Jewkes et al. 2001). HIV prevalence among 15-24 year olds was estimated to be three times higher among young women than young men − 15% versus 4.8% (Pettifor et al. 2005). There is also evidence that early childbearing and HIV risk interact. Ardington et al. (2015) find that early teen births are associated with increased risk of AIDS-related mortality based on longitudinal data from KwaZulu-Natal.

II.B Evidence from Sub-Saharan Africa on the Impact of Teen Childbearing on Maternal and Child Outcomes

Several recent studies have estimated a negative causal relationship between teen childbearing and educational attainment in Sub-Saharan Africa, most analyzing South African data. Using propensity score reweighting in data from Cape Area Panel Study, Ranchhod et al. (2011) estimate the impact of teen childbearing on high school graduation rates among women in Cape Town, South Africa. As with US studies, they find that controlling for background characteristics diminishes the negative association, but in contrast to US studies, the estimated impact of teen childbearing remains negative and substantial. Ardington et al. (2015), use a longitudinal survey from rural KwaZulu-Natal, South Africa, to show that even after controlling for a rich set of observable characteristics, teen childbearing is associated with fewer years of schooling and increased mortality risk. They find that earlier teen births are more detrimental than later teen births, with women giving birth before age 17 a full year behind non-teen mothers compared to mothers who give birth between 17 and 19 who are only 0.3 years behind. In a

nation-wide analysis using the National Income Dynamic Study, Timæus and Moultrie (2015) show that South African youth who give birth between the age of 15 and 18 have a higher likelihood of dropping out of high school and failing to graduate. In Madagascar, Herrera and Sahn (2013) find that among 21 to 23 year old women, those who give birth before age 20 are 44 percent less likely to graduate from lower secondary school. They instrument for age at first birth using conditionally random access to condoms.

We are aware of only one other paper that studies the impact of teen childbearing on health outcomes for children. Branson, Ardington and Leibbrandt (2015) use propensity score reweighting with an extensive set of observable characteristics including mother's childhood background, sexual activity and contraception use. Controlling for maternal characteristics, they estimate that children born to women who give birth before the age of 20 are more likely to have low birthweight, are shorter and are more often stunted than children born to older mothers. They investigate potential mechanisms for these adverse effects and find evidence of behavioral choices related to maternal maturity may be driving the results.

We know of only one other study addressing of the impact of teen childbearing on women's work outcomes in developing countries and none in Africa.[10]

II.C The National Adolescent Friendly Clinic Initiative

High rates of unintended teen pregnancy and escalating rates of HIV among young people were the driving force behind the establishment of the NGO loveLife in 1999. The National Adolescent Friendly Clinic Initiative (NAFCI) was a key component of loveLife's strategy that also included high profile media campaigns and sporting events promoting "more

[10] Buvinic 1998, compares employment and earnings outcomes in the 1990s for teen versus adult mothers in Chile and finds that mothers have substantially lower earnings (though the author does not control for age).

open and better informed communication about sex, HIV, sexuality and gender relations" (Ashton et al. 2009, p. 45). loveLife launched NAFCI in consortium with several other non-governmental organizations and in partnership with the South African Department of Health.[11]

NAFCI had a clinical component aimed at reducing physical and social barriers to accessing reproductive health services, and an education component focused on sex education and life skills. The clinical component was based on an "accreditation model" whereby clinics worked towards service standards through a quality improvement process and were rewarded tiered levels of accreditation based on external assessments. The intensive accreditation process, which typically lasted a year, involved training nurses as well as non-medical staff, equipping facilities to offer the services and pharmaceuticals youth need, youth-targeted educational materials, and publicizing the clinics' youth friendliness through signage and community outreach. NAFCI's education component involved building dedicated spaces *at* clinics for youth education and socialization called "chill rooms" and employing local youth to facilitate sex-education programs.[12] Figure 5 gives an example of "youth friendly" signage.

Figure 3 shows the rollout of accredited clinics by activation year and province. The NAFCI was piloted at 10 clinics in 2000 and thereafter the number of accredited clinics increased each year. A major scale-up occurred in 2004 and 2005 resulting in 350 active NAFCI sites by the end of 2005. By 2010, almost 500 clinics, or approximately twelve percent of all public clinics across the country, were accredited as "youth friendly". Each NAFCI clinic is assigned at least one full-time loveLife peer educator (known as a groundBREAKER, aged 18 to

[11] Other organizations involved in the consortium were Planned Parenthood, the Reproductive Health Research Unit (RHRU) at the University of Witwatersrand and the Health System Trust.
[12] The clinical accreditation process is described in detail in Ashton et al. (2009), and Dickson-Tetteh et al. (2001). The ten NAFCI standards are listed in Appendix Table 1. The education component of NAFCI is also discussed in Ashton et al. (2009).

25). In 2013, 1200 groundBREAKERS were employed nationwide, assisted by 6000 to 8000 part-time youth volunteers.[13]

In 2002, the World Health Organization issued a call to develop youth friendly health services (YFHS) globally to close the gap between pediatric and adult health services for youth who, due to initiation of sexual activity, are particularly vulnerable to unintended pregnancy and sexually transmitted diseases (WHO 2003).[14] Two recent studies have reviewed evidence from initiatives aimed at providing YFHS (Tylee et al. 2007, Dick et al. 2006). Both conclude that while existing studies generally find improvements in service provision, adolescent access to health services, usage of health services, and health-risk behaviors, the evidence on the impact of YFHS is "weak" and inconclusive due to research methodologies that "threatened the validity of most of the assessments made of these programmes" (Tylee et al. 2007, p.1569) In particular, most are observational studies with no control group.

However, two randomized control trials involving YFHS interventions provide evidence relevant to NAFCI. In Bolivia, a pharmacy-based randomization tested the impact of provider training and educational materials on adolescent access to health services (Save the Children 2004). Mystery shoppers found that treatment pharmacies engaged in less age-related discrimination and showed improved information provision. Sales records showed increases in condom sales at treatment versus control pharmacies. In Nigeria, a randomized study evaluated the impact of package interventions targeted at in-school adolescents and health providers aiming to improve sexually transmitted disease (STD) treatment-seeking behavior and reduce STD prevalence (Okonofua et al. 2003). The interventions included community participation, creating health clubs in schools, peer-mentoring, and training local providers (pharmacists, medicine

[13] http://www.lovelife.org.za/corporate/lovelife-programmes/youth-leadership-development/groundbreakers.
[14] Other health concerns for adolescents include depression and suicide.

dealers, and doctors) about STD prevention and treatment. These elements are similar to the package loveLife and the South African DoH provided, although the NAFCI clinic accreditation element was far more formal and extensive. The Nigerian study found significant improvements in knowledge about sexually transmitted diseases, condom use, and STD treatment-seeking behavior among students at treated versus control high-schools as well as a significant reduction in STD symptoms. This is the only study we are aware of that estimates the impact of YFHS on health outcomes.

Two previous studies have assessed NAFCI. One qualitative case-study of a NAFCI clinic in the Limpopo province found evidence that the adolescent-friendly nature of the clinic was well publicized and known within the community and found positive feedback among adolescent clients of the facility (Bayoi 2006). Researchers involved with the implementation of NAFCI conducted a non-randomized comparison of NAFCI and non-NAFCI clinics and found that NAFCI-accredited clinics received significantly higher scores in meeting adolescent-friendly service standards (Ashton et al. 2007). Neither study provides a well-identified assessment of the impact of the program on adolescent health-seeking behavior or health outcomes.

III. Data and Empirical Strategy to Measure the Impact of NAFCI on Early Teen Childbearing, Education, Employment and Child Health

This paper's research design is facilitated by geo-linking data on the timing and location of the NAFCI rollout to birth histories in nationally representative survey data. Our empirical specification uses *proximity* to a NAFCI clinic *during adolescence* as a plausibly exogenous measure of access to reproductive health services and education and estimates the impact on early teen childbearing. NIDS data linked with census and health provision data provide evidence on the impact of the initiative.

III.A Data to Geo-link NAFCI Rollout to Adolescent Birth Histories

We geo-link several datasets to implement our research design: 1) loveLife Project Monitoring Database, 2) District Health Information System (DHIS) GPS and Service Provision by Facility files, 3) National Income Dynamics Study (NIDS) Secure Data, and 4) the 2001 South African Census.

The loveLife Project Monitoring Database provides names of each NAFCI clinic and the month and year the accreditation process began. Based on interviews with loveLife and clinic staff, we estimate that the effective start date of "youth friendly" services is one year after accreditation began. District Health Information System (DHIS) facility-level files provide GPS coordinates and monthly service provision data for every public health facility in South Africa from 2001 to 2012.[15] Figure 4 shows the location and start year of NAFCI clinics from 2000 to 2010 based on linking the loveLife database with the DHIS. We also use contraceptive distribution (including the two major injectable contraceptives, pills, IUDs and condoms) and reported sexually transmitted infections (STIs) aggregated to an annual level to track changes in service provision by facility type—NAFCI or non-NAFCI.

The National Income Dynamics Study (NIDS) is a nationally representative longitudinal household survey of over 28,000 individuals in 7,300 households that started in 2008 and is fielded every two years (SALDRU 2014). NIDS includes detailed birth histories for all women over the age of 14 at the time of interview. NIDS secure data includes GPS coordinates of

[15] The District Health Information System (DHIS) is a health management information system and data warehouse developed by the Health Information Systems Programme (HISP) used by the South African Department of Health (DOH) to collect and monitor routine health data. This data is the basis of the annual South African District Health Barometer that provides indicators of the health system at district level. Monthly facility-level data was obtained with authorization from the DOH and with assistance from HISP.

residence at time of interview as well as a residency history including city/suburb of birth and residence in 1994, 2006, 2009 and 2011.[16]

We define two groups of women—those whose teenage fertility, based on their age, could have been affected by NAFCI and another group who were too old at the time of the rollout to be affected and serve as a comparison group in our differences strategy. The teenage fertility of women who were adolescents—ages 12 to17—during the NAFCI roll out could have been affected by the initiative. This "adolescent" sample consists of approximately 3,200 female NIDS respondents who were ages 8-17 in 2001, the start of the NAFCI rollout. The older comparison group consists of 2,400 NIDS respondents who were 18 to 28 in 2001. We use retrospective residence questions in addition to location information from the NIDS survey years to determine where each woman lived from 2001 to 2010. If, when interviewed, she still resides at the location she did during adolescence, we have the GPS of her residence during adolescence; otherwise we use the GPS of the centroid of the "main-place" of residence to approximate her location in adolescence. Using this residential information and the clinic GPS coordinates, we calculate the distance in kilometers from residence to the nearest accredited NAFCI clinic for each year.[17] We create a series of binary variables for whether she lived within one, two, three, four or five kilometers of a NAFCI clinic based on when and where clinics became accredited and the respondent's age during the rollout. Main results are shown for living within one

[16] Secure NIDS data can only be accessed at the DataFirst secure facility at the University of Cape Town upon approval by the NIDS management committee.

[17] Distances are calculated using the user-written command geonear: "geonear finds the nearest neighbors using geodetic distances, i.e. the length of the shortest curve between two points along the surface."
of a mathematical model of the earth" (Picard 2012).

kilometer of a NAFCI clinic.[18] We also create a variable for distance to any public health facility in 2002.

We begin by studying the impact of NAFCI on fertility timing, specifically early teen childbearing. Using NIDS birth histories we create a set of indicator variables for having a first birth by age 17 or 18 years old. The sample is restricted to respondents who were seen past the age of interest when last interviewed. Next we investigate the impact of NAFCI on years of education, completion of secondary school (matric), employment outcomes (proportion employed, and earnings) and child health and health seeking behavior. Table 1 presents the sample stratified by cohort and NAFCI clinic proximity status.

Finally, we link each respondent to her reported neighborhood of residence at age fifteen. [19] We construct a set of variables describing characteristics for each neighborhood from the 2001 South African census including population size, share urban, a dependency ratio measure (the ratio of children and adults over 65 to prime age adults), the sex ratio, the share of adults over 20 in different education categories (some primary, completed primary, some secondary, matric, higher) and the proportion of the households with no piped water and no electricity. These serve as pre-policy control variables—NAFCI was piloted as early as 1999, but the main rollout occurred in the mid-2000s.

[18] We find that the impacts of NAFCI clinics is only significant when respondents live within one kilometer of clinic, therefore all results in the paper are for an indicator of living within one kilometer. Results for all other distances are available upon request.

[19] We use small area level (SAL) data to define neighborhoods. SAL geographical units are equivalent to enumeration areas in most cases except those with few households, where a SAL will contain multiple EAs. There were 56,255 SAL in the 2001 census. See Appendix Figure 1.

III.B Empirical Strategy to use NAFCI Rollout as a Plausibly Exogenous Measure of Increased Access to Reproductive Health Services

Our empirical strategy exploits NAFCI's staged rollout across South Africa to identify the impact of changes in adolescent access to contraception and sex education on early teen childbearing. We provide both empirical and institutional evidence to suggest that geographic distribution of NAFCI clinics was plausibly random after controlling for observable characteristics and unobserved time invariant characteristics common across cohorts.

First, to provide evidence that NAFCI had an impact on service provision at clinics, we use facility-level DHIS data to measure changes in reproductive health services provided at NAFCI relative to non-NAFCI clinics before and after accreditation using an event-study framework (Jacobson et al. 1993). Appendix Figure 2 shows the overall trends in service provision of male condoms, the two major injectable contraceptives, Depo-Provera and NET-N, and reports of new sexually transmitted infections (STIs) from 2001 to 2011. The figure shows a strong upward trend in condom distribution and fall in new STI cases over the period. Injectable contraception provision was relatively flat with evidence of some switching between the two types.

Figure 6 shows *relative* changes in service provision at NAFCI clinics after accreditation, accounting for the national trends shown in Appendix Figure 2 using non-NAFCI clinics as controls and calendar year-fixed effects. After accreditation there is a trend break in the number of condoms distributed (increase) and STIs reported (decrease) at NAFCI clinics compared to non-NAFCI clinics. Figure 6 provides evidence that NAFCI clinics increased condom distribution at a faster rate than non-NAFCI clinics and that the new STI rate fell more quickly at NAFCI clinics.

There is also evidence, albeit weaker, in the lower two panels of Figure 6 for trend breaks in the two main injectable contraceptives, though the provision of NET-EN decreases while the provision of Depo-Provera increases. Based on interviews, the authors learned that NAFCI-trained clinic staff attempted to dispel the perception that Depo-Provera is "not for youth" which may explain these patterns. Depo-Provera is much more likely than NET-EN to cause temporary amenorrhea (absence of a menstrual period) (Draper et al. 2006). This leads some to believe it causes infertility or other health problems and is therefore not suitable for youth (Wood and Jewkes 2006).

Next we provide suggestive evidence to support our main identification strategy - that clinic locations were not chosen where *trends* in teen fertility were different. Access to adolescent friendly services depended both on location of the rollout and whether an individual was an adolescent during the rollout. We are therefore able to compare outcomes for women in each area who were and were not age-eligible for the initiative. This difference-in-differences strategy requires only that the location and timing of clinic accreditation is uncorrelated with other determinants of *changes* in fertility timing. Our cross-cohort comparison means that even if accreditation was pursued where teen fertility was highest, identification is not threatened.

The first piece of evidence is based on interviews with people involved with the rollout of NAFCI. It is our understanding that clinics were chosen in a relatively ad hoc way that varied by province and district. [20] According to the first director of loveLife, statistics on teen pregnancy and HIV were not used as selection criteria as those statistics did not exist with any geographic detail at the time. We were told on multiple occasions that since clinics were usually chosen by

[20] We visited NAFCI-accredited clinics in Gauteng, Eastern Cape and Western Cape and met with nurses and local loveLife youth peer educators. We conducted extensive interviews with eight current and past employees and consultants of loveLife in total. Two provincial managers interviewed were at loveLife during the initial implementation of the program.

provincial or district level departments of health, and that varying personalities and agendas of provincial or district managers were involved, this led to a "random" mix of clinics across the country (though they did not mean a formal random selection process was used). In some cases "struggling" clinics were targeted, and in others cases clinics perceived to be doing relatively well were rewarded by being chosen for the program. What is clear is that there were many more clinics that either wanted to be involved, or whose district managers wished for them to be included, than could be accommodated due to the intensity and expense of the program. Only around 12 percent of all public clinics were accredited as youth friendly by 2009. Thus while NAFCI was targeted at high-need communities (see Appendix Table 2), there are an abundance of high-need communities across South Africa. We feel confident that many clinics that were otherwise similar to chosen clinics were not selected simply due to lack of funds, organization and time.

The second piece of evidence is provided in Figure 6, which shows the relative changes in service provision at NAFCI clinics after accreditation. The pre-accreditation trend in the provision of contraceptives is relatively flat. This lends credibility to the assumption that the initiative did not target clinics that had different growth trajectories in contraceptive provision from the average clinic.

The next piece of evidence is a direct measure of teen childbearing trends in areas that received NAFCI clinics versus those that did not. Figure 7 shows the proportion of women who gave birth by age at first birth for NAFCI versus non-NAFCI small areas[21] for Census 1996 birth cohorts. The figure shows no evidence of different trends in teen childbearing in NAFCI

[21] A NAFCI small area (see Appendix Figure 1 for relative geographical size of a small area) is defined as a small area that subsequently, during the NAFCI rollout, got at least one NAFCI accredited clinic. No clinics were accredited in areas defined as non-NAFCI small areas.

neighborhoods versus other areas. While the level of geographic detail available in the census is not as precise as the data we have in NIDS, this pre-trend analysis provides further suggestive evidence that the program was not targeted to areas where teen childbearing growth trajectories, at least prior to the program, were different.

Finally, Appendix Table 2 provides evidence on the characteristics of areas where NAFCI clinics were accredited. We regress whether a respondent lived near a NAFCI clinic during adolescence on 2001 characteristics of the neighborhood where the respondent lived at age 15, distance to any public health facility and district council of birth fixed effects. Many of the coefficients are statistically significant showing that the initiative was generally focused on areas of high need and low socio-economic status. We control for all of these variables, and other unobserved time invariant characteristics of the district council of birth, when estimating the impact of NAFCI.

III.C Empirical Specifications

We use a difference-in-differences strategy to examine the impact of the NAFCI program on teenage childbearing, education and employment outcomes by comparing the outcomes of those exposed and not exposed to the program. Exposure is based on date of birth and location of respondent during their teenage years. Given that our teenage childbearing outcome is measured at age 18 and the fact that the program was rolled out from 2001, those respondents who were already older than 17 in 2001 could not have been impacted by the program, while younger respondents could have been exposed. [22]

Access to a NAFCI clinic is defined as the respondent living within 1km of a clinic that was NAFCI accredited during the rollout between 2001 and 2010 – $Near$. We compare outcomes

[22] This strategy is similar to the approach used by Duflo (2001) and Tanaka (2014).

of respondents too old for the program (age 18-28 in 2001) to those who were born in years where they could be exposed and who we saw after the age of 18 (8-17 in 2001)-$Adolescent$.

Table 2 presents the identification strategy in a simple two-by-two table. The means and standard errors of each of the outcome variables are presented for different cohorts and access areas. In both age groups, those that have access to clinics have higher teen childbearing levels, reflecting the allocation of clinics to areas of high need. In both access and no access areas, teen childbearing decreases over time, however the decline is much larger in access areas. The difference-in-differences estimate of -0.059 can be interpreted as a 5.9 percentage point decrease in teenage childbearing by age 17 as a result of the NAFCI program under the assumption that, in the absence of the program, the decrease in the teenage childbearing rates would have been equivalent in access and no access areas.

Generalizing this empirical strategy to a regression framework we estimate equations of the form:

$$Birthby17_{ijk} = \alpha_0 + \beta_1(Near_i \times Adolescent_j) + \beta_2 Near_i + \beta_3 Adolescent_j + \boldsymbol{X'}_i\beta_4 + \boldsymbol{X'}_{SAL}\beta_5 + \left(\boldsymbol{X'}_{SAL} \times Adolescent_j\right)\beta_6 + \delta_k + \epsilon_{ijk} \quad (1)$$

where $Birthby17_{ijk}$ is an indicator for whether individual i in cohort j born in area k gave birth before age 17, α_0 is a constant, $Near_i$ indicates whether individual i's household was within 1km of a NAFCI clinic, $Adolescent_j$ is a dummy indicating whether the individual is in the younger cohort, $\boldsymbol{X}_i$ is a vector of individual characteristics including population group dummies (race), parental education, and distance to closest clinic in 2002 (prior to the main rollout), $\boldsymbol{X}_{SAL}$ is a vector of demographic characteristics of neighborhood of residence in 2001 as per the 2001 census (prior to the rollout), δ_k are district of birth fixed effects. The coefficient of interest

is β_1, which gives the differences-in-differences estimate of the impact of access to a NAFCI clinic.

IV. Estimates of the Impact of NAFCI on Teen Childbearing, Education, Employment and Child Health Outcomes

We begin by presenting estimates of the impact of NAFCI on early teen childbearing, building up from the basic differences estimates shown in Table 2 to estimates of regression equation (1) with a full set of controls. Next we present results for a series of later life outcomes that previous research has shown are negatively impacted by early teen childbearing—education and child health. We also present estimates of the impact of NAFCI on employment and earnings, making this one of only two papers we are aware of to study the association between early childbearing and employment outcomes in a developing country context and the only one in Africa.

Table 3 presents estimates of equation (1) where the outcomes are indicators for having a first birth by age 17 or by age 18. Column 1 is analogous to the estimates from Table 2 only controlling for respondents age with year-of-birth dummies. Columns 2-4 add additional controls—all controls are either time-invariant such as race, parents' education and region of birth or based on pre-policy characteristics of the respondent's neighborhood. The coefficient of interest is on the interaction of living near a NAFCI clinic and being an adolescent during the rollout ($Near \times Adolescent$). The estimates are stable across the columns with the addition of controls. The estimated effect in Column 4 indicates that living within one kilometer of a NAFCI clinic between the ages of 12 and 17 led to a 6.4 percentage point reduction in the likelihood of having a first birth by age 17 with a p-value of 0.09. Column 8 shows that living near a NAFCI clinic during adolescence led to a 6.9 percentage point reduction in the likelihood of a birth by age 18 though the estimate is not statistically significant. These estimates are at or

near conventional levels of significance and reflect a level of precision commensurate with the small sample sizes in the NIDS for the relevant age groups.

The first two entries of Table 4 carry over the results from the final columns of Table 3 for impacts on birth by 17 and birth by18 with a full set of controls. The remaining rows give results for impact of NAFCI on additional outcomes using the fully-controlled specification. The first column of Table 4 presents results for the full sample and the second column restricts the sample to women who lived within two kilometers of any public clinic during adolescence. Given that two thirds of South African's live within two kilometers of a public health facility, this does not reduce sample size dramatically (McLaren et al. 2014). We prefer this specification as it allows us to isolate the impact of youth friendly services versus standard health services. The results in Column 2 are almost all larger in magnitude and more statistically significant than those in Column 1.[23] The final column of Table 4 gives the mean of each outcome among women in the sample who were adolescents during the NAFCI rollout.

Given the average levels of early-teen childbearing, our estimates imply that NAFCI had a substantial impact on fertility timing. In results not shown, but available upon request, we find no statistically significant impact of NAFCI on birth by age 19 or 20 which suggests that the impact of the initiative was to delay rather than decrease fertility. As seen in Table 4, we estimate that among women who gave birth by 2012, access to a NAFCI clinic delayed childbearing by approximately 1.2 years on average (p-value=0.04).

Turning to education and employment outcomes in early adulthood, we estimate that women who lived near a NAFCI clinic in adolescence attained 0.6 additional years of schooling

[23] When we study the characteristics of the subgroup that appears in column 1 but not in column 2, we find that the sample excluded is more likely to be white and rural than the subsample in Column 2. This makes sense in light of the change in coefficients from Column 1 to Column 2 given that early childbearing rates are very low for white respondents and education and earnings are on average higher for whites.

on average, though we find no impact on the likelihood of completing matric. These findings are roughly in line with the magnitudes for impacts of early childbearing found by Ardington et al. (2015). Employment rates among non-white young adults are notoriously low in South Africa, particularly for young women as can be seen by the 60 percent employment estimate in Table 4. We do not find that delaying early childbirth is associated with increased employment. However, among women who have jobs, those who had NAFCI access as adolescents report substantially higher earnings—roughly 30% higher monthly earnings. Together these results suggest that delayed childbearing is associated with greater human capital investment resulting in improved earnings potential.

Finally, we examine intergenerational impacts of early teen childbearing. Sixty percent of the sample who were adolescents during the NAFCI rollout have given birth by 2012. Table 4 shows substantial and statistically significant improvements in child health consistent with recent findings that even delaying early births by a year can have strong positive impacts (Branson et al. 2015). Among first-born resident children, the likelihood of stunting is more than 20 percentage points lower for children born to mothers who had NAFCI access as teens compared to those whose mothers did not.[24] Mothers' NAFCI access is estimated to increase children's height for age by 1.2 standard deviations which is in line with findings from the Branson et al. (2015) study.

Branson et al. (2015) find that behavioral choices and maturity of older mothers may explain better outcomes for children. Our findings suggest an additional mechanism for improved outcomes. Access to reproductive health services initially targeted at contraception

[24] Stunted is an indicator for having a height for age z-score more than two standard deviations below the median score for the World Health Organization reference population (WHO 2006).

may serve as a stepping stone to the health system resulting in improved maternal and child health. As seen in Appendix Table 1, one element of the NAFCI Essential Service Package is antenatal and postnatal care. Table 4 shows that children whose mothers lived near NAFCI clinics as teens are nearly 20 percentage points more likely to be taken for well child checkups. Well-child visits present an opportunity to ask general questions and raise concerns about ones child's development, behavior, and wellbeing and are also a time for scheduled vaccinations and to see whether the child is growing at a desirable rate.

V. Conclusion

In South Africa in the early 2000s, social and institutional barriers blocked teen access to family planning despite a well-established contraceptive infrastructure. Starting in 2001, the NGO loveLife in conjunction with the Department of Health implemented an intensive initiative which increased access to reproductive health services and information for some teens. The rollout of the South African National Adolescent Friendly Clinic Initiative provides a natural experiment to investigate the mechanisms linking contraceptive access with fertility timing and the subsequent impacts of delaying births on human capital accumulation, earnings and child health. Using the location and timing of the rollout geolinked to rich data on location of residence, birth history and outcomes in adulthood from the National Income Dynamics Study, we find that living near a NAFCI clinic during adolescence delayed childbearing by 1.2 years on average with the greatest impacts on women who would otherwise have given birth by age 17. We estimate that adolescents who had access to NAFCI completed more years of schooling and, consistent with increased human capital investments, earn substantially higher wages as young adults. Finally, children born to women who had access to youth-friendly services as

teens show substantial health advantages, indicating a strong intergenerational benefit of delaying early teen childbearing in the South African context.

While this paper deals with a policy intervention in the context of post-Apartheid South Africa, our findings provide important evidence about if and how fertility timing affects women's economic outcomes more broadly. To explain why the observed correlation between teen childbearing and worse economic outcomes falls away in the US after controlling for factors like household environment in adolescence, researchers have argued that women for whom early childbearing is costly prevent early births using contraception or abortion (Geronimus and Korenman 1992, Lang and Weinstein 2015). Given this line of reasoning, when adolescent access to family planning is *limited* as it was in the US prior to the 1960s or in many developing countries today, it is not surprising to find evidence that early childbearing *causes* worse outcomes.

These results corroborate recent research showing that early teen childbearing has substantial negative consequences for women's economic outcomes in many developing economies. Our study provides the added contribution of estimating the impacts of teen childbearing in a setting where contraceptive access for teens was initially limited and then later expanded. We find that a reproductive health intervention targeted directly at youth has the immediate intended goal of delaying childbearing and also provides the longer term benefits of improved later-life outcomes indicating an important role for youth friendly health services.

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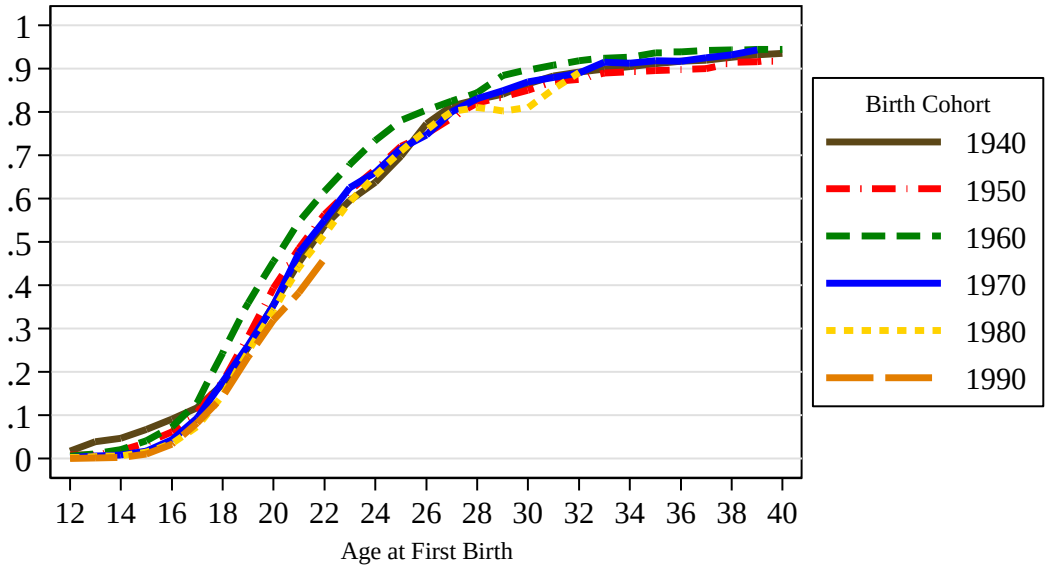
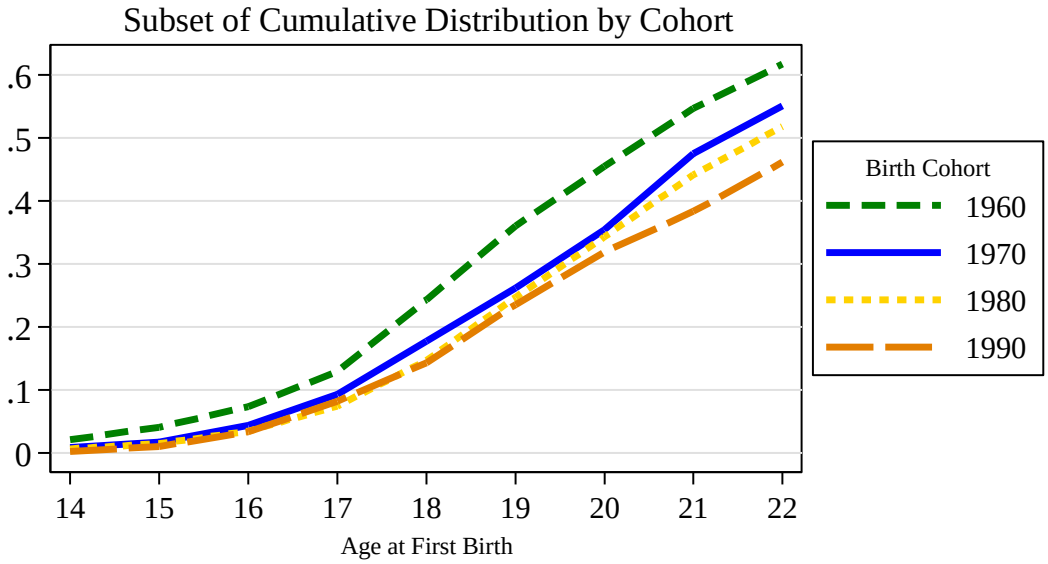
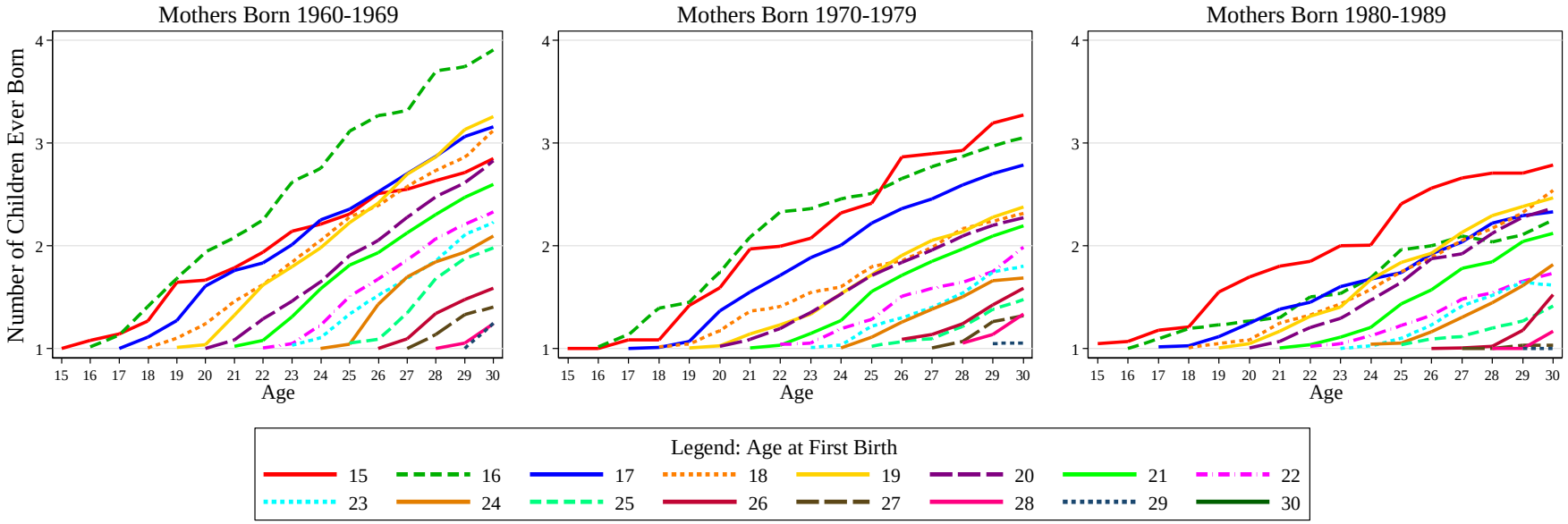
Figure 1. Cumulative Distribution of Age at First Birth by Cohort





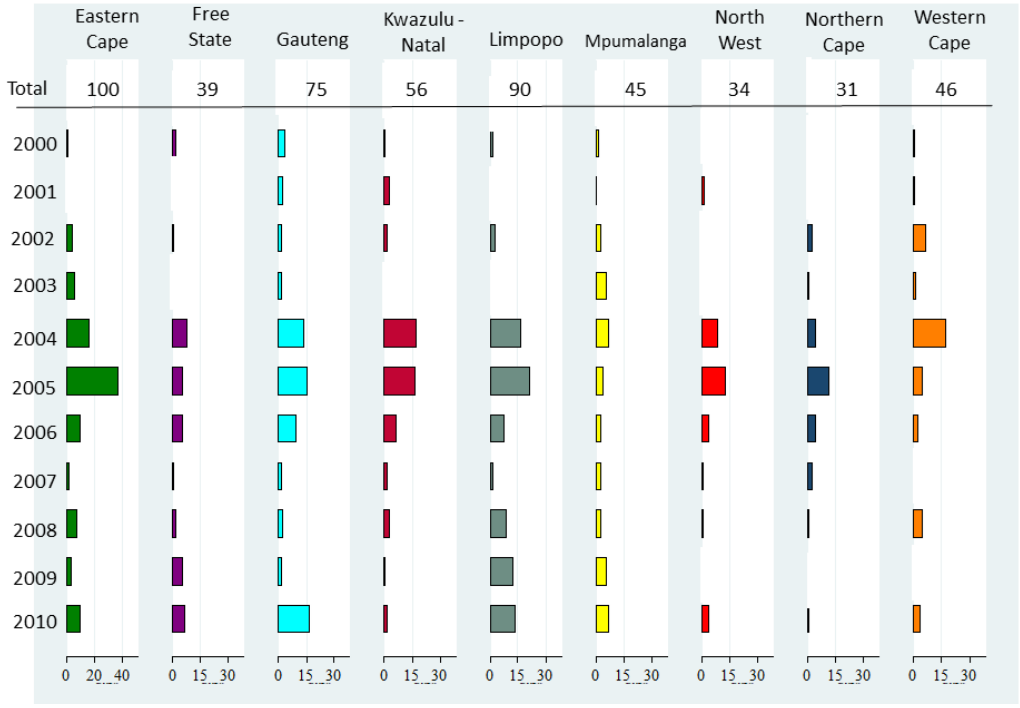
Notes: Proportion of women who have given birth by a given age for different birth cohorts. Birth cohorts in ten-year groups e.g. 1960 represent those born between 1960 and 1969. The second panel zooms in on births to mother's between the ages of 14 and 22. Source: Author's calculations based on birth histories in the South African National Income Dynamics Study (NIDS). Data weighted using the post-stratified weights.

Figure 2. Children Ever Born by Age at First Birth, across Cohorts



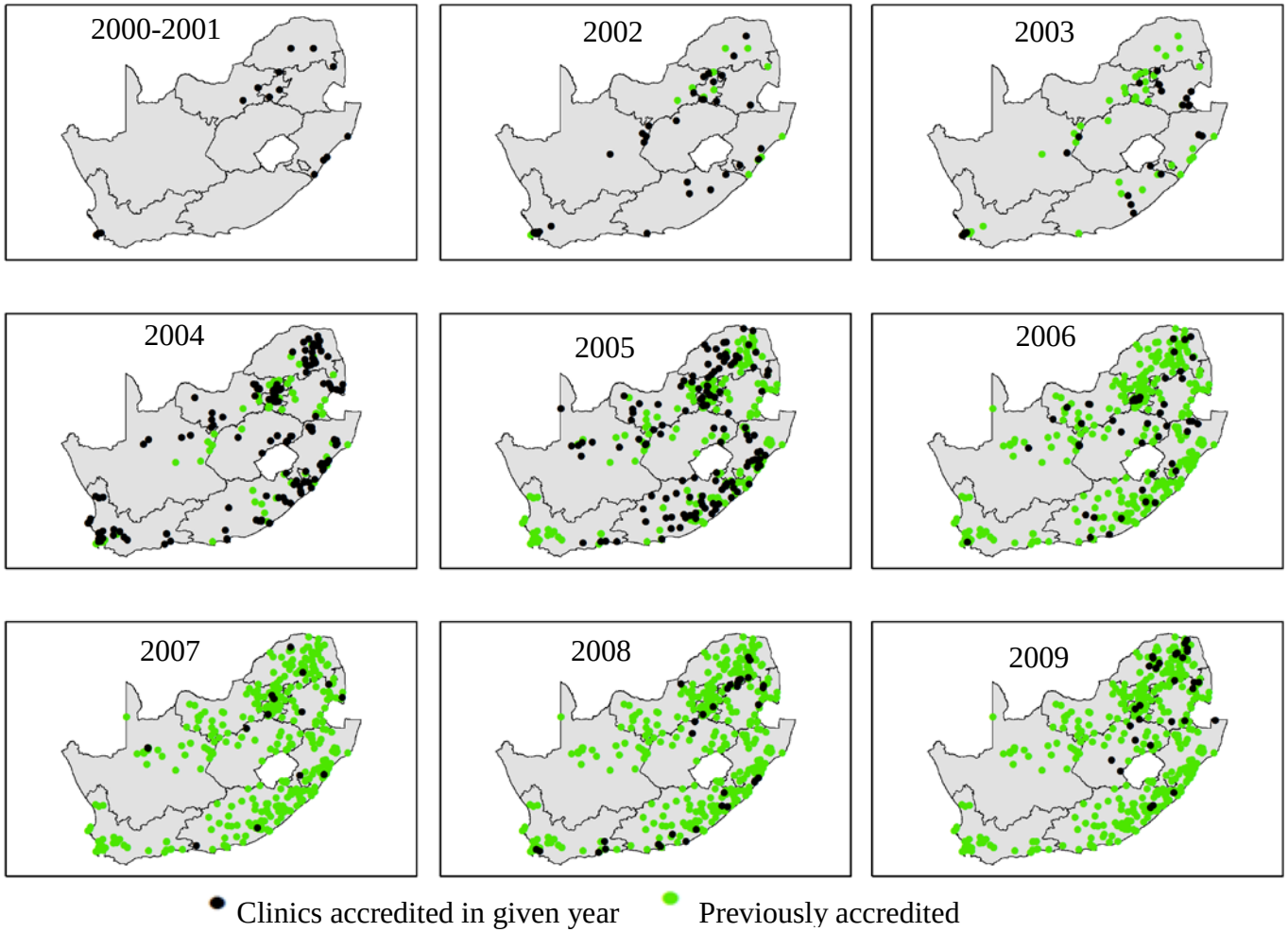
Notes: Number of children ever born by age. Each line in a figure represents the number of children at each age for women grouped by age at first birth. Source: Author's calculations based on birth histories in the South African National Income Dynamics Study (NIDS). Data weighted using the post-stratified weights.

Figure 3. Rollout of National Adolescent Friendly Clinic Initiative by Year of Accreditation and Province



Notes: The figure shows the number of clinics accredited as NAFCI by year and province. The total row indicates the number of clinics as at 2010. Legends differ by province. Source: loveLife project monitoring database.

Figure 4. Geography and Timing of National Adolescent Friendly Clinic Initiative Rollout

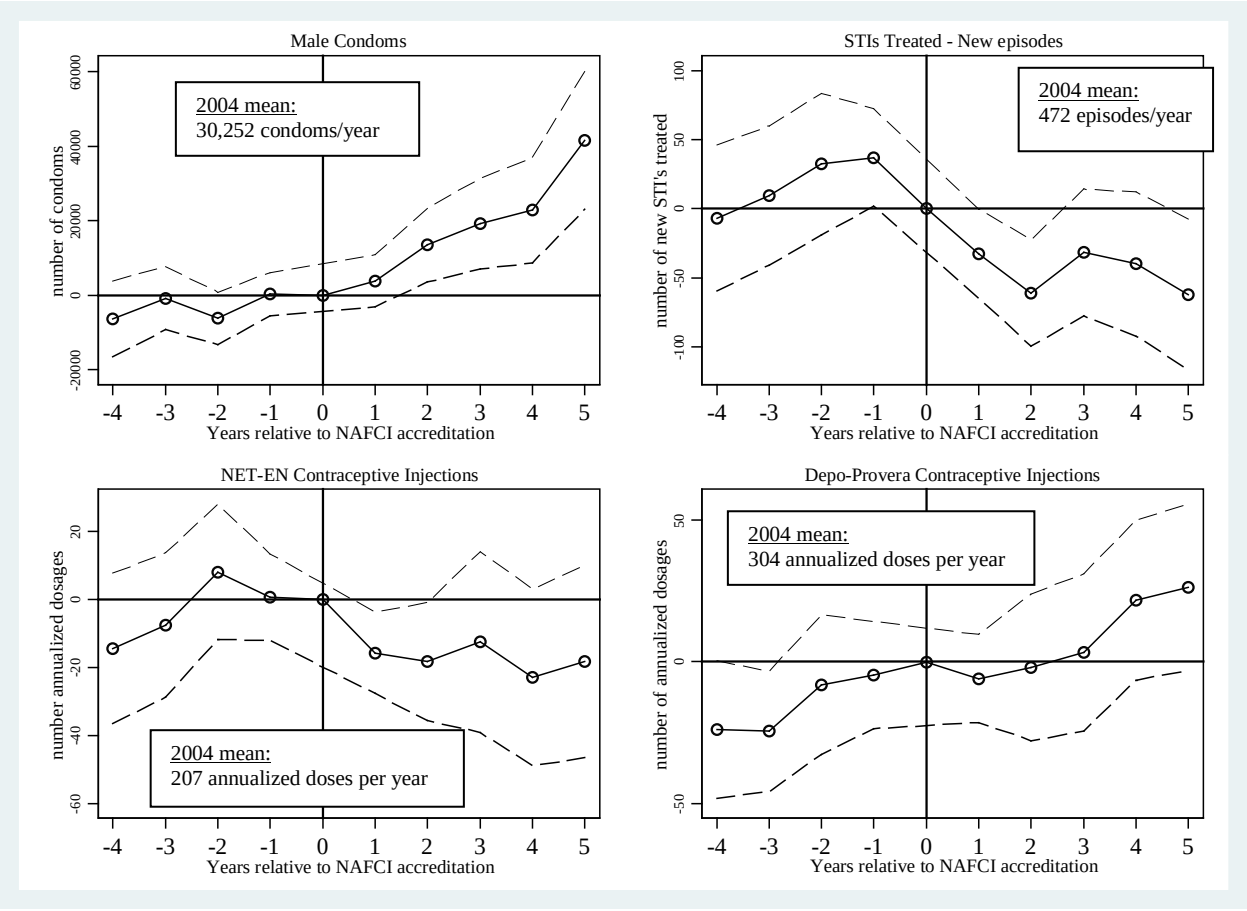


Notes: The figure shows the rollout of NAFCI clinics between 2000 and 2009. The black (dark) spots indicate newly accredited clinics, while the green (light) spots represent clinics previously accredited. Source: loveLife project monitoring database and District Health Information System (DHIS)

Figure 5. Youth Friendly Clinic Signage

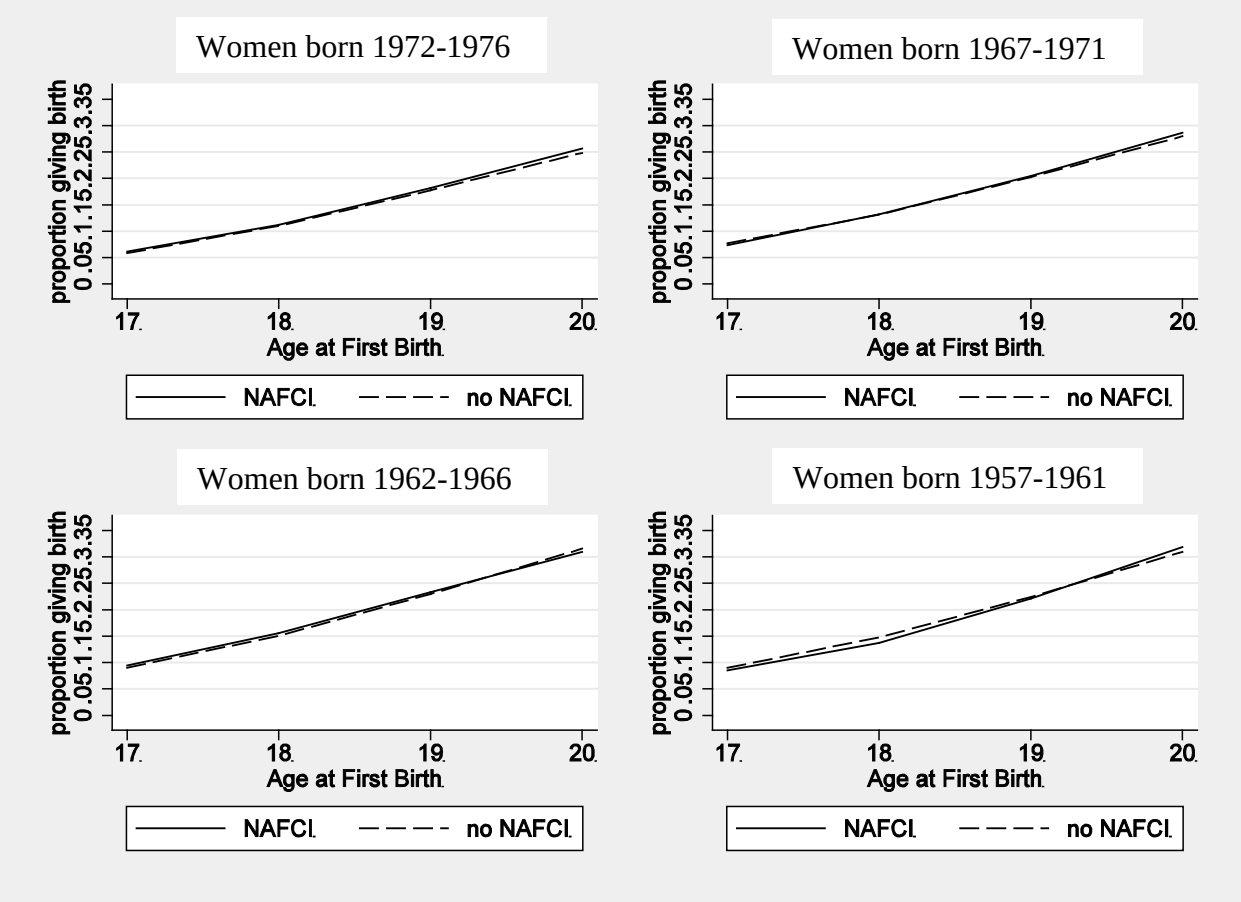
Notes: The figure presents an example of youth-friendly signage used at a NAFCI clinic in the Western Cape province. The program was implemented in existing clinics and focused on providing clinical and informational services specific to the needs of youth. See for example the extended opening hours.

Figure 6. Changes in Reproductive Health Service Provision Relative to Year of NAFCI Accreditation



Notes: Each plot shows the change in amount of a given service/contraceptive provided at the clinic relative to the level in year zero (one year after the accreditation process started). These estimates control for national trends in service provision by including controls for trends among non-NAFCI accredited clinics and calendar year fixed effects. Results (not shown) including province fixed-effects and year×province fixed-effects show very similar patterns. Depo-provera (depot medroxyprogesterone acetate) and NET-EN (norethisterone oenanthate) are long-acting injectable contraceptives. Depo-provera is given every three months and NET-EN every two months. In the figures above the number of injections are annualized by dividing the number of Depo-Provera injections by six and the number of NET-EN injections by four. The 2004 mean levels listed in each section of the graph are calculated among all public clinics. See Appendix Figure 3.2 for average trends from 2001 to 2011. Source: Service provision data from the South African District Health Information System. Information on the timing of clinic accreditation from loveLife Project Monitoring Databases.

Figure 7. Trends in the proportion of women giving birth by age at first birth and NAFCI access



Notes: Small area level data on the proportion giving birth by age at first birth for cohorts of women born between 1957-1976 in the South African Census 1996 linked to information on whether the areas gained an NAFCI accredited clinic between 2000 and 2010 (NAFCI). Source: South African Census and loveLife Project Monitoring Database.

Table 1. NIDS Sample: Teen Birth by Cohort and Proximity to a NAFCI Clinic

	NAFCI Clinic w/in 1km of residence?			
	Younger cohort		Older cohort	
Birth by 17	Yes	No	Yes	No
Yes	19	232	20	172
No	147	2341	130	1936
Total	166	2573	150	2108
Birth by 18	Yes	No	Yes	No
Yes	30	405	25	318
No	111	2131	90	1553
Total	141	2536	115	1871

Notes: Sample sizes by whether gave birth by 17 (18), cohort (young/older) and whether residence was within 1km of a NAFCI clinic. For the birth by 17 outcome, younger cohort refers to female NIDS respondents who were ages 8-16 in 2001 and could have been impacted by the initiative. Older cohort is women who were 17 to 28 in 2001 who were too old during the NAFCI rollout to be eligible for adolescent friendly services and serve as a comparison group in our differences strategy. Similarly, for the birth by 18 outcome younger cohort refers to women 8-17 in 2001 and older cohort to women 18-28 in 2001. Source: Respondents from the NIDS geo-linked to NAFCI clinics using data from District Health Information System and loveLife Project Monitoring Databases.

Table 2. Difference-in-Differences Matrices for Means of Early Teenage Childbearing

	NAFCI Clinic w/in 1km of residence?		
	Yes	No	Difference
Birth by 17			
Younger cohort	0.093	0.065	0.028
	(0.03)	(0.007)	(0.03)
Older cohort	0.146	0.06	0.085
	(0.035)	(0.007)	(0.036)
Difference	-0.053	0.004	-0.058
	(0.036)	(0.009)	(0.037)
Birth by 18			
Younger cohort	0.188	0.118	0.07
	(0.033)	(0.01)	(0.034)
Older cohort	0.278	0.144	0.134
	(0.047)	(0.012)	(0.049)
Difference	-0.09	-0.026	-0.064
	(0.044)	(0.014)	(0.047)

Notes: Proportion giving birth by age 17 and 18, younger versus older cohort and whether their residence was within 1km of a NAFCI clinic. Robust standard errors in parentheses. Post stratification weights used. For the birth by 17 outcome, younger cohort refers to female NIDS respondents who were ages 8-16 in 2001 and could have been impacted by the initiative. Older cohort is women who were 17 to 28 in 2001 who were too old during the NAFCI rollout to be eligible for adolescent friendly services and serve as a comparison group in our differences strategy. Similarly, for the birth by 18 outcome younger cohort refers to women 8-17 in 2001 and older cohort to women 18-28 in 2001. Source: Respondents from NIDS geo-linked to NAFCI clinics using data from District Health Information System and loveLife Project Monitoring Databases.

Table 3. Effect of NAFCI Access on Early-Teen Childbearing: Coefficients on the interactions between proximity to a NAFCI clinic and being an adolescent during the NAFCI rollout

	Dependent Variable							
	Teenage childbearing - birth by 17				Teenage childbearing - birth by 18			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Adolescent X Near	-0.064*	-0.066*	-0.062*	-0.064*	-0.062	-0.068	-0.057	-0.069
	(0.038)	(0.039)	(0.037)	(0.038)	(0.047)	(0.048)	(0.049)	(0.053)
Near	0.087*	0.087**	0.082***	0.081***	0.125***	0.128***	0.117**	0.115**
	(0.037)	(0.035)	(0.030)	(0.030)	(0.047)	(0.047)	(0.048)	(0.052)
Observations	4992	4992	4992	4,992	4,659	4,659	4,659	4,659
Year of birth dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Race and Parental education	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Distance to any clinic	No	No	Yes	Yes	No	No	Yes	Yes
Small area controls	No	No	Yes	Yes	No	No	Yes	Yes
Province of birth	No	No	Yes	No	No	No	Yes	No
District council of birth	No	No	No	Yes	No	No	No	Yes

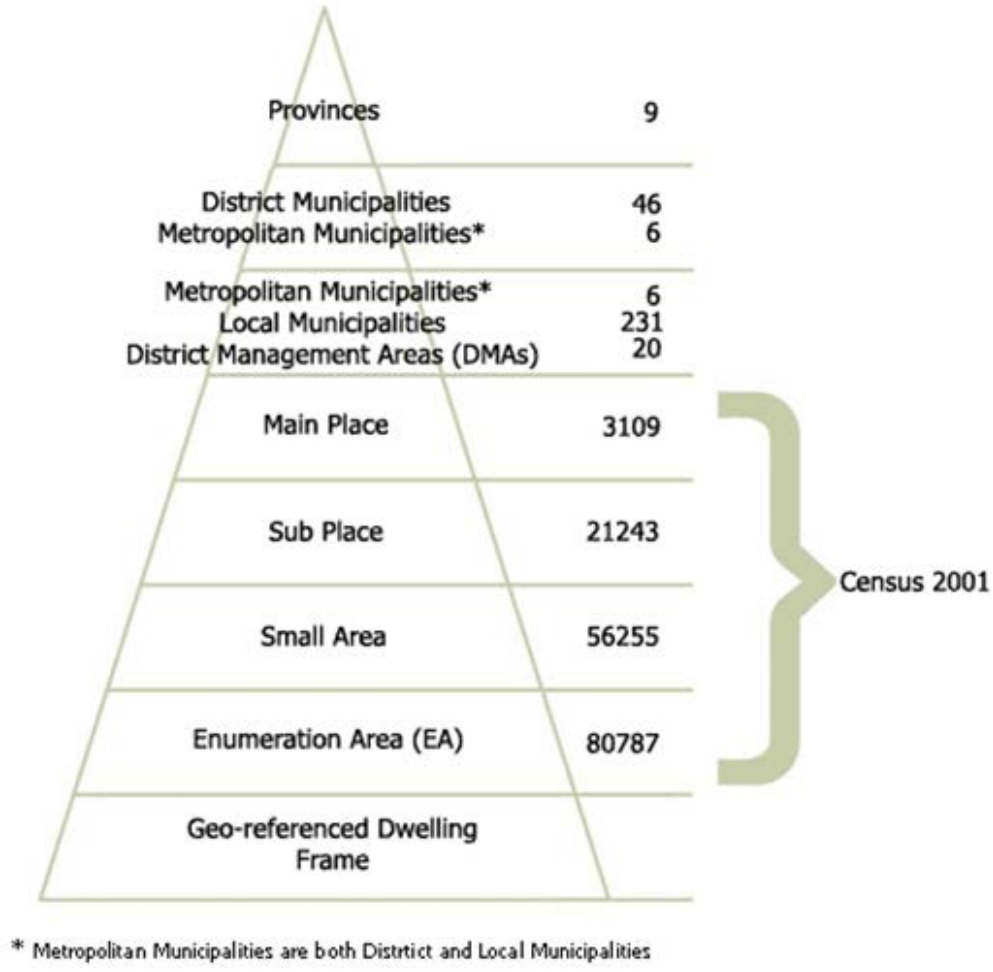
Notes: The table presents the β_1 and β_2 coefficients from equation 1 with difference X variables included. Standard errors that take account of the survey design in parentheses. ** Significant at the 5 percent level, * significant at the 10 percent level. Post stratification weights used. Small Area controls are based on pre-policy measures from the 2001 Census including population size, share urban, a dependency ratio measure (the ratio of children and adults over 65 to prime age adults), the sex ratio, the share of adults over 20 in different education categories (some primary, completed primary, some secondary, matric, higher) and the proportion of the households with no piped water and no electricity. Source: Respondents from the South African National Income Dynamics Study geo-linked to NAFCI clinics using data from District Health Information System and loveLife Project Monitoring Databases.

Table 4. Effect of NAFCI Access on Birth, Education, Employment and Child Outcomes: Coefficients on the interactions between proximity to a NAFCI clinic and being an adolescent during the NAFCI rollout.

	Full Sample	Living within 2 km of any public clinic	Mean
Birth outcomes			
Birth by 17	-0.064*	-0.077**	0.092
	(0.038)	(0.039)	
	4,992	3,524	
Birth by 18	-0.069	-0.062	0.139
	(0.053)	(0.055)	
	4,659	3,289	
Age at first birth	1.151**	1.167**	20.97
	(0.549)	(0.574)	
	3,413	2,376	
Education outcomes:			
Years of Education	0.455	0.590*	11.0
	(0.398)	(0.350)	
	4,828	3,395	
Completed Matric	-0.014	-0.026	0.474
	(0.105)	(0.098)	
	4,828	3,395	
Labour market outcomes:			
Employed	0.016	0.013	0.596
	(0.083)	(0.088)	
	2,950	2,131	
Log Wages	0.210	0.283*	R4671 /mnth
	(0.191)	(0.165)	
	1,280	954	
Child outcomes:			
Well child checkup	0.198**	0.187**	0.697
	(0.090)	(0.088)	
	2,235	1,586	
First born height for age	1.029***	1.216***	-0.890
	(0.381)	(0.424)	
	2,116	1,515	
First born child stunted	-0.216***	-0.275***	0.186
	(0.074)	(0.094)	
	2,116	1,515	

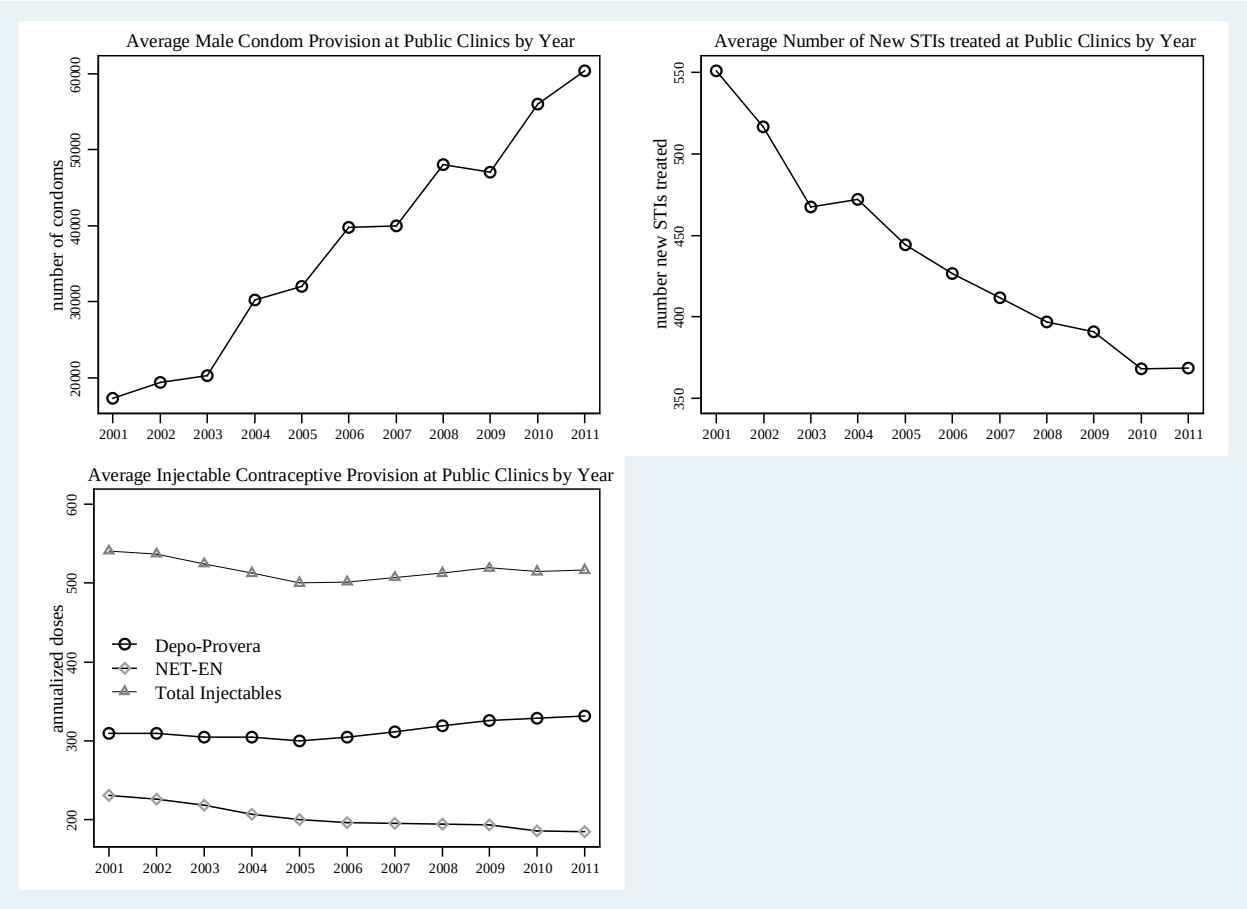
Notes: The first row for each outcome is the β_1 coefficient from estimating equation (1) for the relevant dependent variable. The second row gives robust standard errors in parentheses. The third row gives the relevant sample size. Column 1 presents estimates on the full sample. Column 2 restricts the sample to respondents living within 2km of a clinic. Column 3 presents the mean values for the young cohort. ** Significant at the 5 percent level, * significant at the 10 percent level. We correct for the survey design and use the post stratification weights provided. All regressions control for woman's year of birth and regressions for child outcomes also include controls for child's age. Additional controls are race, parental education (including indicators for missing parental education), ever repeated a grade, distance to any public clinic, district council of birth and the pre-policy Small Area controls listed in the notes to Table 3. Source: Respondents from the South African National Income Dynamics Study geo-linked to NAFCI clinics using data from District Health Information System and loveLife Project Monitoring Databases.

Appendix Figure 1. South African Census 2001 geographical area hierarchy structure



Source: (Statistics South Africa) http://www.statssa.gov.za/census01/html/Geography_Metadata.htm

Appendix Figure 2. Trends in Reproductive Health Service Provision - All Public Clinics by Year



Notes: Depo-Provera (depot medroxyprogesterone acetate) and NET-EN (norethisterone oenanthate) are long-acting injectable contraceptives. Depo-Provera is given every three months and NET-EN every two months. Source: Service provision data from the South African District Health Information System facility-level data.

Appendix Table 1. **National Adolescent Friendly Clinic Initiative Standards**

NAFCI Standards:

1. Management systems are in place to support the effective provision of adolescent-friendly services.
2. The clinic has policies and processes that support the rights of adolescents.
3. Clinic services appropriate to the needs of adolescents are available and accessible.
4. The clinic has a physical environment conducive to the provision of adolescent friendly health services.
5. The clinic has the drugs, supplies and equipment necessary to provide the **Essential Service Package** for adolescent-friendly health care
6. Information, education and counseling consistent with the **Essential Service Package** are provided.
7. Systems are in place to train staff to provide effective adolescent-friendly services.
8. Adolescents receive an accurate psychosocial and physical assessment.
9. Adolescents receive individualized care based on standard service delivery guidelines.
10. The clinic provides continuity of care for adolescents.

The Essential Service Package:

1. Information and education on sexual and reproductive health
2. Information, counseling and referral for violence/abuse and mental health problems
3. Contraceptive information and counseling, and provision of methods including oral conceptive pills, emergency contraception, injectables and condoms
4. Pregnancy testing and counseling, antenatal and postnatal care
5. Pre- and post-termination of pregnancy counseling and referral
6. Sexually transmitted infections information, including information on the effective prevention of STIs and HIV, diagnosis and syndromic management of STIs

Source: Ashton et al. (2007) "Evolution of the National Adolescent-Friendly Clinic Initiative in South Africa," World Health Organization.

Appendix Table 2: Determinants of NAFCI Placement

Dependent variable: NAFCI clinic in small area, regressors from 2001 Census

	(1)	(2)	(3)	(4)
Birth by 17	0.005	0.007		
	(0.006)	(0.006)		
Birth by 18			0.002	0.003
			(0.004)	(0.004)
Birth info not linked	-0.004***	-0.003***	-0.004***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Urban		-0.003***		-0.003***
		(0.001)		(0.001)
Population/ 1000		0.003***		0.003***
		(0.001)		(0.001)
Dependency ratio		-0.001		-0.001
		(0.001)		(0.001)
Sex Ratio		-0.002		-0.002
		(0.001)		(0.001)
Proportion of 20 + population with:		0.003		0.003
Tertiary		(0.005)		(0.005)
		-0.001		-0.001
Matric		(0.005)		(0.005)
		0.012***		0.012***
Incomplete secondary		(0.004)		(0.004)
		0.016		0.016
Completed primary		(0.011)		(0.011)
		-0.001		-0.001
No electricity		(0.001)		(0.001)
		-0.003**		-0.003**
No pipied water		(0.001)		(0.001)
		-0.003*		-0.003*
Informal		(0.001)		(0.001)
Observations	56,255	54,881	56,255	54,881

Notes: Probit models estimated at the Census 2001 small area level (SAL). Marginal effects displayed. Area characteristics are from the Census 2001 data. Age at birth information is from the Census 1996. There is no direct match between Census 1996 EAs and Census 2001 SALs, therefore the GPS of the centroid of the 2001 SAL is matched to its respective 1996 enumeration areas (EA) to attain birth information at the Census 2001 SAL. In addition, we find that the number of EAs in the Census 1996 community profiles does not match the number in the attributes tables of the respective shape files. This is because the 1996 EA demarcation was paper based and was only captured after the census was completed. During the capturing process, some EAs were found not to be properly spatially separated as they did not have boundary descriptions e.g. unstructured informal settlements. As a result, these EAs were deliberately lumped together resulting in more data records than spatial entities (email communication with StatsSA). Given the spatial issues described above, some 2001 SALs are not matched with a 1996 EA and therefore no birth information can be provided for these SALs. The variable 'birth information not linked' represents this scenario. Sources: District Health Information System and loveLife Project Monitoring Databases linked to the 2001 and 1996 South African Census data.