Maternal Care and Child Mortality: Evidence from Three Policy Reforms in Ghana

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Abstract

Neonatal and infant mortality rates in low-income countries remain roughly ten times higher than high-income countries. At the same time, usage of maternal care – including antenatal care, institutional deliveries, and postnatal services - in these settings is also low. Within countries, these disparities are often evident as well across the rural-urban divide. This paper evaluates a sequence of policies in Ghana that reduced the costs faced by mothers for maternal services. Using both an event-study and difference-in-differences framework, and combining 8 rounds of Demographic and Health Surveys to construct a 45-year retrospective panel of birth outcomes, we find that access to antenatal care alone has no impact on mortality, that access to facility deliveries reduces the rural-urban mortality gap but does not close it, and that access to both high quality antenatal care, free institutional deliveries, and postnatal check ups eliminates the mortality gap entirely. These results suggest that reducing early childhood mortality requires both screening of high-risk pregnancies and access to qualified care providers.

Keywords: infant mortality, antenatal care, institutional delivery, health-service provision **JEL Codes:** I15, I18, O15

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1 Introduction

Despite substantial reductions over recent decades, rates of early child mortality in many low income countries remain roughly ten times higher than in high income nations (UN IGME, 2018). Nearly half of all deaths under the age of 5 occur in the first 28 days of life (the neonatal period), and of these, the majority occur at birth or in the days following birth (Lawn et al., 2005). In regions where child mortality tends to be highest, take-up of maternal health services before, during, and following childbirth is often low. For example, in sub Saharan Africa only about half of births occur in a formal health facility such as a hospital or clinic. Yet evidence from low income countries about the effectiveness of maternal health services – including antenatal care, institutional deliveries, and postnatal care – remains limited and mixed, raising questions about whether health systems in these settings can improve child survival.

This paper contributes new evidence on the effects of expanding access to maternal health services by examining a set of policy reforms implemented in Ghana between 1998 and 2008 that, sequentially, lowered the direct costs paid by mothers for antenatal care, facility births, and prenatal care. Prior to this series of reforms, health care financing in Ghana followed a system known as "cash and carry" in which health services required full upfront payment, and there were large disparities between rural and urban areas in health care usage and outcomes. For example, rural women averaged about 4 antenatal visits compared to 7 among urban women, and delivered in health facilities around 30 percent of the time compared to 80 percent among urban women. In the late 1990s, infant mortality of rural children was about 80 per 1000 births compared to 62 per 1000 among urban-born children.

Starting in 1998, Ghana first exempted expectant mothers from paying user fees for up to 4 antenatal care visits. Then, in 2003, in addition to the 4 free antenatal visits, user fees were also removed for deliveries at both public and private facilities. Finally, in 2008 expectant mothers were granted free access, through the National Health Insurance Scheme (NHIS), to up to 6 antenatal care visits, institutional deliveries, and 6 months of postnatal care.

To measure effects of these reforms on health-service take-up, delivery location decisions, and early child mortality, we combine 8 rounds of Demographic and Health Survey (DHS) data to construct a retrospective panel of births spanning more than 40 years. We exploit the timing of

the reforms along with geographical variation (rural vs urban) in pre-reform health care usage and outcomes in an event-study and differences-in-differences framework. The 8 rounds of DHS data allow us to show strong evidence in favor of parallel pre-trends across decades of birth cohorts prior to the implementation of the various policies.

We find that the 1998 antenatal exemption policy had minor positive effects on antenatal care usage, no impact on facility births, and no impacts on early childhood mortality or health. The addition of the 2003 free delivery care policy increased institutional deliveries among rural women by about 6 percentage points, and started to close the rural-urban infant mortality gap (a decrease of about about 11 deaths per 1000 births) before reversing when the program ran out of funds in 2007. Finally, we find that the 2008 maternal care package provided through access to the National Health Insurance Scheme increased the number of antenatal visits among rural women from about 4 to 6 visits on average, increased the quality of those visits as measured by diagnostic tests conducted and information provided, increased facility births by 25 percentage points, and fully erased the rural-urban neonatal and infant mortality gaps.

Together these results suggest that complementarities across the full package of maternal health care services can have large effects on child survival beyond those which may be provided by the individual components. Access to antenatal care alone is not sufficient if women, particularly those with high-risk pregnancies, are unable to access services at birth provided by formal health facilities. At the same time, the full benefits of free access to formal delivery services may remain unrealized if antenatal care quality is not high enough to help identify high-risk pregnancies and guide mothers to the appropriate care.

This study contributes to a small, mixed, but growing body of research on the efficacy of access to maternity health care in low-income settings. Studies that examine the impacts of policies that shift women who otherwise do not use facilities into facilities generally find no effects. Powell-Jackson et al. (2015) show that a large conditional cash transfer program in India that encouraged facility deliveries had no effect on neonatal mortality. Godlonton and Okeke (2016) also find no overall effect on early mortality following a ban on traditional birth attendants that increased institutional deliveries in Nigeria. However, they do find large reductions in neonatal mortality for women whose closest facility was "high" quality.[1]

[1] Godlonton and Okeke (2016) define "high" quality facilities as those meeting at least four of the following criteria:

Indeed, health care quality is likely an important mitigating factor on the impact of expanding access to institutional births. A large literature documents the low quality of care available in many health facilities in developing countries. Absenteeism rates are high (Chaudhury et al., 2006), and effort and knowledge of best practices among practitioners can be limited (Das and Hammer, 2005; Das et al., 2008; Das and Hammer, 2014). In addition, surveys of health facilities often find inadequate supplies of drugs, equipment, and infrastructure.[2] Thus, the current lack of facility use may simply reflect a revealed preference for home births given the available options. Alternatively, programs that effectively get more women to deliver in facilities may trigger supply side constraints that limit resulting improvements in health. For example, Adam et al. (2018) show that over-crowding in a private health facility in Kenya, due to a public health sector strike, increased neonatal mortality.

On the other hand, a pair of studies from developing countries have also found that, for women who typically use facilities, institutional births can confer large child health benefits.[3] Okeke and Chari (2018) compare outcomes between children born during the day and during the night in areas with and without 24-hour care in Nigeria and find that neonatal mortality doubles when women are unable to deliver in facilities. **?** show that for Kenyan women who would normally deliver in hospitals, disruptions to care at birth caused by health worker strikes increase both neonatal and infant mortality (deaths within the first year of life). This evidence suggests that removing barriers to institutional deliveries could have positive benefits even under standard levels of care.

Our study also contributes to a large literature on the collection of user fees for health services, particularly in developing countries. A key focus of the debate around user fees is the effect on demand for services and whether small user fees decrease demand for a health input among those who need it. Our results show that user fees constrain women from seeking institutional deliveries and that this contributes to excess mortality and reduced health, particularly for the poor. These results are consistent with previous studies showing that policies that removed user fees increased demand for health services in Uganda (**?**) and Zambia (**?**). Our findings are also in line with

has operating theater, has intensive care unit, has pharmacy, has trained staff available 24 hours per day, offers blood transfusions, offers ambulance services, offers laboratory services, is open 7 days a week.

[2]see, e.g., Demographic and Health Surveys Service Provision Assessment, `https://dhsprogram.com/What-We-Do/Survey-Types/SPA.cfm`; World Bank Service Delivery Indicators, `https://www.sdindicators.org/`

[3]Positive effects have also been found in more developed countries. In the Netherlands, Daysal et al. (2015) use distance to hospitals as an instrument for hospital births and find that hospital births decrease neonatal mortality relative to home deliveries.

research on cost-sharing for particular inputs using randomized evaluations (**?**Kremer and Holla, 2009).

The remainder of this paper proceeds as follows. Section 2 provides information on health care in Ghana, with a focus on available maternity care and the timeline and implementation of the various policy reforms. Section 3 describes the sample characteristics in our data, while Section 4 presents the analysis and results. Finally, we conclude with a discussion of our findings in Section 5.

2 Setting and Policy Changes

2.1 Setting

In Ghana child delivery services are offered in public health clinics, district and regional hospitals, and national referral hospitals. Private facilities, including mission clinics and private maternity homes, also offer basic obstetric services, but are less frequently used. The distribution of health facilities is uneven, with most located in more urban areas. Quality of care varies as well, with hospitals generally offering better services. However, no clinics, health centers, or maternity wards, and less than 30 percent of hospitals, offer comprehensive emergency obstetric or neonatal care (**?**). A survey of all facilities that provide delivery services in one region of Ghana similarly found that few provided emergency obstetric or neonatal care, and that this was mainly driven by a lack of infrastructure, supplies, or essential medicines (**?**). Nationally, there are 10 doctors, nurses, and midwives per 10,000 people, which is comparable to the regional average (13), and well below the 23 high-level health professionals recommended by the World Health Organization (**?**). Public health care spending as a fraction of total government spending is 7.1 percent, which is also similar to the average spending of other Sub-Saharan African countries.

In terms of access to maternal care, Ghana has long had high rates of usage of antenatal care but low rates of facility births. While both rural and urban women almost universally access some antenatal care, there have traditionally been differences in the quantity of antenatal care visits with urban women obtaining more care. There is substantial variation between rural and urban areas in terms of facility births. Between 1990 and 2003, many rural children were born outside of formal health facilities (typically at home). In this period , only about 43 percent of children were born

in health facilities. In urban areas, approximately 80 percent of children were born in facilities. In rural areas, that figure was less than 30 percent. There was essentially a flat trend line in both rural and urban areas over the 13 year period. However, between 2003 and 2007 there was a huge transformation. By 2017, 92 percent of urban and 72 percent of rural children were born in health facilities.

There have also been longstanding gaps in early child mortality between children born in rural and urban areas. Neonatal and infant mortality rates in Ghana have been falling over the past several decades, but remain high compared to higher income countries. Infant mortality rates have fallen from a high of about 100 deaths per 1000 births in the 1970s to less than 30 deaths per 1000 births in 2016. Until about 2003 there was a persistent gap in neonatal mortality of about 20 deaths per 1000 births. This gap, and the gap in neonatal mortality rates (of about 5 additional deaths), disappears following the 2003 birth cohort. According to estimates from the World Health Organization, in Ghana the majority of child deaths in the neonatal period (first 28 days of life) were due to complications from pre-term or low birth-weight, asphyxia, or infection. In the post-neonatal period deaths were mainly due to diarrhea, measles, malaria, and acute respiratory infections.[4]

2.2 Sequence of policy changes

In 1998, Ghana exempted expectant mothers from paying user fees for up to 4 antenatal care visits. The policy was launched by the Ghana Health Service and the Ghana Ministry of Health through the Safe Motherhood Initiative. At the time, there was no consensus on the appropriate number of antenatal care visits, and there was considerable debate about the effectiveness of such care (Carroli et al., 2001; Villar et al., 2001). Many high-income countries typically recommended approximately 12 visits total, including monthly visits during the first two trimesters of pregnancy, visits every 2 to 3 weeks for the next two months, followed by weekly visits until delivery. In 2002 the World Health Organization issued a recommendation of 4 antenatal visits, but later updated that recommendation in 2016 to include at least 8 visits (WHO, 2016). Basic procedures during antenatal visits include measurement of mother's weight and blood pressure and analysis of blood and urine samples.

In late 2003, in addition to the 4 antenatal visits, Ghana also exempted mothers from paying

[4] http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html

user fees for deliveries at health facilities. The Delivery Fee Exemption Policy (DFEP) eliminated all costs associated with facility deliveries other than transportation (Witter et al., 2007a). The policy extended to both public and private facilities, which were reimbursed for services provided at a set rate per delivery (and type of delivery: normal, assisted, or cesarean). The policy was initially implemented only in the four most deprived regions of Ghana: Upper East, Upper West, Northern, and Central (Witter et al., 2007a,b). In April, 2005, the DFEP was extended to include all regions. The policy was supported by funds from the Highly Indebted Poor Country debt relief program.

Early evidence suggested that the policy increased demand for facility births, that health workers also supplied more hours, and that they were compensated for the extra effort. Witter et al. (2009) and Okoroh et al. (2018) found that the policy reduced out-of-pocket expenditures for delivery services, but did not constitute a full cost reduction. Health workers knew of the exemptions policy and reported neutral reactions to it (Witter et al., 2007a). Over the period after the DFEP was introduced, health worker hours increased, but so also did pay. At the time, the lowest paid public health worker earned nearly 10 times GNI per capita, while the average public employee earned 4 times GNI per capita (Witter et al., 2007a).

By 2007, however, DFEP funding had run out and the program ended (of Health, 2009; Dubbledam et al., 2007). There is evidence funds were running out prior to 2007, even as early as October 2005, leading to uneven implementation across regions (Witter et al., 2007b; Dubbledam et al., 2007). Although facilities reportedly did not turn women away who could not pay, health workers reportedly believed that inability to pay deterred women from delivering at facilities and caused a reduction in facility births in 2007 (MOH, 2008).

During this same period of time, the Government of Ghana was also standing up a National Health Insurance Scheme (NHIS). The NHIS was first announced at the end of 2003 with the passage of Act 650, which established the National Health Insurance Authority (NHIA) and the government's commitment to universal health coverage (Otoo et al., 2014). For enrolled users NHIS benefits for pregnant women included coverage for antenatal care, facility deliveries (including cesarean sections and other emergency obstetric interventions), postnatal care, and management of STI/HIV/AIDS (but not antiretroviral therapy) (Birungi et al., 2006). Child immunizations were not included in the NHIS, but were already provided for free by government. Insurance premiums

were at least 8 USD per year, with slight variation across districts (Mensah et al., 2010).

While Act 650 officially made participation in the NHIS mandatory for all Ghanaians, de facto enrollment was voluntary and take-up lagged for several years particularly in rural areas. The law did not specify any consequences for failing to enroll, nor was there a mechanism for automatic registration (formal sector workers are automatically enrolled and contribute to the scheme through deductions from the social security contributions, but they are not automatically registered) (Otoo et al., 2014; Mensah et al., 2010). Benefits for the NHIS started becoming available in the fall of 2005, and the first full year of implementation was 2006 (Witter and Garshong, 2009).

By the end of 2005, total registrations were 22 percent of the population, but only 6.8 percent had received cards, while at the end of 2006, 38 percent were registered, and 19 percent had received cards (Dubbledam et al., 2007). Individuals who are registered but who do not have valid cards can be denied access to services (Otoo et al., 2014). By 2007 somewhere between 42 and 47 percent of the population had registered for insurance (MOH, 2008; Mensah et al., 2010). Membership to the NHIS demonstrated a pro-rich and pro-urban bias (Witter and Garshong, 2009; Saleh, 2012). According to the 2008 Demographic Health Survey, overall 40 percent of women reported NHIS registration, with rates higher in urban areas (48 percent) compared to rural areas (37 percent).

In July 2008, in response to the end of the DFEP, the declining rate of facility births, and the low take-up of the NHIS among (poor) women, the President of Ghana announced the Free Maternal Health Service Initiative exempting pregnant women from paying NHIS premiums (of Health, 2009; Otoo et al., 2014). The one stipulation for the exemption was that women needed to make at least one antenatal care visit. Pregnant women covered under the scheme were now entitled to receive the full package of antenatal, delivery, and postnatal care benefits including six antenatal visits, childbirth care (including complications during birth), two postnatal visits within six weeks of childbirth, and newborn care for three months. However, the exemption policy did not remove the enrollment policy, and thus many women who would otherwise qualify for fully subsidized maternity care could remain uncovered (Otoo et al., 2014).

Following the implementation of the Free Maternal Health Service Initiative, NHIS membership increased, but rural-urban differences in take-up persisted (Saleh, 2012). By 2016-2017, 77 percent of the population had officially registered, but only 45 percent were actually covered (with valid cards). The urban-rural difference in registration (78 percent vs 75 percent) masked larger

differences in coverage (50 percent for urban areas compared to 39 percent in rural areas) (GSS, 2019).

[Note: need to add evidence from others on the general effects of these policies.]

3 Sample characteristics

Data come from the 1988, 1993, 1998, 2003, 2007, 2008, 2014, and 2017 Ghana Demographic and Health Surveys (GDHS). In each cross section, data are collected from a nationally representative sample of women aged 15-49 and contain information on basic demographic characteristics of women (e.g. age, education, asset ownership) as well as completed birth histories, including information on the month and year of all births and all child deaths that have occurred prior to the survey date. Additional information on location of birth, medical personnel present at birth, vaccinations, and child anthropometric measurements (height and weight) are collected for all children under the age of 5 at the time of the survey.

Sample characteristics are presented in Table 1. The first column shows overall means, while columns 2 and 3 presents means for children born to urban and rural women separately. About 60 percent of all children are born in any health facility, with large differences across urban and rural births. Just 48 percent of rural women delivered in a facility, while almost 90 percent of urban women did so. While a handful of women used private facilities (predominantly the urban), the overwhelming majority of institutional births for all women were in government-run facilities. Among facility births, more than 70 percent occurred in a hospital rather than a clinic or health center. On average, women in the sample had about 6.5 antenatal visits prior to a birth; women in rural areas had 5.5, while women in urban areas made 8 visits on average. There are also large gaps across the urban rural divide with respect to early infant care as proxied by vaccination rates. Children born to rural women are roughly 10 percentage points less likely to be vaccinated against tuberculosis (BCG), diphtheria, pertussis, and tetanus (DPT), polio, and the measles.

Given the differences in early life health inputs across location, it is not altogether surprising that there are also disparities in child health outcomes. However, these differences take time to fully materialize. Infant mortality rates – measured as either deaths in the first 1 month of life – are approximately 40 per 1000 births. Children born to rural mothers experience 6 additional

deaths in the first month, compared to children of urban mothers. This mortality gap increases significantly by the end of a child's first year; children born to rural mothers now experience about 20 additional deaths per 1000 births compared to urban mothers. Among children who survive, indicators of overall health also reveal differences by mother's urban-rural status. While all children in the sample have height- and weight-for-age z-scores below the reference population mean, children born in rural areas are about a half a standard deviation smaller across both measures. Similarly, these differences are relatively small to begin with and appear to widen as children age.

4 Analysis and results

We begin by describing the effects of the various policies on, first, antenatal care, including the quantity and quality of that care, then on the take-up of facility births, and finally on early child mortality outcomes. In all such cases, we draw a distinction between women living in rural and urban areas. Our results are primarily presented through figures. [Note: in subsequent drafts we will add event-study analyses, and provide results using difference-in-differences specifications, however, we believe the figures plotting the raw data tell the full story.]

4.1 Antenatal care

The 1998 policy exempting fees for antenatal care visits appears to have had very little effect on antenatal care usage (Figure 1). As described earlier, usage was already quite high both among urban mothers (average of 7 visits) and rural mothers (average of 4 visits) prior to 1998. While usage does appear to increase more rapidly among the first couple of cohorts born to rural women following the reform, usage rates were arguably already trending upward and appear to return to that trend in subsequent cohorts. There appears to be no change in antenatal care usage rates among urban women during this period.

The 2003 delivery fee exemption policy likewise appears to have had no impact on antenatal care usage among urban mothers, who continue to make about 7 visits on average, or rural mothers, who continue to increase usage and average closer to 5 visits per pregnancy in the period 2003-2008.

In stark contrast, the 2008 policy to exempt expectant mothers from paying the premium to obtain coverage under the National Health Insurance Scheme appears to have had large impacts on

antenatal care usage, particularly among children born to rural women. Antenatal care visits jump by more than 1 visit per pregnancy for rural women, now averaging more than 6 visits for children born between 2009 and 2017. As before, there is little change in antenatal care usage rates among children born to urban women.

The reverse CDFs presented in Figure 2 demonstrate that it is really the whole distribution of antenatal care visits that shifts among rural women after the 2008 policy was put in place. Between 1992 and 2008 there is a steady rise and rightward movement of the reverse CDF for rural births, indicating increasing antenatal care usage over this period. From 2009 onward, however, the reverse CDFs separate entirely, indicating a jump in usage across the distribution. The reverse CDFs for the urban births, in contrast, show very little movement over time. The increase in antenatal care usage across the distribution is somewhat surprising given that the NHIS exemption policy only required expectant mothers to make at least one antenatal visit, something more than 95 percent of rural women who delivered in 2008 already did.

In response to the 2008 policy all women, but especially rural women, started antenatal care earlier in their pregnancies, a fact which can help explain how (if not why) overall usage increased. Figure 3 shows that, over time, women in Ghana had been moving the timing of their first antenatal care visit toward within the first trimester of pregnancy, with rural women lagging behind urban women by about half a month. After 2008, the timing of first visits shifts markedly earlier for both groups and the gap between rural and urban women is nearly eliminated.

The 2008 exemption to the NHIS, but not the earlier policy changes, also coincided with improvements in the reported quality of neonatal care visits for rural women. As shown in Figures 4 and 5, both blood pressure and weight are routinely checked during antenatal care visits for all women, with more than 90 percent coverage and a gap of only a few percentage points between rural and urban women. In contrast, prior to the policy change there were much larger differences (of about 10-15 percentage points) for diagnostic testing of blood and urine samples (Figures 6 and 7). These latter two interventions are important for screening for potentially life-threatening complications (e.g. preeclampsia). Following the NHIS exemption policy, coverage rates reached nearly 100 percent for all four procedures, largely eliminating any gaps between rural and urban women. Similarly, pre-existing gaps between rural and urban women in information received regarding signs and symptoms of pregnancy complications, and where to seek care in the event of

such complications, largely disappear after 2008 (Figures 8 and 9).

4.2 Facility births

The antenatal visit exemption policy had no effect on women's decision to deliver in health facilities, while the 2003 delivery fee exemption policy and the 2008 NHIS exemption policy did. Between 1990 and 2003 about 80 percent of babies born to urban mothers were delivered in health facilities, while only about 30 percent of rural babies were (Figure 10). Over this period these rates remained remarkably stable. After 2003, rural women immediately increased the rate at which they delivered at facilities by about 10 percentage points. These gains appear to have stalled out toward the end of the period 2004-2008, likely owing to the fact that the program had run out of funds and many hospitals and facilities were no longer offering fee exemptions. Following the NHIS exemption policy in 2008, however, which covered the cost of facility births for women covered under the scheme, institutional deliveries among rural women rose rapidly once again. By 2012 about 65 percent of rural women delivered in formal health facilities. Urban women do not appear to have been affected by either policy, and while facility birth rates rose slightly over the period 2003-2016 they do not appear to have diverged from prior trend.

[Note: in future draft describe and show that gains in facility births come entirely from increase in government (rather than private) facility use; show also that probability that birth is attended by a trained health professional (doctor, nurse, or trained midwife) also increases.]

4.3 Child mortality

The effects of the three policies on child mortality track closely with the effects of those policies on access to quality care; i.e. no effect of the 1998 antenatal policy, small effects for the free delivery policy, and larger effects for the full package of maternal care policy of 2008. While neonatal mortality and, to a somewhat lesser extent, infant mortality are still relatively rare events, the data series for these outcomes (presented in Figures 11 and 12) is somewhat noisier. At the same time, coverage of these outcomes in the DHS is longer and we are able to show outcomes over the 45 year period from 1970-2016.

Both neonatal and infant mortality have been falling over the four-plus decades in our study. Up until the 2003 birth cohort, there has been a persistent gap in these outcomes, with rural-born

children having a greater risk of early death relative to urban-born children. The neonatal mortality gap is about 5 additional deaths per 1000 births, and the infant mortality gap is about 20 additional deaths per 1000 births.

After 2003, however, these gaps begin to close. This change coincides with the introduction of free delivery care at formal health facilities. Both neonatal and infant mortality drop for rural-born children born after 2003, while there is no apparent change from trend for urban-born children. However, mortality rates for rural children climb back upward towards the end of this policy period (ending in 2007-2008) when we also see a decline in institutional births.

Once facility births are again made free again in 2008, rural child mortality rates fall as well. This time there are larger increases in institutional births among rural women, but there are also improvements in the quantity and quality of antenatal care they receive. The rural-urban gaps in both neonatal and infant mortality disappear completely after 2008, and stay closed through the 2016 birth cohort. Mortality rates continue to decline for all children, rural- and urban-born during this period.

5 Conclusion

This paper contributes to a still small but growing body of evidence regarding the efficacy of policies that encourage maternal care services as a means to improve child health and early mortality outcomes. We find that the 1998 policy of providing free antenatal care alone did not work. Possibly this was due to the fact that rural women were already making 4 antenatal care visits back in 1997 before the policy was introduced. We also find that the policy to remove user fees for facility deliveries had immediate effects on the rate of institutional births, particularly for rural mothers, suggesting that costs are a significant barrier to access to health care for this population. In terms of child mortality outcomes, we find both that neonatal and infant mortality decrease as the number of facility births increased following the 2003 reform. These mortality effects were possibly substantial, but ultimately it is hard to tell how much because the program ran out of money and ended by 2007. After 2008, when free facility births were again available, we see neonatal and infant mortality among rural births declining again as well and the mortality gap between rural and urban children disappearing. Yet it seems unlikely that access to facility births

alone can explain these reductions in mortality. While facility births among rural women do increase dramatically, they remain about 20 percentage points below those of urban women through the end of the panel. One likely, albeit more speculative, explanation is that there are complementarities between (high quality) antenatal care services and access to institutional births. As more women accessed antenatal care and the quality of that care improved following the 2008 policy, women could be more effectively screened for high-risk pregnancies and better informed about where to go in the case of complications around the time of delivery.

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6 Figures and Tables

Table 1 – Child Characteristics

	All	Rural	Urban
Facility birth	0.62	0.48	0.87
	(0.49)	(0.50)	(0.34)
Government facility birth	0.53	0.43	0.71
	(0.50)	(0.49)	(0.45)
Private facility birth	0.09	0.05	0.15
	(0.28)	(0.22)	(0.36)
Doctor, nurse, or midwife present	0.63	0.49	0.87
	(0.48)	(0.50)	(0.34)
Number of antenatal visits	6.53	5.52	8.11
	(8.23)	(7.06)	(9.56)
BCG vaccine	0.88	0.85	0.94
	(0.33)	(0.36)	(0.25)
Complete DPT vaccine	0.68	0.65	0.75
	(0.47)	(0.48)	(0.43)
Complete polio vaccine	0.66	0.63	0.71
	(0.48)	(0.48)	(0.46)
Measles vaccine	0.67	0.65	0.71
	(0.47)	(0.48)	(0.45)
Height for age: z-score	-1.11	-1.25	-0.79
	(1.44)	(1.46)	(1.35)
Weight for age: z-score	-1.11	-1.21	-0.86
	(1.24)	(1.23)	(1.21)
Number of observations			
Child died, first month	39.47	41.56	35.68
	(194.70)	(199.57)	(185.48)
Child died, first year	71.00	77.62	59.03
	(256.82)	(267.58)	(235.68)
Number of observations	148192	96507	51685

Note: Standard deviations in parentheses. Computed based on one observation per child. Mortality information is collected for all children born to surveyed women. Other variables are only asked about children born in the last 5 years.

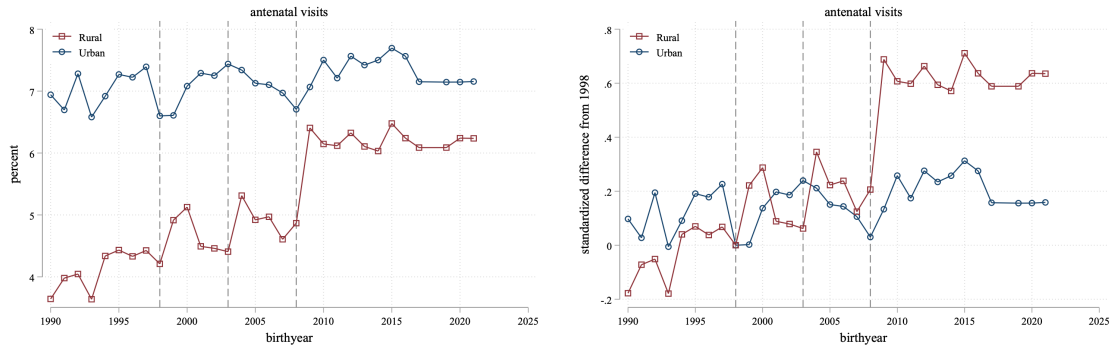

Figure 1 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in antenatal visits, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1993, 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

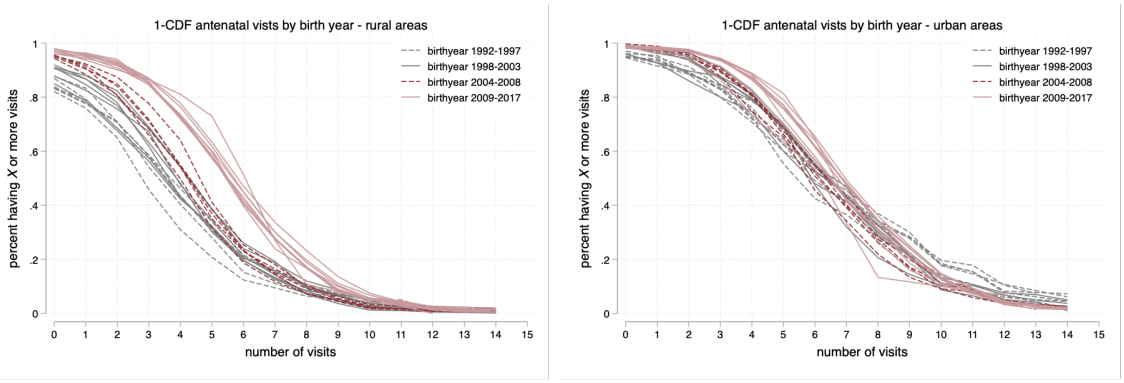

Figure 2 – Reverse CDF of number of antenatal visits by birth cohort for rural births (panel a) and urban births (panel b). Data are from the 1993, 1998, 2003, 2007, 2014, and 2017 DHS.

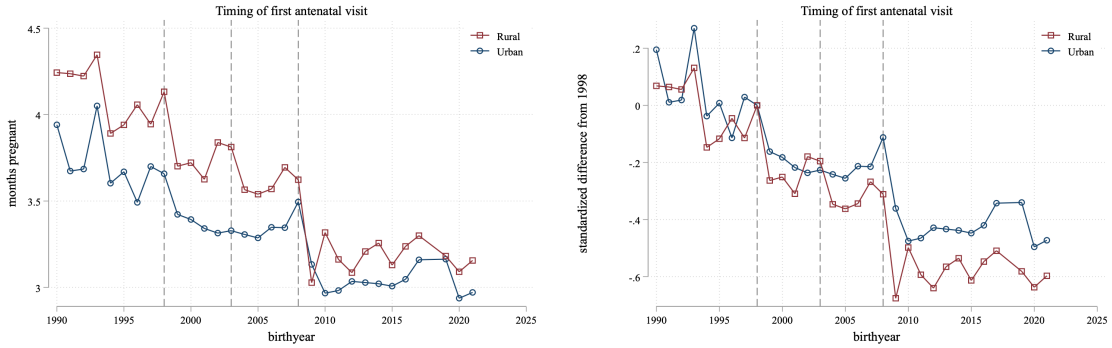

Figure 3 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in the timing of the first antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

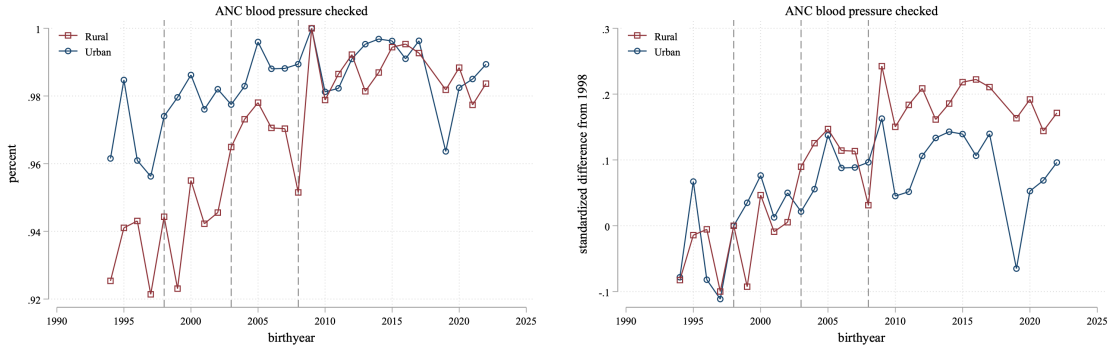

Figure 4 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in whether blood pressure checked during antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

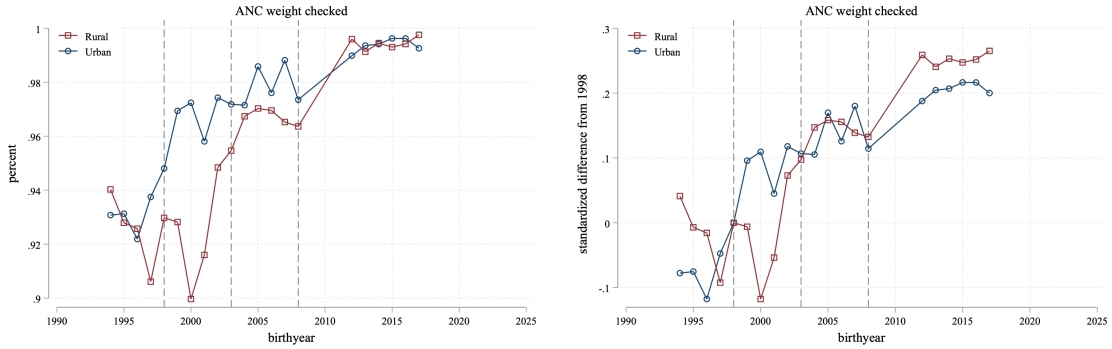

Figure 5 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in whether weight checked during antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

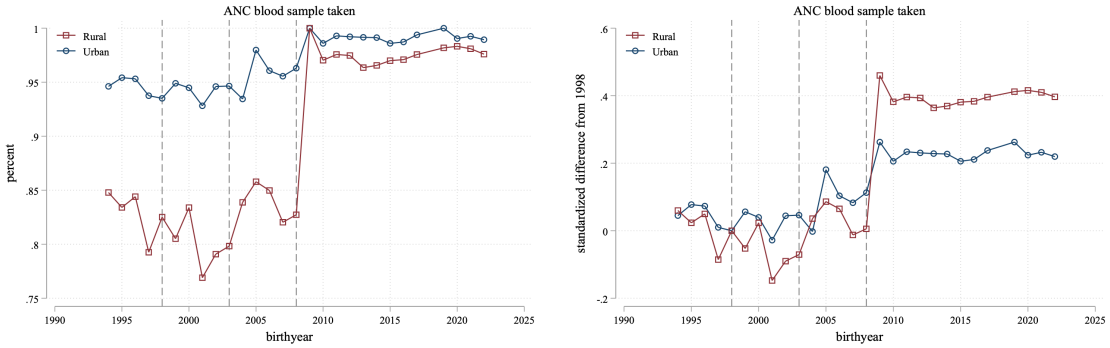

Figure 6 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in whether blood sample taken during antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

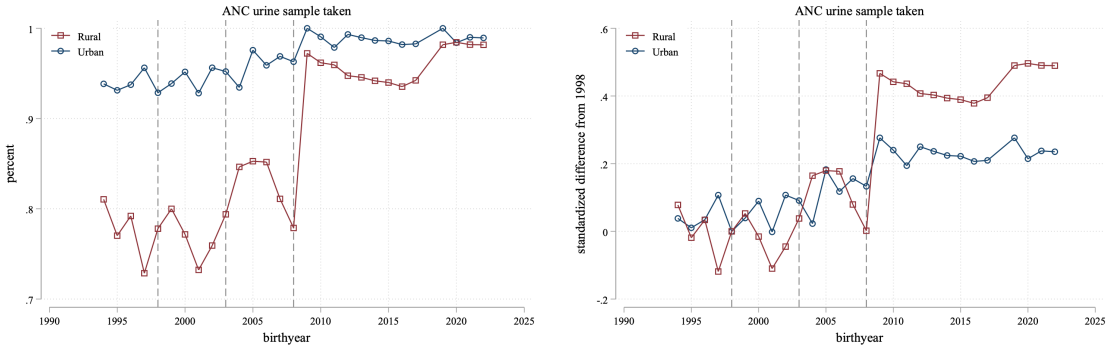

Figure 7 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in whether urine sample taken during antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

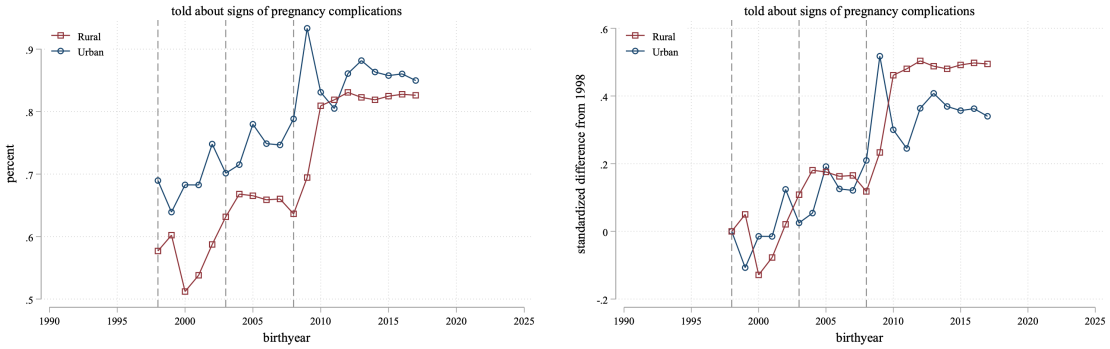

Figure 8 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in whether told about pregnancy complications during antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 2003, 2007, 2008, 2014, and 2017 DHS.

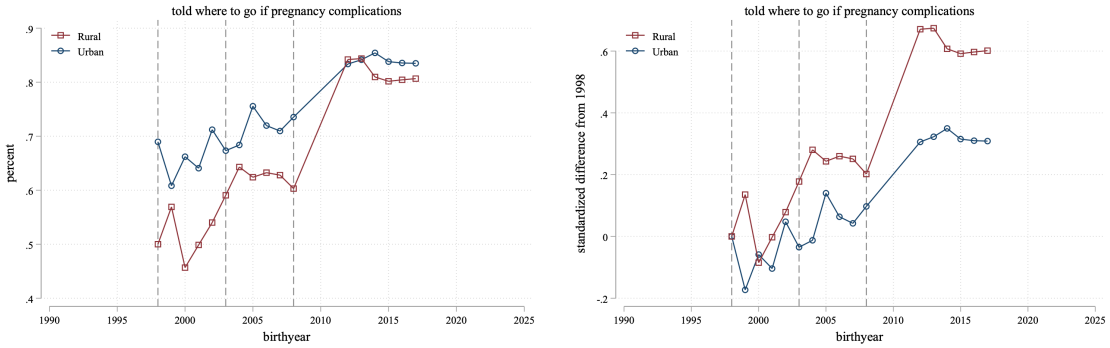

Figure 9 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in whether told where to go for pregnancy complications during antenatal visit, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 2003, 2007, 2008, 2014, and 2017 DHS.

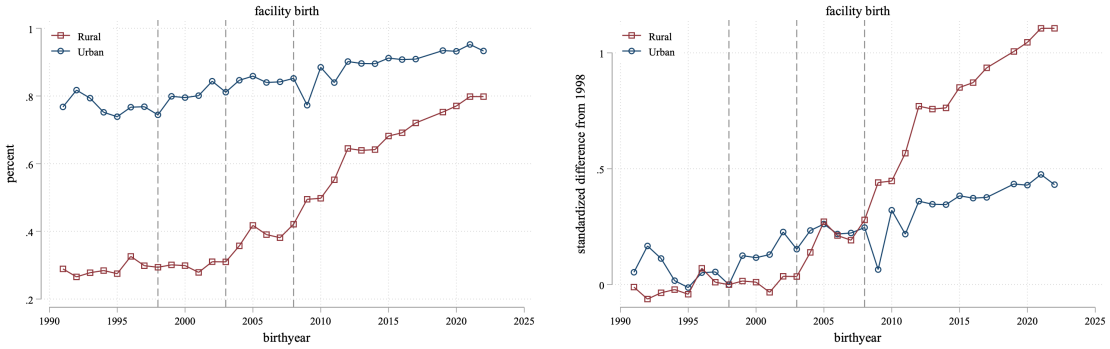

Figure 10 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in facility births, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1993, 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

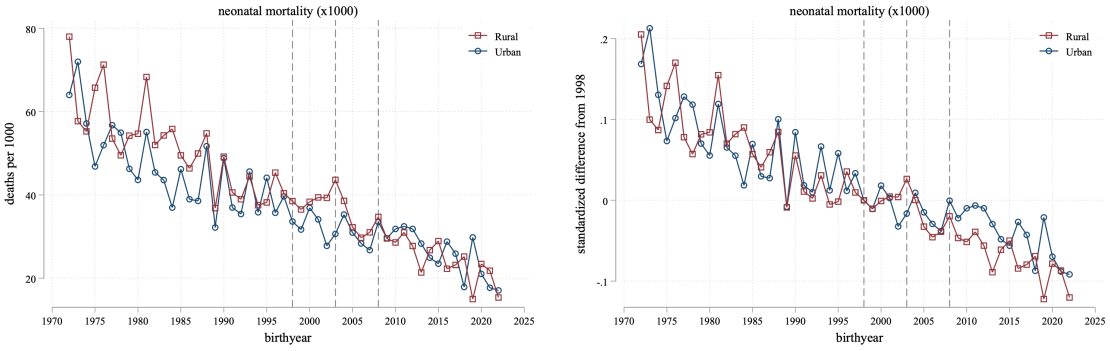

Figure 11 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in neonatal mortality, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1993, 1998, 2003, 2007, 2008, 2014, and 2017 DHS.

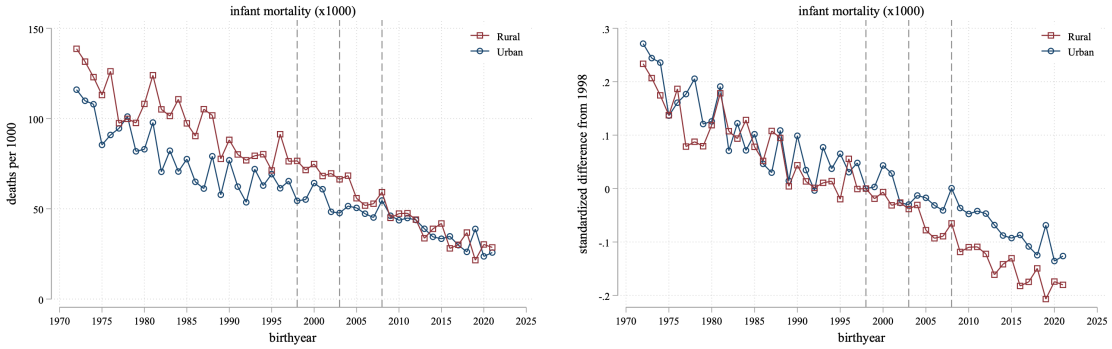

Figure 12 – Rate (panel a) and change relative to the 2003 birth cohort (panel b) in infant mortality, by rural/urban status. Vertical lines represent the start of the free antenatal care policy (1998), the start of the free delivery policy (2004), and the start of the free insurance policy (2008). Data are from the 1993, 1998, 2003, 2007, 2008, 2014, and 2017 DHS.