What can we learn from babies born during health worker strikes?

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Abstract

What is the benefit of the provision of health-care services in low-resource settings? We address this question by studying what happens when such services are removed, as in the case of health-worker strikes. We construct a panel of births linked with the timing of strikes in the same area, which lets us control for variation in unobservable factors across time and place to identify the impacts of health-worker strikes. The timing of health-worker strikes are reasonably assumed to be exogenous with respect to women's prior decisions to become pregnant. This provides insights about the benefit - or lack thereof - of access to different types of health facilities in improving maternal and child outcomes. In addition, we learn about the effects of an important and growing phenomenon of health-worker strikes. We find that babies born during strikes are less likely to have survived and less likely to have received valuable early-life health inputs.

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1 Introduction

Health facilities in developing countries are notoriously understaffed and under supplied. Paul Farmer blamed the spread of Ebola on the poor quality of the health systems in West Africa.[1] Some have taken concerns of the quality of health services so far as to question whether the care provided is better than no care at all. In a blog post entitled "Are Institutional Births Institutionalizing Deaths?" Jishnu Das points out the glaring lack of evidence that some health facilities are not making people worse off.[2] The benefit (or lack thereof) of health services can be difficult to measure, because it is expensive to deliver and ethically difficult to withhold. One way to assess the benefits is to exploit situations in which services are removed.

This paper uses instances of health-worker strikes in Kenya to study the benefits of health-service availability on birth and early child health outcomes. Recently, a few large health-worker strikes in sub-Saharan Africa garnered broad media attention.[3] Moreover, data we have collected on health strikes across Sub-Saharan Africa suggests they are an increasingly common phenomenon. Most of the these strikes are over low salaries or non-payment of salaries, and media reports often claim they result in the loss of life, particularly for those whose need for health care is urgent or cannont be delayed. We focus on child outcomes in large part because the pre-determined timing of pregnancies means that whether a strike occurs at childbirth is essentially exogenous with respect to individual characteristics of either mother or child. In addition, despite gains in recent years, the rate of infant mortality in Kenya, as in many sub-Saharan Africa countries, remains stubbornly high (at about 50 per 1000 births, compared to just 6.1 in OECD countries), and factors which change health at birth can potentially have large effects. Beyond mortality, a growing literature has demonstrated a strong connection between early-life health inputs and long-term outcomes Currie and Vogl (2013).

However, the impact of strikes on birth and child health outcomes is not obvious. On the one hand, limiting access to care should have adverse effects on health. In the U.S., there

[1] See, for example: Boozary, Andrew S., Paul E. Farmer, and Ashish K. Jha. "The Ebola outbreak, fragile health systems, and quality as a cure." JAMA 312.18 (2014): 1859-1860.

[2] http://blogs.worldbank.org/futuredevelopment/are-institutional-births-institutionalizing-deaths

[3] For example, the following headlines appeared in newspapers from sub-Saharan Africa in the last few years: "Babies die as Pumwani Maternity Hospital strike bites," September 11, 2013, Daily Nation, Kenya; "Man dies after being kicked out of hospital," December 13, 2013, Standard, Kenya; "GABON: Health workers strike 'has cost lives'," April 9, 2009, IRIN, Gabon; "Doctors in Ghana continue to strike over salary dispute," April 12, 2013, BBC Africa, Ghana; "Health workers' strike bites harder, meeting deadlocked," August 27, 2013, \text{Star Africa}, Nigeria; "Uganda: Nodding syndrome patients suffer as Pader health-workers strike" October 22, 2012, The Daily Monitor, Uganda; "HIV/AIDS Patients Hit Hard By Health Workers Strike," October 21, 2013, Red Pepper, Uganda; "Kenya medics call for strike after talks flop," December 10, 2013, Standard, Kenya.

is evidence that distance to a health facility worsens health outcomes (for example, see Li (2014)), and that the supply of doctors increases health outcomes (for example, see Piérard (2014)).[4] In our context, a strike could result in a woman about to give birth being turned away from a facility or delivering in an understaffed facility, either with fewer providers or providers working fewer hours and skipping some usual services. If a woman knows in advance that there is a strike, she may choose to deliver at home or at a lower quality facility that is not subject to a strike, even if she would have otherwise made a different choice.

On the other hand, there are also risks associated with using health care facilities, particularly those with low-quality services, inadequate resources, or misaligned incentives. In these environments, the negative impacts of reduced access may be mitigated or even become positive. For example, an extensive body of work demonstrates high rates of health-worker absenteeism in developing countries. Chaudhury et al. (2006) estimate that on average 35 percent of health-workers in developing countries are absent from their posts at any given time. Similarly, a more recent survey of Kenya found that 28 percent of health care providers (and 38 percent of doctors) were absent from facilities during unannounced visits (World Bank SDI, 2013)). Given these high rates of absence, it may be that the relatively less frequent health worker strikes have little or no additional impact on outcomes.

Evidence also shows that even when health workers are present, the quality of care they provide is often low due to lack of knowledge, failure to impart critical information, or low effort (Das and Hammer, 2005; Das et al., 2008; Das and Hammer, 2014). For example, in India Das and Hammer (2005) find that among the top quintile of providers the likelihood of harming a patient due to lack of knowledge was more than 50 percent for viral diarrhea, 25 percent for preeclampsia, and 7 percent for tuberculosis. In Kenya, the SDI survey found that just 72 percent of providers could accurately diagnose common illnesses, and less than half adhered to clinical guidelines in vignettes related to these conditions as well as maternal and neonatal complications.

The lack of adequate health facility infrastructure or other health inputs could also expose patients to risks they would otherwise not face if they had gone elsewhere for treatment or received none at all. Among the sample of health facilities visited in the SDI survey in Kenya, only 49 percent of facilities had clean water, sanitation, and electricity simultaneously. Further, none had all of the 10 tracer drugs for children or all of the 16 tracer drugs for mothers investigated by the survey.

Finally, there is also evidence (although mainly from developed countries) suggesting that health care provider incentives may not be aligned with patient outcomes. For example,

[4]In contrast, however, Dobkin (2003) finds that despite lower staffing on weekends, hospitals do not experience excess inpatient mortality during these days.

Jena et al. (2014) find that 30-day mortality rates from heart failure and cardiac arrest were lower for high-risk patients admitted to a hospital when their cardiologist was away at a scientific meeting compared to when the cardiologist was not away at a meeting. Johnson and Rehavi (2013) find that physicians treating physicians are less likely to respond to financial incentives, resulting in lower rates of cesarean sections and improved maternal health outcomes. [5]

In developing countries, the evidence of the benefits of health services is mixed. Goldstein et al. (2013) find that plausibly random health-worker absences in Kenya led to a dramatic decrease in the use of effective methods to reduce HIV transmission from mother to child. With regards to child delivery outcomes, one recent study found that a program that effectively increased institutional births did not change infant mortality in Rwanda (Okeke and Chari, 2014). At the same time, a single program in India designed to increase the number of births in facilities has generated research finding both that it reduced perinatal and neonatal deaths (Lim et al., 2010) and that it did not(Mazumdar et al., 2012; Randive et al., 2013). Another study in India found that a different incentive program that increased facility births by 9% decreased neonatal death, but had no impact on later child mortality (Debnath, 2014)

In terms of the impacts of health-worker strikes specifically, the evidence is quite limited. Gruber and Kleiner (2012) find a substantial increase in in-hospital mortality during nurses' strikes in New York State. Pinto et al. (2013) use a labor disruption in Toronto that reduced sexual health service provision to estimate the value of these services, and they find a small resulting increase in chlamydia infections among young women following the disruption. In contrast, Cunningham et al. (2008) conduct a meta-analysis of seven articles, looking at 5 physician strikes in developed countries lasting between 9 days and 17 weeks, and none of these studies find a reduction in mortality during the strikes. They explain this through postponing elective surgeries, continuing emergency care during the strikes, and difficulty in the identification of long-term outcomes resulting from short strikes. Similarly, in a recent summary piece, Metcalfe et al. (2015) find that existing evidence points to little or no immediate health consequences of industrial actions in developed countries as health systems in rich countries are able to postpone non-urgent procedures.

Finally, a few medical case studies find impacts of strikes on health outcomes in developing countries. In one study, Njuguna (2015) show a 50% reduction in deliveries taking place in a health facility during a single strike in Mombasa, Kenya. Gyamfi (2011) find a decline in patient outcomes during a nurses' strike at a hospital in Ghana. Bhuiyan and Machowski

[5] In the Netherlands, Daysal et al. (2013) find no additional benefit of obstetrician supervision of a birth relative to midwife supervision.

(2012) find a decline in mortality during a strike in a single facility in South Africa, but an increase in mortality per patient. However, extrapolating from the patients who visit a facility during and before/after a strike - as these studies do - raises some complications that do not arise when using population surveys, as in this study.

This paper makes two primary contributions. First, it investigates the impacts of access to health services at the time of deliveries, by looking at what happens when these services are temporarily unavailable. Second, it sheds light on the impacts of health-worker strikes, an important and growing phenomenon in many Sub-Sahara African countries. We combine survey data regarding the experiences and outcomes of delivery among a large sample of women from Kenya (from Demographic and Health Surveys) with a record of the timing of health-worker strikes we collected from a broad set of media reports. We find that babies born in the month and county of a health-worker strike are more likely to have died by one month, 6 months, and one year. We do not see large differences in the likelihood of facility births, suggesting alternate mechanisms through which strikes change child health. We also see that children born during strikes are less likely to have been vaccinated and the survivors are somewhat smaller.

The remainder of the paper procedes as follows. Section 2 describes the data on health-worker strikes and outcomes. Section 3 outlines the estimation strategy used to obtain the results discussed in Section 4, and Section 5 concludes.

2 Data

This paper uses panel data, linking information on the timing and location of health-worker strikes with birth outcomes. The birth outcomes information is from the Demographic and Health Surveys, which are population surveys with detailed fertility histories. Information about strikes comes from data we collected through digital archives of newspapers from Sub-Saharan Africa, and includes information about who was striking, and the timing and location of the strikes. The two sets of data are linked by county, month, and year.

2.1 Strikes data

The database of health-worker strikes was compiled by searching through the digital archives of newspapers from sub-Saharan Africa and includes information from 38 countries between 1996 and 2015.[6] For each strike, we record the location, the start and end-dates, who is on

[6]We are still in the process of collecting information to complete this database to include both more years and countries.

strike, and the target of the grievance.[7] Overall, we have identified 620 strikes, 82% of which were local strikes and the remainder were national strikes. In the vast majority (70%) of cases, health worker salaries, general compensation, or working conditions are the source of the strike.

1 presents the frequency of strikes across the entire sample and in Kenya only. In both instances, there appears to be an increase of strikes over the past 5 years.

In Kenya, there were 39 strikes from 1998 through the end of 2014.[8] Of these, 33 are local and 6 are national. Among the local strikes, half occurred in Nairobi, the capital, with the remainder spread across 11 separate counties (there are 47 counties in Kenya total). National strikes are longer, lasting almost 27 days on average. The complete list of strikes used in the analysis is included in Table 1.

2.2 DHS

Demographic and Health Surveys are population surveys conducted all over the developing world with the original goal of providing information necessary to estimate future population trends. The surveys ask respondents to report extensive details of their fertility histories, including the timing of all previous births, the actions of the mother and services sought both before and at birth, and initial and long-term health outcomes of the children. This information is collected for all children born in the previous 5 years to the DHS's nationally representative sample of women ages 15-49. A few questions are asked of all previous births (beyond just those born in the past 5 years), including whether the child is still alive. The data used in the analysis is from 1997-2015.

Sample characteristics of mothers are presented in 2, and key outcomes used in this paper are presented in 3. In both tables means are presented for the full sample, and then separately for observations with high and low maternal education (defined as greater than 7 years of education). Women with more education are somewhat younger, m ore likely to live in urban areas, have electricity and other assets. They are equally likely to be married, and they have fewer children. Children born to highly educated mothers are also better off early in life. They are more likely to be born in a health facility (rather than at home) and have a trained professional present at the time of birth. They also appear to be in better health in terms of both height and weight, and are more likely to have received vaccines against tuberculosis, diphtheria, polio, and the measles.

[7] When an article listing the end-date of the strike was not available, the date of the most recent article that said the strike was ongoing was used as the end-date.

[8] The information about strikes in Kenya was obtained from the following sources: allafricaXX, The Nation, The Star, Hope FM, News 24, and IRIN.

Using the timing of these births, we can construct a retrospective panel of births, which we link with the strikes data. For each birth reported in the DHS, we know whether there was a health-worker strike in that country during the month of the birth, and during the previous months. We also know the duration of the strike.[9]

3 Empirical Strategy

We use variation in strike occurrences across counties and over time to identify the causal impacts of health-worker strikes. We compare the differences in outcomes of babies born in a given county when there is a strike and when there isn't one relative to the differences in outcomes of babies born in other counties in the same months, including county and month fixed effects. The validity of this strategy relies on the assumption that, in the absence of any strike, the differences over time in outcomes across the two locations would have been the same. The panel data structure allows for time and location fixed effects to control for time-invariant location specific factors and time-varying factors, which are not place specific.

Additionally, this strategy also relies on the assumption that the timing of a birth with respect to the timing of a strike is exogenous. The fact that conception occurs 9 months before the birth makes this a reasonable assumption: for the most part, women cannot choose to change the timing of their deliveries with respect to the timing of a strike. There are some exceptions to this. Particularly with the availability of induction and cesarean-sections, it is absolutely possible for women to change the date of delivery, within a small window. It has been shown in developed countries that women do have some control over the timing of deliveries and respond to tax incentives Gans and Leigh (2009); Dickert-Conlin and Chandra (1999); Milligan (2005). There are a few reasons why this should be less of a concern in this context. First, while women can change the timing within a few days, it is unlikely that women can or would want to change the timing by a larger amount. This analysis relies on the month of birth, and thus this is not likely to be altered frequently in response to a health-worker strike. Second, inductions and cesarean sections are somewhat less common in the developing world, and thus these are somewhat less likely to be used to alter the date of delivery. Finally, we can test whether women are more or less likely to give birth when there are strikes to see to what degree women are changing the timing of delivery in response to strikes.[10]

[9] We do not know the day within the month of the birth, and so our measure of having experienced a strike will be over-stated, which may bias our estimates of the impacts of strikes toward zero.

[10] This test is somewhat complicated because there is under-reporting of miscarriages, stillbirths, and the births of children who have died in DHS data and other surveys Haws et al. (2010). If health-worker strikes lead to a larger number of miscarriages and stillbirths, then this will look similar to women changing the

We estimate the following equation:

$$Y_{icym} = \beta_1 strike_{cym} + \gamma_c + \delta_y + \upsilon_m + \varepsilon_{icym}$$

Y_{iym} is the outcome variable for a birth to mother i, during year y, and month, m. The variable $strike_{cym}$ is an indicator for whether there was a local strike occurring in the month and county of birth. The county, year, and month fixed effects, represented by γ_c, δ_y, and υ_m respectively, control for time-invariant variation in unobservables across counties as well as any factors that change outcomes over time similarly across the country. Thus, β_1 is the coefficient of interest, which captures the difference in outcomes in a county with strikes relative to periods without strikes in the same county and relative to other counties at the same time. Standard errors are clustered at the birth month-year and county level.

Strikes are likely to matter most for individuals who are most likely to use health facilities. As shown in Table 3, children born to more educated mothers are more likely to be born in a health facility (64% compared with 27%). Therefore, we estimate a second equation that includes the effects of strikes separately for babies born to women with high and low levels of education. To do so, we estimate the following equation:

$$Y_{icym} = \beta_1 strike_{cym} * higheduc_{ic} + \beta_2 strike_{cym} * loweduc_{ic} + \omega higheduc_{ic} + \gamma_c + \delta_y + \upsilon_m + \varepsilon_{icym}$$

In this specification, $strike_{cym}$ is interacted with indicators for high maternal education (more than 7 years) and low maternal education (less than or equal to 7 years).[11] We also separately include the indicator, $higheduc_{ic}$. As demonstrated in Figure 3, the fraction of facility births is increasing with years of education, and there is a sharp increase after 7 years, representing the transition from primary to secondary school. Strikes should disproportionately change outcomes for those who are most likely to give birth in a facility, which we proxy with level of education. If strikes do disproportionately change outcomes for those with high levels of education, we would expect the coefficient, β_1, to be large and significant, while β_2 should be smaller.

The indicator, $strike_{cym}$, necessarily involves some misclassification as most strikes do not last the full month. In addition to this misclassification, this also ignores variation in the duration of the strikes. Thus, we also estimate similar equations replacing this indicator with a continuous variable representing the number of days in a month in which a strike occurred, $strikedays_{cym}$. Thus we estimate the following two equations:

timing of their deliveries.

[11] As they represent less than half a percent of the sample, we do not include observations with more than 17 years of education. Our results do not noticeably change when this group is included.

$$Y_{icym} = \beta_1 strikedays_{cym} + \gamma_c + \delta_y + \upsilon_m + \varepsilon_{icym}$$

and

$$Y_{icym} = \beta_1 strikedays_{cym} * higheduc_{ic} + \beta_2 strikedays_{cym} * loweduc_{ic} + \omega higheduc_{ic} + \gamma_c + \delta_y + \upsilon_m + \varepsilon_{icym}$$

It is possible that strikes at times other than the month of birth could have important effects on children's outcomes if, for example, a strike during pregnancy changes the quantity or quality of antenatal care or a strike early in a child's life changes early-life health-inputs. To see whether this is the case, we plot the effect of a strike in the county of birth on children's mortality for each month within a year of birth. We estimate the following equation:

$$Y_{icym} = \sum_{j=-12}^{12} \beta_j strikedays_{kicym} + \gamma_c + \delta_y + \upsilon_m + \varepsilon_{icym}$$

and plot each of the coefficients β_{-12} through β_{12} separately. We present this for the full sample, and separately for those born to mothers with more and less than seven years of schooling.

4 Results and Dicussion

Table 4 presents the results on child mortality. Panel A includes the coefficient on an indicator for whether there was a strike in the county and month of birth from the estimation of equation 1, and panel B presents the same for equation 2. Panels C and D present the estimates of equations 3 and 4, using the number of days of strikes in th emonth of birth as the independent variable of interest. Column 1 shows an increased likelihood of 4.9 percentage points that a child born during a strike has died by the time of the survey. The next columns estimate the likelihood of mortality by different ages. In column 2, the point estimate of the change in the likelihood of mortality within the first month of life is 1.8 percentage points and not statistically different from zero. In column 3, we find a 3.2 percentage point increase in the likelihood of mortality within the first 6 months, and column 4 shows a 4.0 percentage point increase in mortality within the first year. In panel B of Table 4, when we split this by education, we see that the increases in mortality are largely driven by those born to mothers

with more than 7 years of education. Here we see increases in mortality by the time of the survey, within 1 month, within 6 months, and 1 year that are all large and statistically significantly different from zero. In Panels C and D, the results are similar, although with less statistical significance. As the average strike lasts for about two weeks in a month, these coefficients are reasonably smaller. As in Panels A and B, the positive point estimates of the coefficients in Panels C and D show an increase in mortality for babies born during strikes, particularly among births to highly-educated mothers.

Table 5 begins to investigate mechanisms by looking at variation in the place of delivery as a function of health-worker strikes. We do not see stastitically significant differences in the likelihood of deliverying at home or in any formal health facility or whether the delivery was in a government or private hospital, or whether a doctor or nurse was present. Across specifications, we see point estimates that show a positive relationship between strikes and both home deliveries and private hospitals. We also see negative associations between strikes and facility births, although these estimated relationships are not statistically significantly different from zero.

Table 6 presents estimates of the effects of strikes on measures of child health among the survivors, including height for age, and weight for age. In Panels A and B, we do not observe any statistically significant impacts on health and weight of children, although the point estimates are large and negative. This may be partly due to survival bias if the weakest children did not survive until the survey to be measured. This is consistent with Bozzoli et al. (2009) who argue that selection should dominate scarring (non-fatal adverse effects of health shocks) at high mortality levels, while scarring should dominate at low mortality levels. In Panels C and D, we do see statistically significant negative effects of the number of strike days in the birth month on height for age and weight for age. An additional day of strikes in a month is associated with a reduction in height for age of 2.4 percentage points and a reduction of 2.8 percentage points in weight for age. In Panel D, we see that these differences show up for those with both high and low levels of education, although they are higher for those with low education. This may suggest that strikes prevent the receipt of valuable health services for even newborns who are not born in facilities.

Table 7 looks at whether strikes changed vaccination rates. In Panel A, we see a 2.8 percentage point reduction in the likelihood of having received a Tuberculosis vaccine, a 5.4 percentage point reduction in receipt of the Diptheria vaccine, and a 5.5 percentage point reduction in the Polio vaccine, all of which are statistically significantly different from zero. In Column 4, we see a negative but not statistically significant coefficient on strikes predicting having received the Measles vaccine. Looking at Panel B, we see statistically significant reductions of a similar magnitude in vaccine rates for births to mothers with more than 7

years of education. For those with lower education levels, the coefficients are negative and of a similar size, but they are not statistically significantly different from zero. Panels C and D show similar results with consistently negative point estimates on the association between the number of days of strikesduring the birth month and the likelihood of receipt of the four vaccines. These results suggest that early-life health inputs provided to children around the time of birth may be reduced by strikes and may be responsible for the increases in mortality observed among children born during health-worker strikes. Given that the mortality benefits of these vaccines may take longer to be realized, they may be proxying for other health inputs that are limited by strikes.

The receipt of vaccines may also proxy for other health inputs received at the time of birth. In the context of Kenya, one important intervention received by some children at the time of birth is Prevention of Mother to Child Transmission of HIV (PMTCT). Unfortunately, this survey does not include information about whether the mother child recieved PMTCT, but its absence would have a dramatic effect on child mortality among children born to HIV positive mothers. Mothers' HIV status was collected for the 2003 and 2008/2009 DHS waves. If we look at mothers who are HIV positive at the time of the survey (8% of the sample), 18% of their children have died. Among those who are currently HIV negative, 8% have died. In this sample, only two children were born to HIV positive mothers during strikes, and so we cannot separately estimate the effect of a strike on them.

In the graphical analysis presented in Figures 3-5, we plot separate coefficients estimating the effect of a strike on mortality for a strike that occurred in each of the twelve months before and after a child's birth. In Figure 3, we see a statistically significant increase in mortality due to a strike in the month of birth and in the second month of life. When we look only at children born to mothers with more than 7 years of education in Figure 4, we see increased mortality only when a strike occurred in the month of birth. In Figure 5, we see no change in mortality from a strike in the birth month, and while the coefficient on a strike in the second month of life is large and positive, it is not statistically different from zero.

5 Conclusion

The analysis presented above demonstrates a meaningful impact of health-worker strikes on child health and survival. The effects on receipt of vaccines suggest that this is a likely mechanism through which the strikes increase infant mortality.

These findings have a few implications. First, this can contribute to an assessment of health-worker strikes. However, there are many other factors that cannot be incorporated in

this type of analysis. This analysis does not recognize any long-term benefits of the resolution of a strike. If it leads to demands of workers being met and this in turn increases motivation and attendance of health-workers, the long-term benefit could easily be positive.

Perhaps more importantly, the demonstration of an instantaneous cost of health-worker strike implies that there is an important value to the usual health services being provided. If there were not, we would not be able to see an impact on health when the services are removed.

However, the focus on birth and child outcomes is unable to capture costs to those needing other types of health services. For example, what are the effects of interruptions in HIV treatment when a break in antiretroviral drugs facilitates the development of drug resistance that can hurt both the direct recipient of the drugs and anybody who is infected with the mutated strain. What happens to those having heart-attacks or involved in traffic accidents or those who postpone preventive health interventions? These will be difficult to measure because the timing of demonstrated need could be changed by the start of a strike.

Moving forward, we hope to provide more robustness and nuance to the story of the impacts of health-worker strikes with more detailed analysis. The largest step is to complete the creation of a more reliable database of all health-worker strikes using digital records of African newspapers. We will also incorporate geographic information on sub-national strikes linked with geographic data from DHS records for all countries in our strikes database. We can look at whether strikes among different types of health-workers (e.g.: doctors or nurses) differentially change who is present at birth. We will incorporate more placebo checks confirming that those who are likely to be less affected by a strike (e.g.: those with low levels of education, who are less likely to give birth in a health facilities) do not show differences in outcomes as a function of a sub-national or national strike occurrences. The DHS data provides information about sibling mortality including the age and date of deaths, and - for sisters - whether she was pregnant and whether she died during childbirth. This can be incorporated to measure impacts on maternal mortality as well.

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Figure 1: Frequency of Health Worker Strikes in Sub-Saharan Africa

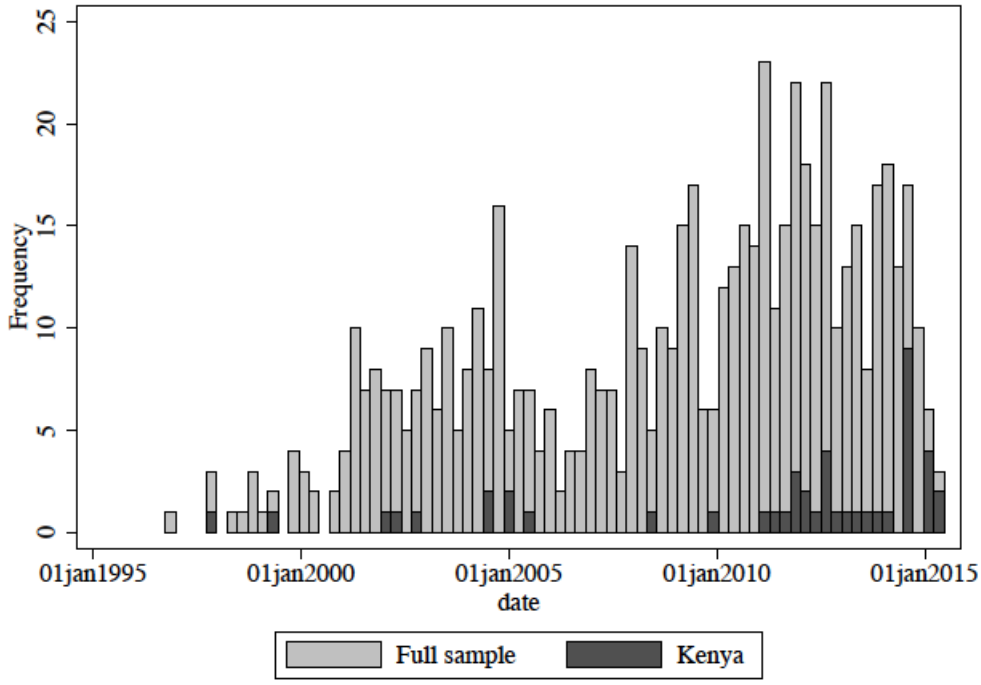

Figure 2: Fraction of deliveries in facility by years of education

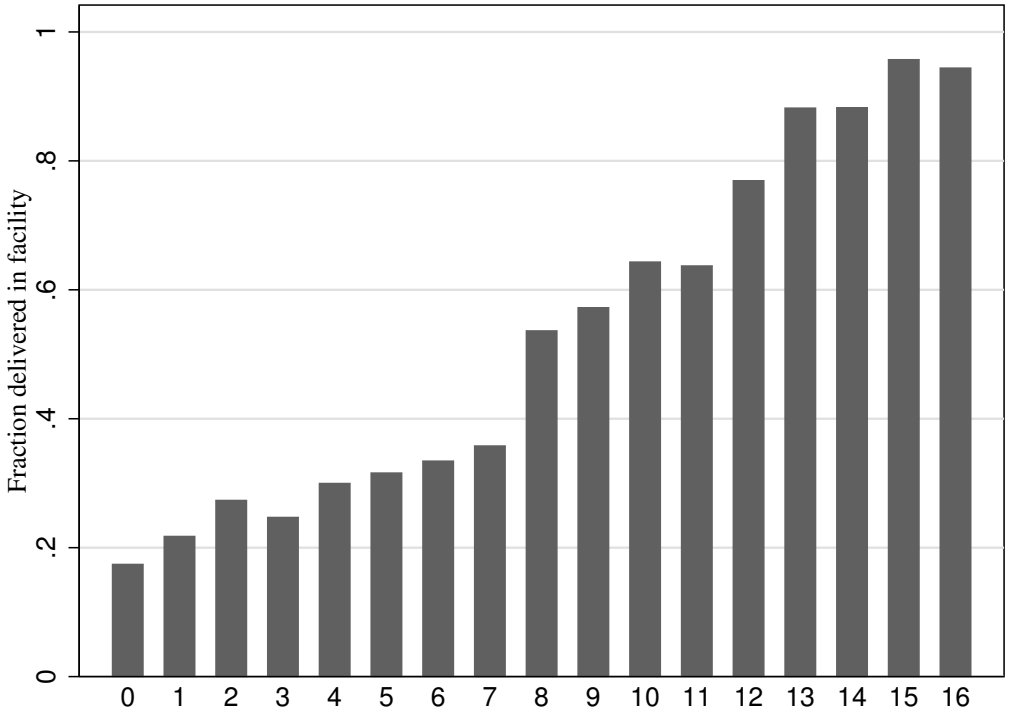

Figure 3: Timing of Strike on Infant Mortality

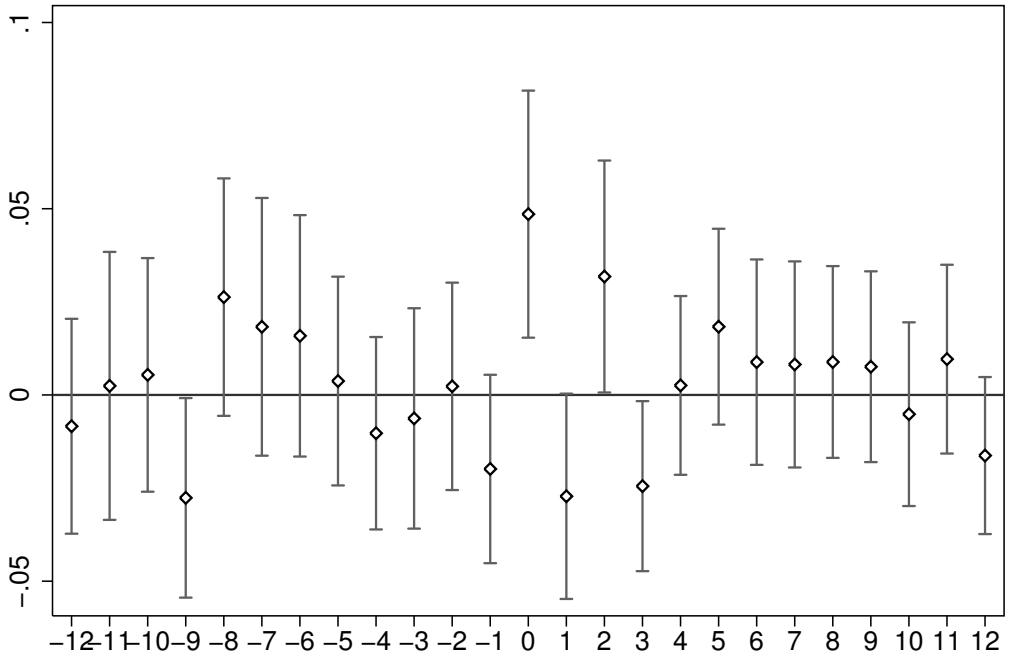

Figure 4: Timing of Strike on Infant Mortality - High Education

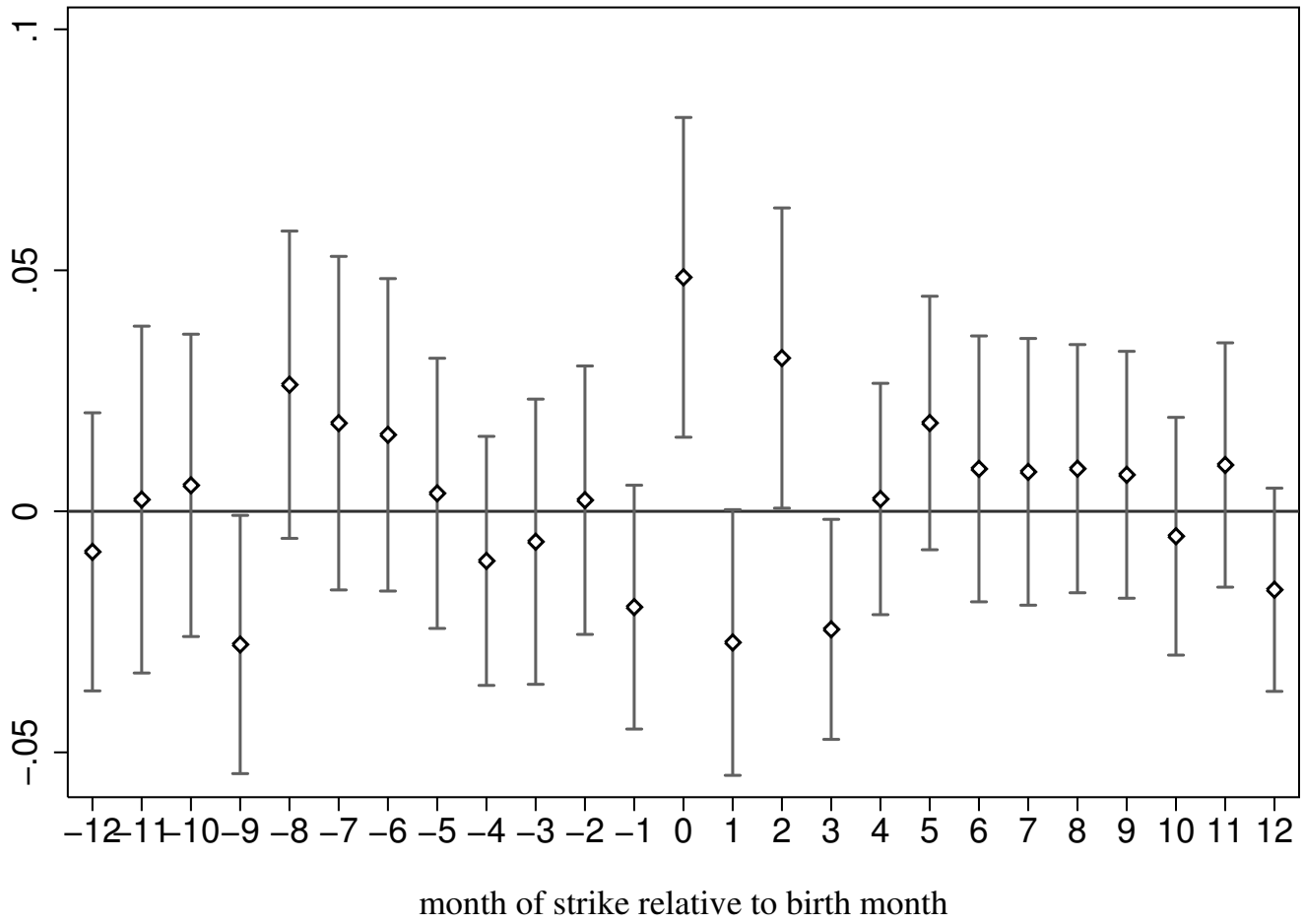

Figure 5: Timing of Strike on Infant Mortality - Low Education

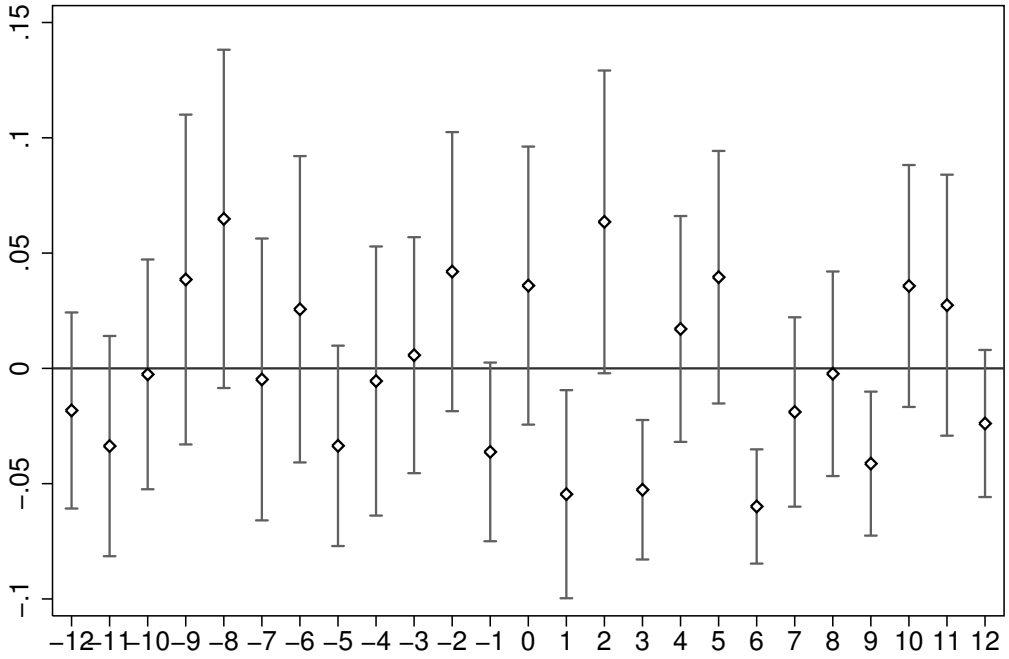

Table 1: Kenya Strikes List

	Start Date	Days	County	Who went on strike
National strikes				
	December 5, 2011	10		health workers
	March 1, 2012	4		nurses
	March 1, 2012	15		health workers
	September 13, 2012	22		doctors
	December 3, 2012	71		nurses
	December 10, 2013	11		health workers
Local strikes				
	April 22, 1999	3	Nyamira	health workers
	February 18, 2002	2	Nairobi	nurses
	April 15, 2002	7	Uasin Gishu	nurses
	November 1, 2002	3	Nairobi	doctors
	May 31, 2004	2	Nyeri	nursing students
	August 9, 2004	2	Nairobi	nurses
	November 25, 2004	2	Nairobi	health workers
	November 30, 2004	2	Nairobi	health workers
	May 24, 2005	4	Nairobi	nurses
	July 3, 2008	2	Nakuru	health workers
	January 15, 2010	2	Tana River	health workers
	March 16, 2011	3	Nairobi	nurses
	April 27, 2011	1	Nairobi	nurses
	October 20, 2011	17	Uasin Gishu	doctors
	November 9, 2011	3	Nairobi	health workers
	June 9, 2012	37	Nairobi	doctors
	August 13, 2012	6	Uasin Gishu	doctors
	August 27, 2012	39	Nairobi	doctors
	September 13, 2012	14	Uasin Gishu	nurses
	January 9, 2013	2	Nairobi	health workers
	June 19, 2013	2	Nairobi	nurses
	September 9, 2013	5	Nairobi	nurses
	March 1, 2014	11	Embu	health workers
	August 1, 2014	1	Baringo	health workers
	August 11, 2014	2	Kisumu	nurses
	August 4, 2014	32	Mombasa	nurses
	August 6, 2014	14	Kitui	doctors
	August 19, 2014	1	Uasin Gishu	nurses
	August 21, 2014	1	Kisumu	intern doctors
	August 21, 2014	1	Nairobi	intern doctors
	August 25, 2014	3	Homa Bay	health workers
	September 5, 2014	21	Uasin Gishu	nurses
	September 11, 2014	2	Nairobi	doctors

Table 2: Mother Characteristics

	All	High Education	Low Education
Age	31.04	30.31	31.78
	(8.02)	(7.46)	(8.52)
Education	7.07	10.04	3.66
	(4.22)	(2.27)	(2.96)
Married	0.74	0.72	0.76
	(0.44)	(0.45)	(0.43)
Urban	0.32	0.42	0.21
	(0.47)	(0.49)	(0.41)
Has electricity	0.22	0.33	0.08
	(0.41)	(0.47)	(0.28)
Has radio	0.65	0.77	0.53
	(0.48)	(0.42)	(0.50)
Literate	0.66	0.94	0.36
	(0.47)	(0.25)	(0.48)
Wealth Index	2.92	3.52	2.20
	(1.46)	(1.29)	(1.31)
Number of Children	3.63	2.82	4.54
	(2.39)	(1.81)	(2.61)
Number of observations	36299	18832	17235

Notes: Standard deviations in parentheses. Computed based on one observation per woman.

Table 3: Birth and Child Characteristics

	All	High Education	Low Education
Child died	0.07	0.06	0.08
	(0.26)	(0.23)	(0.27)
Child died, first month	0.03	0.03	0.03
	(0.17)	(0.16)	(0.17)
Child died, first 6 months	0.04	0.03	0.05
	(0.20)	(0.18)	(0.21)
Child died, first year	0.05	0.04	0.06
	(0.22)	(0.21)	(0.24)
Number of observations	100202	44285	55501
Home birth	0.50	0.31	0.69
	(0.50)	(0.46)	(0.46)
Government facility birth	0.33	0.47	0.21
	(0.47)	(0.50)	(0.41)
Private facility birth	0.11	0.17	0.05
	(0.32)	(0.38)	(0.22)
Facility birth	0.44	0.64	0.27
	(0.50)	(0.48)	(0.44)
Doctor, nurse, or midwife present	0.50	0.70	0.32
	(0.50)	(0.46)	(0.47)
Number antenatal visits	3.84	4.27	3.36
	(2.18)	(2.08)	(2.15)
MOBF	14.34	14.42	14.28
	(8.67)	(8.49)	(8.82)
Height for age: z-score	-1.08	-0.93	-1.22
	(1.45)	(1.36)	(1.51)
Weight for age: z-score	-0.92	-0.69	-1.13
	(1.26)	(1.23)	(1.24)
BCG vaccine	0.92	0.96	0.88
	(0.27)	(0.19)	(0.33)
First DPT vaccine	0.90	0.94	0.87
	(0.30)	(0.24)	(0.34)
First polio vaccine	0.91	0.94	0.87
	(0.29)	(0.23)	(0.33)
Measles vaccine	0.70	0.76	0.64
	(0.46)	(0.43)	(0.48)
Number of observations	34289	16237	17873

Notes: Standard deviations in parentheses. Computed based on one obervation 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.

Table 4: Child Mortality

	Child died (1)	Child died first 1 month (2)	Child died first 6 months (3)	Child died first year (4)
Panel A.				
Strike	0.049 ***	0.018	0.032 **	0.040 ***
	(0.017)	(0.013)	(0.015)	(0.016)
Panel B.				
Strike*High Education	0.058 ***	0.027 *	0.036 **	0.044 ***
	(0.019)	(0.015)	(0.016)	(0.016)
Strike*Low Education	0.016	-0.015	0.020	0.026
	(0.031)	(0.015)	(0.029)	(0.016)
Panel C.				
Strike Days	0.004 **	0.001	0.002	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Panel D.				
Strike Days*High Education	0.005 *	0.002	0.003	0.004 **
	(0.003)	(0.002)	(0.002)	(0.002)
Strike Days*Low Education	-0.001	-0.002 **	0.000	0.000
	(0.002)	(0.001)	(0.002)	(0.002)
Mean of dep. var.	0.071	0.028	0.041	0.054
Std. Dev. of dep. var.	0.257	0.166	0.198	0.225
Observations	99786	99786	99786	99786

*Notes: Each regression includes month, year, and survey fixed effects. Standard errors, clustered at the birth-month-year*survey-cluster level are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively. In Panels A and B, the variable, Strike, represents an indicator for whether there was a strike in the county and month of birth. High Education is defined as having more than 7 years of schooling. In Panels C and D, the variable, Strike Days is defined as the number of days in the county and month of birth during which a strike was occurring.*

Table 5: Delivery Outcomes

	At home	In any health facility	At government hospital	At private hospital	Doctor or Nurse present
	(5)	(6)	(7)	(10)	(11)
Panel A.					
Strike	0.030	-0.011	-0.026	0.015	-0.016
	(0.030)	(0.029)	(0.039)	(0.035)	(0.028)
Panel B.					
Strike*High Education	0.009	0.013	-0.011	0.024	0.007
	(0.031)	(0.034)	(0.047)	(0.035)	(0.028)
Strike*Low Education	0.110	-0.104	-0.086	-0.018	-0.106
	(0.069)	(0.065)	(0.060)	(0.035)	(0.028)
Panel C.					
Strike Days	0.004	-0.001	-0.002	0.000	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Panel D.					
Strike Days*High Education	0.002	0.000	0.000	0.000	0.001
	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)
Strike Days*Low Education	0.011	-0.008	-0.011 **	0.003	-0.010
	(0.008)	(0.008)	(0.005)	(0.003)	(0.002)
Mean of dep. var.	0.507	0.442	0.333	0.110	0.498
Std. Dev. of dep. var.	0.500	0.497	0.471	0.312	0.500
Observations	35984	35984	35984	35984	36002

*Notes: Each regression includes month, year, and survey fixed effects. Standard errors, clustered at the birth-month-year*survey-cluster level are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively. In Panels A and B, the variable, Strike, represents an indicator for whether there was a strike in the county and month of birth. High Education is defined as having more than 7 years of schooling. In Panels C and D, the variable, Strike Days is defined as the number of days in the county and month of birth during which a strike was occurring.*

Table 6: Child Health Measures

	Height for age (11)	Weight for age (12)
Panel A.		
Strike	-0.139	-0.037
	(0.141)	(0.118)
Panel B.		
Strike*High Education	-0.090	-0.010
	(0.151)	(0.129)
Strike*Low Education	-0.318 *	-0.136
	(0.191)	(0.154)
Panel C.		
Strike Days	-0.024 *	-0.028 ***
	(0.014)	(0.008)
Panel D.		
Strike Days*High Education	-0.018	-0.025 ***
	(0.016)	(0.008)
Strike Days*Low Education	-0.054 ***	-0.041 ***
	(0.015)	(0.012)
Mean of dep. var.	-1.084	-0.921
Std. Dev. of dep. var.	1.444	1.252
Observations	31246	31246

*Notes: Each regression includes month, year, and survey fixed effects. Standard errors, clustered at the birth-month-year*survey-cluster level are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively. In Panels A and B, the variable, Strike, represents an indicator for whether there was a strike in the county and month of birth. High Education is defined as having more than 7 years of schooling. In Panels C and D, the variable, Strike Days is defined as the number of days in the county and month of birth during which a strike was occurring.*

Table 7: Vaccinations

	Tuberculosis	Diptheria	Polio	Measles
	(14)	(15)	(16)	(17)
Panel A.				
Strike	-0.028 **	-0.054 **	-0.055 **	-0.014
	(0.014)	(0.024)	(0.025)	(0.033)
Panel B.				
Strike*High Education	-0.027 **	-0.055 **	-0.055 **	-0.025
	(0.013)	(0.024)	(0.024)	(0.033)
Strike*Low Education	-0.033	-0.052	-0.055	0.029
	(0.038)	(0.056)	(0.057)	(0.033)
Panel C.				
Strike Days	-0.003	-0.005 *	-0.004	-0.002
	(0.002)	(0.003)	(0.003)	(0.003)
Panel D.				
Strike Days*High Education	-0.003	-0.005 *	-0.005 *	-0.004
	(0.002)	(0.003)	(0.003)	(0.003)
Strike Days*Low Education	-0.004	-0.003	-0.003	0.005 *
	(0.004)	(0.004)	(0.004)	(0.003)
Mean of dep. var.	0.918	0.901	0.905	0.698
Std. Dev. of dep. var.	0.275	0.299	0.293	0.459
Observations	34152	34145	34107	34110

*Notes: Each regression includes month, year, and survey fixed effects. Standard errors, clustered at the birth-month-year*survey-cluster level are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively. In Panels A and B, the variable, Strike, represents an indicator for whether there was a strike in the county and month of birth. High Education is defined as having more than 7 years of schooling. In Panels C and D, the variable, Strike Days is defined as the number of days in the county and month of birth during which a strike was occurring.*