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Paid maternity leave and childhood vaccination uptake: Longitudinal evidence from 20 low-and-middle-income countries

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A B S T R A C T

The availability of maternity leave might remove barriers to improved vaccination coverage by increasing the likelihood that parents are available to bring a child to the clinic for immunizations. Using information from 20 low-and-middle-income countries (LMICs) we estimated the effect of paid maternity leave policies on childhood vaccination uptake. We used birth history data collected via Demographic and Health Surveys (DHS) to assemble a multilevel panel of 258,769 live births in 20 countries from 2001 to 2008; these data were merged with longitudinal information on the number of full-time equivalent (FTE) weeks of paid maternity leave guaranteed by each country. We used Logistic regression models that included country and year fixed effects to estimate the impact of increases in FTE paid maternity leave policies in the prior year on the receipt of the following vaccines: Bacillus Calmette-Guérin (BCG) commonly given at birth, diphtheria, tetanus, and pertussis (DTP, 3 doses) commonly given in clinic visits and Polio (3 doses) given in clinic visits or as part of campaigns. We found that extending the duration of paid maternity leave had a positive effect on immunization rates for all three doses of the DTP vaccine; each additional FTE week of paid maternity leave increased DTP1, 2 and 3 coverage by 1.38 (95% CI = 1.18, 1.57), 1.62 (CI = 1.34, 1.91) and 2.17 (CI = 1.76, 2.58) percentage points, respectively. Estimates were robust to adjustment for birth characteristics, household-level covariates, attendance of skilled health personnel at birth and time-varying country-level covariates. We found no evidence for an effect of maternity leave on the probability of receiving vaccinations for BCG or Polio after adjustment for the above-mentioned covariates. Our findings were consistent with the hypothesis that more generous paid leave policies have the potential to improve DTP immunization coverage. Further work is needed to understand the health effects of paid leave policies in LMICs.

1. Introduction

The Expanded Program on Immunization (EPI) was established by the World Health Organization (WHO) in 1974 to increase childhood immunization coverage throughout the world. Since then, international initiatives and institutions, including Universal Childhood Immunization (UCI), the Global Alliance for Vaccines and Immunization (GAVI), the United Nations Millennium Development Goals (MDGs), the Global Immunization Vision and Strategy (GIVS) and most recently, the Global Vaccine Action Plan (GVAP), have combined with regional and national immunization efforts to improve EPI coverage (Machingaidze et al., 2013). The introduction of EPI has lowered childhood morbidity and mortality due to infectious diseases in many countries (Falagas and Zarkadoulia, 2008; Hak et al., 2005; Harmanci et al., 2003).

Notwithstanding the significant improvement in childhood immunization rates throughout the world, vaccination uptake is not universal even in countries where vaccinations are provided free of charge (Soares, 2007; Trunz et al., 2006). In fact, vaccine-preventable diseases continue to be a global public health

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problem and contribute to severe rates of morbidity and mortality in low-income countries. Some vaccine preventable diseases are also re-emerging in middle-and-high-income countries (MHICs) due to low immunization rates (Glatman-Freedman and Nichols, 2012).

The current literature has identified several key factors which influence childhood vaccination, including parental education, maternal age, household living conditions, financial factors, place of residence, physical availability of vaccines, distance to clinic, transportation, and mass media campaigns (Danis et al., 2010b; Glatman-Freedman and Nichols, 2012; Niederhauser and Markowitz, 2007; Paschal et al., 2009; Pérez-Cuevas et al., 1999; Racine and Joyce, 2007; Semali, 2010; Shefer et al., 1999). In addition, studies from both low and high income countries have indicated 'conflicting work schedules' as a barrier to the immunization of children (Coreil et al., 1994; McCormick et al., 1997; Niederhauser and Markowitz, 2007; Paschal et al., 2009). Paid maternity leave – defined as "leave that the country guarantees employed women in connection with the birth of a child" (Heymann et al., 2011) – can provide households with the opportunity to vaccinate their children without requiring a tradeoff between providing health care for infants and earning income (Daku et al., 2012). Insufficient paid maternity leave, thus, may contribute to low or delayed vaccination uptake among children (Laryea et al., 2014).

To date, few studies have examined the effect of maternity leave policies on vaccination uptake. A study by Berger et al. (2005) found a negative impact of early return to work on diphtheria, tetanus, and pertussis (DTP) and Polio vaccinations in the US. Another study by Ueda et al. (2014) demonstrated the positive effect of paid maternity leave on the uptake of routine childhood immunizations in Japan. A study of OECD countries, however, where paid maternity leave is a nearly universal benefit, did not find an association between the duration of parental leave and vaccination uptake (Tanaka, 2005). In the global context, there is substantially more variability in maternity leave and a recent ecological study using data from 185 UN member countries showed that paid maternity leave was associated with higher childhood vaccination rates (Daku et al., 2012). To the best of our knowledge, however, the effect of paid maternity leave policies on individual-level outcomes has not been evaluated in low-and middle-income countries (LMICs). Moreover, the effect of maternity leave on childhood vaccination uptake might vary between higher and lower income countries. The effect of maternity leave policy on childhood vaccination could be weaker in LMICs relative to high-income countries due to lower rates of participation in the formal labor market among women in LMICs (Schneider et al., 2010; World Bank, 2014). On the other hand, the effect of maternity leave on vaccination coverage could also be more pronounced in poorer contexts where financial constraints may create very strong incentives for women to return to work and where it may be harder for women to take leave after returning to work to get children immunized (Schliwen et al., 2011). Therefore, although fewer women in LMICs are eligible for the benefit, the effects among those who are might be stronger.

In this study we used Demographic Health Surveys (DHS) from 20 LMICs to estimate the effect of maternity leave policies (i.e., full-time equivalent weeks of paid maternity leave) on childhood vaccination uptake between 2001 and 2008. By leveraging variations in maternity leave policies occurring within some countries relative to others, we were able to rigorously examine effects on vaccination uptake in analyses that accounted for confounding by shared temporal trends in vaccination coverage, unobserved time-invariant confounders that varied across countries, and measured covariates, including birth characteristics, household-level covariates, attendance of skilled health personnel and country-level covariates.

2. Methods

2.1. Sample

We used DHS from participating LMICs, which were provided by MEASURE DHS (Rutstein and Rojas, 2006). The multistage sampling designs of the DHS produce large nationally representative samples that can be used to monitor and evaluate trends in population health and nutrition, as well as other outcomes (Corsi et al., 2012). The DHS contain information on health and reproduction, including fertility and total fertility rate, reproductive health, maternal health, child health, immunization and survival (Rutstein and Rojas, 2006). Using standard model questionnaires and well-trained interviewers, the DHS Program collects data that are comparable across countries (Demographic and Health Survey, 2006). Further details regarding the sampling and survey techniques are available elsewhere (Corsi et al., 2012; Rutstein and Rojas, 2006).

We used data from the DHS to construct a representative sample of live births occurring in selected LMICs between 2001 and 2008. Selection of countries was determined by the availability of at least two DHS surveys between 2001 and 2011 that contained information on the vaccination status of children born between 2001 and 2008. Briefly, mothers surveyed in the DHS are asked to provide information on immunization coverage of all children born alive in the previous 59 months and still living at the time of the survey. These data were used to construct a panel of live births, each with information on the vaccinations they had received, over a consistent set of years and countries. We excluded 37,908 live births that occurred less than four months prior to the survey interview to allow each child a follow-up period of at least four months to receive the vaccinations recorded by the DHS. In addition, we excluded 19,018 children from our sample because immunization history was unavailable for decedents. The final sample included

Table 1
Survey years, sample size and GDP per capita for the sampled countries.

Countries	DHS surveys	Sample size	Average GDP/Cap[a]
Treated countries[b]			
Bangladesh	2004, 2007 and 2011	11,105	423
Ghana	2003 and 2008	4509	493
Kenya	2003 and 2008–09	8521	522
Lesotho	2004 and 2009	5486	716
Uganda	2006 and 2011	11,700	317
Zimbabwe	2005–06 and 2010–11	7636	491
Control countries[c]			
Armenia	2005 and 2010	2183	1246
Bolivia	2003 and 2008	11,975	1004
Cambodia	2005 and 2010	12,371	460
Colombia	2005 and 2010	22,591	3417
Egypt	2005 and 2008	17,378	1233
Honduras	2005–06 and 2011–12	16,651	1390
Madagascar	2003–04 and 2008–09	14,253	278
Malawi	2004 and 2010	23,546	217
Nepal	2006 and 2011	8565	320
Nigeria	2003 and 2008	28,213	795
Philippines	2003 and 2008	9692	1173
Rwanda	2005 and 2010	13,280	271
Senegal	2005 and 2010–11	16,787	751
Tanzania	2004–05 and 2010	12,327	366
Philippines	2003 and 2008	9692	1173
Rwanda	2005 and 2010	13,280	271
Senegal	2005 and 2010–11	16,787	751
Tanzania	2004–05 and 2010	12,327	366
Total		258,769	

[a] Average GDP per capita (purchasing power parity, constant 2005 international $) for the period between 2000 and 2008.
[b] Countries that experienced a change in the duration of any paid leave.
[c] Countries that did not experience a change in the duration of any paid leave.

258,769 live births in 20 DHS countries between 2001 and 2008. Table 1 reports survey years, sample size and Gross Domestic Product (GDP) per capita for the sampled countries.

2.2. Measures

2.2.1. Outcome variables

For each child the DHS measures the receipt of Bacillus Calmette-Guérin (BCG), diphtheria, tetanus, and pertussis (DTP, three doses), and Polio (three doses) vaccines. These vaccines must be administered according to a certain time schedule (see Table 2). BCG is commonly given in health settings near birth, DTP in clinic visits, and Polio in clinic visits and national campaigns (WHO, UNICEF, & World Bank, 2009; World Health Organization, 2009). Information on childhood immunization was collected via vaccination record cards provided by mothers to DHS interviewers during their interview. Mothers' verbal reports of children's vaccination coverage were used in the absence of vaccination cards. Maternal reports may be measured with error; however, Valadez and Weld (1992) and AbdelSalam and Sokal (2004) suggest that reports based on maternal recall are valid for comparing childhood immunization rates across populations.

2.2.2. Exposure variable

The exposure of interest in our study was the legislated length of paid maternity leave in full time equivalent (FTE) weeks for each country and year. Data on current maternity leave policies for each sampled country were made available by UCLA's World Legal Rights Data Centre (WoRLD) and then collected retrospectively for each study year by McGill University's Maternal and Child Health Equity (MACHEquity) research program. Briefly, for each country and year, we first recorded the legislated length of paid leave available to mothers only. We did not distinguish leave that could be taken in the pre-natal period from leave that could be taken after birth. Second, we calculated the length of paid maternity leave in FTE weeks by multiplying the legislated length of leave by the wage replacement rate. Further details regarding the calculation of FTE weeks of paid leave are available elsewhere (Daku et al., 2012; Heymann et al., 2011).

2.2.3. Control variables

Based on the extant literature (Babalola and Lawan, 2009; Bondy et al., 2009; Daku et al., 2012; Danis et al., 2010a, 2010b; Falagas and Zarkadoulia, 2008; Glatman-Freedman and Nichols, 2012; Sanou et al., 2009; Wiysonge et al., 2012) we accounted for individual- and country-level determinants of childhood vaccination uptake. This included socio-demographic characteristics of the mother and household (e.g., mother's education and urban/rural area of residence), relevant birth characteristics (e.g., gender, mother's age at birth, birth order and number of children), and attendance of skilled health personnel. Controlling for these characteristics, although they were unlikely to confound the effects of maternity leave policies, may have increased the precision of our estimates. Additionally, the World Bank's World Development Indicators and Global Development Finance (WDI and GDF) (World Bank, 2014) were used to obtain country-level information for each study year, including per capita gross domestic product (GDP) (purchasing power parity, constant 2005 international $), per capita total health expenditure and per capita government health expenditure. We also included country and year fixed effects in order to adjust for unobserved heterogeneity at the country-level and across time that may be correlated with our independent variables. Table 3 reports the definition of all variables used in the analysis.

2.3. Statistical analysis

We estimated the effects of paid maternity leave, measured by FTE weeks, on the probability of receiving BCG, DTP (three doses) and Polio (three doses) vaccines using Logistic regression models of the general form:

$$Log\left[Pr(Y_{ijt}=1)/1-Pr(Y_{ijt}=1)\right] = \propto + \delta ML_{jt-1} + \sum_{i=1}^{n}\beta_k X_{ijt} + \sum_{j=1}^{k}\Phi_k Z_{jt} + \varphi_j + \gamma_t + \varepsilon_{ijt}, \qquad (1)$$

where Y_{ijt} specifies our outcome of interest (i.e. BCG, DTP and Polio vaccines) for birth i in country j in year t and ML_{jt-1} is the number of FTE weeks of paid maternity leave guaranteed by policy in country j in the year before the birth (lagged by one year to respect the temporal ordering between the policy and outcome). Therefore, the estimated marginal effect of ML_{jt-1} measures the effect of a one FTE week increase in guaranteed paid maternity leave on the probability of receiving the vaccine. X_{ijt} and Z_{jt} index individual- and country-level covariates, respectively. We included fixed effects for country (φ_j) and year (γ_t) to control for unobserved time-invariant confounders that vary across countries and any temporal trends in vaccination uptake that are shared across countries, respectively. Therefore, we were able to identify the effects of paid maternity leave policy through changes in vaccination rates occurring in countries that changed their policies relative to corresponding changes in vaccination in countries that did not change their policies over the study period (the “difference-in-differences”). In our analysis, we constructed three models. Model 1 contained FTE and country and year fixed effects. The second model additionally adjusted for birth characteristics, household-level covariates and attendance of skilled health personnel. In Model 3, we also controlled for time varying country-level covariates. We incorporated respondent-level sampling weights and used robust standard errors in all models to account for clustering of births by birth mother and country. Using the annual female population provided by the Population Division of the United Nations (UN DESA, 2014) we applied the de-normalization of standard weights approach (as per the DHS Sampling and Household Listing Manual (ICF International, 2012)) in order to calculate an appropriate weight for each observation in the analyses. All statistical analyses were performed using version 13 of the Stata software package (Stata Corp, College Station, Tex).

Table 2
Vaccination schedules for BCG, DTP and Polio vaccines: The World Health Organization recommendations.

Antigen	Age of 1st dose	Interval between doses	
		1st and 2nd	2nd and 3rd
Bacillus Calmette-Guérin (BCG)	As soon as possible after birth		
Diphtheria, tetanus, and pertussis (DTP)	6 weeks (minimum)	4 weeks (minimum)	4 weeks (minimum)
Polio	6 weeks (minimum)	4 weeks (minimum)	4 weeks (minimum)

Adapted from World Health Organization (2014).

Table 3
Description of the main variables.

Variables	Definitions
Outcome variables	
BCG	1 = if child received BCG vaccination, 0 otherwise
DTP1	1 = if child received DTP dose 1 vaccination, 0 otherwise
DTP2	1 = if child received DTP dose 2 vaccination, 0 otherwise
DTP3	1 = if child received DTP dose 3 vaccination, 0 otherwise
Polio1	1 = if child received Polio dose 1 vaccination, 0 otherwise
Polio2	1 = if child received Polio dose 2 vaccination, 0 otherwise
Polio3	1 = if child received Polio dose 3 vaccination, 0 otherwise
Exposure variable	
FTE	The legislated length of paid maternity leave in full time equivalent (FTE) weeks for each country
Birth characteristics variables	
Gender	
Male	1 = if male, 0 otherwise
Female (ref.)	1 = if female, 0 otherwise
Birth order	
Birth order# 1	1 = if child's birth order was first, 0 otherwise
Birth order# 2	1 = if child's birth order was second, 0 otherwise
Birth order#2+ (ref.)	1 = if child's birth order was third or higher, 0 otherwise
Mother's age at birth (years)	
19 and below	1 = if mother's aged at birth was 19 and below, 0 otherwise
20 to 39 (ref.)	1 = if mother's age at birth was 20–39, 0 otherwise
40 and above	1 = if mother's age at birth was 40 and above, 0 otherwise
Household-level covariates	
Mother's education	Years of education completed by mother
Household size	Number of household members
Residency status	
Urban	1 = if child resided in urban area, 0 otherwise
Rural (ref.)	1 = if child resided in rural area, 0 otherwise
Attendance of skilled health personnel	1 = if delivery was assisted by an accredited health professional (e.g. midwife, doctor or nurse), 0 otherwise
Country-level covariates	
Log GDP per capita	Natural logarithm of per capita gross domestic product (purchasing power parity, constant 2005 international $)
Log total health expenditure per capita	Natural logarithm of per capita total health expenditure
Log government health expenditure per capita	Natural logarithm of per capita government health expenditure

Note: *ref.* indicates the reference category in the regression analysis.

2.4. Supplementary analyses

We performed supplementary analyses, including several sensitivity analyses to assess the robustness of our main estimates. Firstly, we performed our analyses using duration of paid maternity leave (paid duration, PDR). This analysis enabled us to examine the effect of the duration of maternity leave without adjusting for wage replacement. Secondly, in order to examine whether an alternative measure of wage replacement affected our findings, we used a maternity leave variable constructed based on International Labor Organization (ILO) Convention No. 183 as our exposure variable. Per the ILO convention, this exposure variable measured for each country and year the duration of paid leave with a wage replacement rate of at least two-thirds of previous earnings. Thirdly, we estimated the effects of maternity leave on the probability of vaccination uptake using linear probability models. Fourthly, we investigated whether policy lags of different lengths influenced our main conclusions. As policy changes should not influence vaccination uptake in prior years, we also examined this by using a policy lead (with policies measured the year after vaccination uptake, $t+1$). Finally, as female labor force participation may influence both maternity leave policy and vaccination uptakes, we repeated our analyses including female labor force participation.

3. Results

3.1. Descriptive statistics

The descriptive statistics reported in Table A.1 suggest that 87 percent of children in the selected countries were immunized for BCG over the study period. The average vaccination coverage for DTP1, DTP2 and DTP3 were 85, 81 and 74 percent, respectively. The proportion of children in the sampled countries who received Polio1, Polio2, and Polio3 were 91, 86 and 75 percent, respectively. Fig. 1 illustrates trends in vaccination coverage over the study period. As shown in the figure, coverage rates for all vaccines were higher in countries that changed their maternity leave policy (treated countries) compared to the countries without any policy change (control countries). The figure also indicated an initial decrease in the coverage of all vaccines from 2001 to 2002, followed by an increase.

The average FTE weeks of paid maternity leave in our sample was around 10 weeks. Fig. 2 shows FTE weeks of paid maternity leave for sampled countries for the period between 2000 and 2008. There was substantial variation in the duration of FTE across countries. While countries such as Armenia, Bangladesh, Madagascar and Senegal offered at least 14 FTE weeks of paid leave, mothers in Cambodia, Lesotho and Nigeria were entitled to less than 7 weeks. The duration of FTE week of paid leave increased in Bangladesh, Ghana, Kenya, Lesotho, Uganda and Zimbabwe by an average of 5.4 weeks over the study period.

3.2. The effect of FTE weeks of paid maternity leave on vaccination uptake

Table 4 reports the effects of a one FTE week increase in paid maternity leave on the uptake of BCG. The results of the fully-adjusted model specification (i.e. Model 3) suggested a positive but not statistically significant effect of FTE weeks of leave on the probability of BCG vaccination. These findings were similar when linear probability models were used in the analysis. Additionally, maternal leave measured using PDR was not associated with BCG

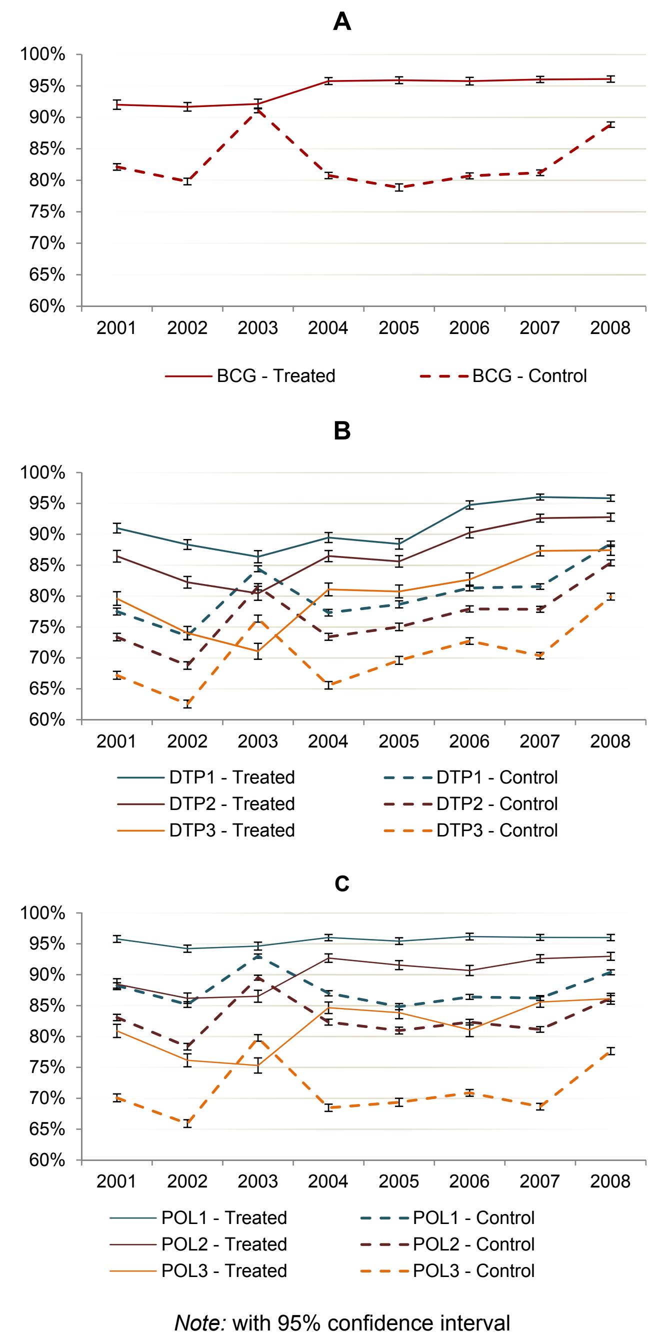

Fig. 1. Trends in vaccination rates for BCG, DTP (3 doses) and Polio (3 doses) in treated and control countries, 2001–2008.

uptake. Similar to our main findings, a positive but insignificant effect was found when we used policy lags of zero and two years for the FTE variable in our regressions (Table A.2 in the appendix). In addition, our results suggested that lower birth order, urban residence, mother's education and attendance of skilled birth attendance were positively associated with the probability of BCG vaccination, whereas GDP per capita, household size and mother's age at birth (less than 19 years) were negatively associated with BCG vaccination uptake.

An increase in paid maternity leave increased immunization rates for all three doses of DTP (Table 5). According to the fully-adjusted model specification, each additional week of leave increased the proportions of DTP1, 2 and 3 coverage by 1.38 (CI = 1.18, 1.57), 1.62 (CI = 1.34, 1.91) and 2.17 (CI = 1.76, 2.58) percentage points, respectively. These results were similar when modeled using linear probability regressions and robust to alternate measures of maternity leave. The results of our supplementary analyses with policy lags of zero and two years also revealed a positive and statistically significant effect of FTE weeks of leave (and other measures of maternity leave) on uptake of three doses of DTP. As expected if the relationship is not spurious, when we included a one-year lead of the policy in our regression analyses, the results did not show any association between increases in maternity leave and DTP immunization of children prior to the policy change (Table A.3 in the appendix). Results showed that factors such as lower birth order, per capita total and government health expenditures, mother's education and attendance of skilled birth attendance were positively associated with the probability of DTP (three doses) immunization. In contrast, mother's age at birth (less than 19 years) and household size were negatively associated with the probability of DTP vaccination.

Table 6 shows the effects of paid maternity leave on Polio (3 doses) vaccination uptake. Our fully-adjusted model suggested a positive but not statistically significant effect of FTE weeks of leave on uptakes for Polio1 and 3. Results were, in general, similar when modeled using linear probability and alternate measures of maternity leave. There was a positive impact of leave, measured using FTE weeks or based on the ILO convention, on Polio2 and 3 vaccination uptakes when we used a two-year lag period in our analysis (Table A.4 in the appendix). Other characteristics, including mother's education and attendance of skilled birth attendance were positively associated with the probability of Polio vaccination. Similar to the results for BCG and DTP, there was a negative association between mother's age at birth (less than 19 years) and household size and the probability of Polio vaccination.

4. Discussion and conclusions

Raising children is an extremely time-intensive activity. The commitment of time is particularly large during the first months of life. Some important time investments, such as childhood vaccination, present challenges for employed parents that may be alleviated by rights to leave (Ruhm, 2000). This is particularly true if immunizations are provided at specified times in health centers, as opposed to in more locations or at more flexible times as part of campaigns. In this study, we aimed to provide a rigorous analysis of the effect of maternity leave policies on childhood vaccination uptakes in 20 LMICs. More specifically, we used a fixed effects approach to estimate the effect of paid maternity leave on childhood immunization by linking national maternity leave policies with individual, household and country level data. We used DHS surveys to construct a longitudinal dataset of live births occurring between 2001 and 2008 and examine the impact of paid maternity leave on the uptake of BCG, DTP and Polio vaccines. Examining effects of paternity leave is also important but at present far fewer countries provide paternity leave of sufficient duration to potentially affect vaccination rates.

Similar to studies in the US (Berger et al., 2005), Japan (Ueda et al., 2014) and an initial global ecological study by Daku et al. (2012), our fixed effects results indicated that paid maternity leave was positively associated with higher immunization rates for all three doses of the DTP vaccine. An additional week of paid maternity leave increased the probability of DTP1, 2 and 3 vaccinations by 1.38, 1.62 and 2.17 percentage points, respectively. Our findings were robust to control for time-varying country characteristics, household-level covariates, individual birth characteristics, and attendance of skilled health personnel. These findings

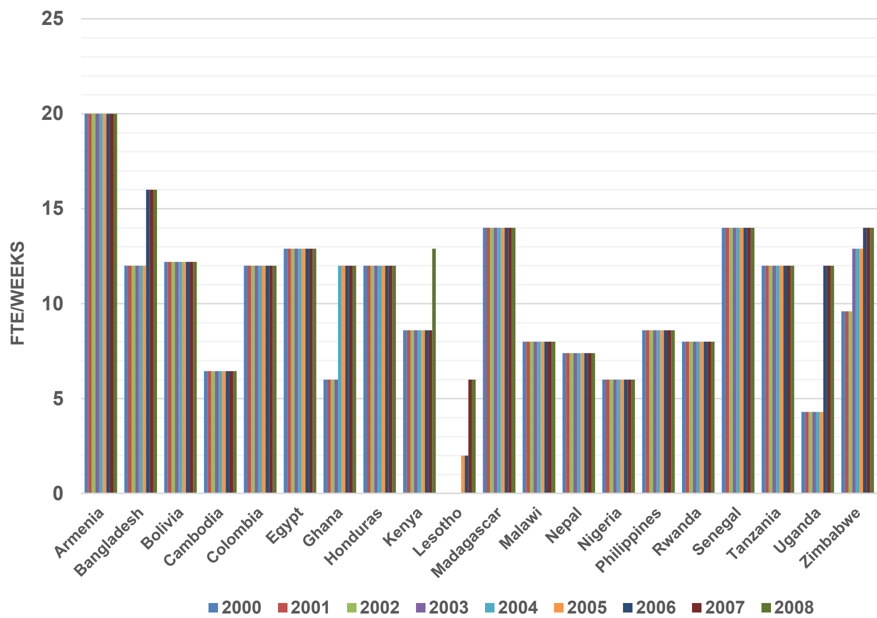

Fig. 2. Full-Time Equivalent (FTE) weeks of paid maternity leave, 2000–2008.

suggested that there is a benefit to increasing paid maternity leave for DTP vaccination uptake in LMICs and supported the findings of a qualitative study by McCormick et al. (1997), which suggested that time off from work was one of the main barriers to adhering to an immunization schedule.

In contrast to analyses of DTP vaccinations, we found little evidence for an effect of paid maternity leave on the probability of receiving BCG or Polio immunizations, after adjustment for potential confounders. The positive but insignificant impact of FTE on BCG vaccination could be explained by the fact that this vaccine is scheduled soon after birth, thus making conflicting work schedules less of a barrier to BCG vaccination. The insignificant effect of maternity leave on Polio vaccination might be partly explained by the large-scale Polio immunization campaigns in LMICs that increased knowledge about Polio immunization goals and access to immunizations in a wide range of settings and times beyond clinic hours. As a result, work could be less of a barrier to Polio immunization. This is consistent with the descriptive statistics of our sample suggesting that Polio vaccination coverage was higher than DTP coverage (see Table A.1). In order for Polio campaigns to bias our

Table 4
Effect of an additional FTE week of paid maternity leave on the probability BCG vaccination among births occurring in 20 low and -middle-income countries between 2001-2008: results from logistic regression models.

	Model 1	Model 2	Model 3[a,b]
FTE week of paid leave	0.41 (0.14, 0.68)	0.2 (0.02, 0.38)	0.16 (−0.02, 0.34)
Birth characteristics			
Gender/Male		0.19 (−0.09, 0.46)	0.19 (−0.09, 0.46)
Birth order			
Birth order# 1		0.99 (0.57, 1.42)	1.02 (0.6, 1.45)
Birth order# 2		0.65 (0.3, 0.99)	0.65 (0.31, 0.99)
Mother's age at birth			
19 and below		−1.81 (−2.35, −1.27)	−1.81 (−2.35, −1.27)
40 and above		0 (−0.57, 0.58)	−0.03 (−0.6, 0.53)
Household-level covariates			
Mother's education		0.81 (0.76, 0.87)	0.8 (0.75, 0.86)
Household size		−0.06 (−0.11, −0.02)	−0.06 (−0.11, −0.02)
Urban		1.1 (0.58, 1.61)	1.16 (0.64, 1.67)
Attendance of skilled health personnel		5.19 (4.78, 5.6)	5.18 (4.76, 5.6)
Country-level covariates			
Log GDP per capita			−7.23 (−11.4, −3.06)
Log total health expenditure per capita			0.91 (−0.63, 2.45)
Log government health expenditure per capita			−0.5 (−1.74, 0.74)
Sample weights	Y	Y	Y
Country fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Pseudo R-squared	0.262	0.378	0.385

Notes: Reported estimates are marginal effects calculated at the means of the independent variables; The estimated marginal effects are multiplied by 100; The values in parentheses are 95% confidence intervals.
[a] Zimbabwe was dropped from Model 3 due to missing information on total and government health expenditures.
[b] Similar results obtained when we included female labor-force participation in the model (see Table A.2, Model S).

Table 5
Effect of an additional FTE week of paid maternity leave on the probability DTP (3 doses) vaccination among births occurring in 20 low and -middle-income countries between 2001-2008: results from logistic regression models.

	Model 1	Model 2	Model 3[a,b]
DTP1 (First dose)			
FTE week of paid leave	1.36 (1.13, 1.58)	1.04 (0.86, 1.22)	1.38 (1.18, 1.57)
Birth characteristics			
Gender/Male		0.23 (−0.05, 0.52)	0.22 (−0.07, 0.52)
Birth order			
Birth order# 1		1.06 (0.61, 1.52)	1.16 (0.69, 1.63)
Birth order# 2		0.83 (0.46, 1.2)	0.86 (0.48, 1.25)
Mother's age at birth			
19 and below		−1.86 (−2.44, −1.28)	−1.92 (−2.5, −1.33)
40 and above		0.41 (−0.26, 1.08)	0.34 (−0.34, 1.01)
Household-level covariates			
Mother's education		0.88 (0.82, 0.94)	0.89 (0.83, 0.95)
Household size		−0.06 (−0.12, −0.01)	−0.06 (−0.11, −0.01)
Urban		0.52 (−0.06, 1.09)	0.58 (−0.01, 1.17)
Attendance of skilled health personnel		4.81 (4.38, 5.24)	4.87 (4.43, 5.31)
Country-level covariates			
Log GDP per capita			−10.11 (−15.36, −4.85)
Log total health expenditure per capita			3.13 (1.18, 5.08)
Log government health expenditure per capita			4.95 (3.57, 6.33)
Pseudo R-squared	0.274	0.355	0.364
DTP2 (Second dose)			
FTE week of paid leave	1.52 (1.22, 1.82)	1.24 (0.98, 1.5)	1.62 (1.34, 1.91)
Birth characteristics			
Gender/Male		0.27 (−0.19, 0.73)	0.28 (−0.19, 0.75)
Birth order			
Birth order# 1		1.57 (0.87, 2.27)	1.71 (0.99, 2.42)
Birth order# 2		1.49 (0.88, 2.09)	1.56 (0.94, 2.19)
Mother's age at birth			
19 and below		−2.77 (−3.64, −1.89)	−2.85 (−3.74, −1.95)
40 and above		0.78 (−0.2, 1.77)	0.73 (−0.27, 1.72)
Household-level covariates			
Mother's education		1.36 (1.28, 1.44)	1.38 (1.29, 1.46)
Household size		−0.14 (−0.22, −0.07)	−0.14 (−0.21, −0.06)
Urban		0.45 (−0.42, 1.31)	0.52 (−0.35, 1.4)
Attendance of skilled health personnel		7.17 (6.54, 7.8)	7.27 (6.64, 7.91)
Country-level covariates			
Log GDP per capita			−8.3 (−16, −0.61)
Log total health expenditure per capita			6.73 (3.63, 9.82)
Log government health expenditure per capita			7.04 (4.84, 9.25)
Pseudo R-squared	0.243	0.317	0.326
DTP3 (Third dose)			
FTE week of paid leave	1.99 (1.59, 2.4)	1.83 (1.44, 2.21)	2.17 (1.76, 2.58)
Birth characteristics			
Gender/Male		0.2 (−0.43, 0.84)	0.23 (−0.42, 0.88)
Birth order			
Birth order# 1		1.87 (0.88, 2.87)	2.04 (1.02, 3.06)
Birth order# 2		1.63 (0.7, 2.56)	1.72 (0.76, 2.68)
Mother's age at birth			
19 and below		−4.12 (−5.43, −2.82)	−4.22 (−5.57, −2.88)
40 and above		0.7 (−0.77, 2.16)	0.56 (−0.94, 2.05)
Household-level covariates			
Mother's education		1.89 (1.78, 2.01)	1.92 (1.8, 2.03)
Household size		−0.29 (−0.4, −0.18)	−0.29 (−0.4, −0.18)
Urban		0.46 (−0.75, 1.67)	0.52 (−0.71, 1.75)
Attendance of skilled health personnel		9.69 (8.86, 10.51)	9.88 (9.04, 10.71)
Country-level covariates			
Log GDP per capita			−6.01 (−16.46, 4.44)
Log total health expenditure per capita			18.35 (13.61, 23.09)
Log government health expenditure per capita			8.48 (5.2, 11.76)
Pseudo R-squared	0.204	0.261	0.270
Sample weights	Y	Y	Y
Country fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y

Notes: Reported estimates are marginal effects calculated at the means of the independent variables; The estimated marginal effects are multiplied by 100; The values in parentheses are 95% confidence intervals.

[a] Zimbabwe was dropped from Model 3 due to missing information on total and government health expenditures.

[b] Similar results obtained when we included female labor-force participation in the model see Table A.2, Model S.

estimates, their impacts would need to be concurrent with the changes in maternity leave policies that we examined.

In response to the challenges faced by working parents and their newborn children, 187 countries have already introduced leave for mothers with the aim of promoting infant and maternal health, child development, and providing economic security for families (Daku et al., 2012; Heymann and McNeill, 2013; Heymann et al., 2011). However, the duration and wage replacement during this

Table 6
Effect of an additional FTE week of paid maternity leave on the probability Polio (3 doses) vaccination among births occurring in 20 low and -middle-income countries between 2001–2008: results from logistic regression models.

	Model 1	Model 2	Model 3[a,b]
Polio1 (First dose)			
FTE week of paid leave	0.18 (−0.01, 0.36)	0.11 (−0.05, 0.26)	0.06 (−0.09, 0.22)
Birth characteristics			
Gender/Male		0.02 (−0.22, 0.25)	0.02 (−0.22, 0.25)
Birth order			
Birth order# 1		0.44 (0.06, 0.82)	0.45 (0.07, 0.83)
Birth order# 2		0.36 (0.06, 0.65)	0.35 (0.06, 0.65)
Mother's age at birth			
19 and below		−1.05 (−1.53, −0.58)	−1.05 (−1.52, −0.57)
40 and above		0.14 (−0.35, 0.64)	0.12 (−0.37, 0.61)
Household-level covariates			
Mother's education		0.48 (0.43, 0.53)	0.47 (0.42, 0.52)
Household size		−0.07 (−0.11, −0.03)	−0.07 (−0.11, −0.03)
Urban		−0.01 (−0.43, 0.41)	0.02 (−0.4, 0.44)
Attendance of skilled health personnel		2.78 (2.43, 3.13)	2.77 (2.41, 3.12)
Country-level covariates			
Log GDP per capita			−2.88 (−6.47, 0.71)
Log total health expenditure per capita			1 (−0.33, 2.34)
Log government health expenditure per capita			0.14 (−0.81, 1.09)
Pseudo R-squared	0.193	0.251	0.254
Polio2 (Second dose)			
FTE week of paid leave	0.44 (0.18, 0.7)	0.32 (0.09, 0.55)	0.24 (0.01, 0.48)
Birth characteristics			
Gender/Male		0.2 (−0.24, 0.64)	0.2 (−0.25, 0.64)
Birth order			
Birth order# 1		1.19 (0.55, 1.83)	1.22 (0.58, 1.87)
Birth order# 2		1.16 (0.59, 1.72)	1.15 (0.58, 1.72)
Mother's age at birth			
19 and below		−2.23 (−3.05, −1.41)	−2.23 (−3.06, −1.4)
40 and above		0.65 (−0.24, 1.54)	0.61 (−0.28, 1.51)
Household-level covariates			
Mother's education		0.98 (0.9, 1.06)	0.98 (0.9, 1.05)
Household size		−0.11 (−0.19, −0.04)	−0.11 (−0.19, −0.03)
Urban		−0.15 (−0.81, 0.52)	−0.12 (−0.78, 0.55)
Attendance of skilled health personnel		4.2 (3.64, 4.75)	4.14 (3.58, 4.71)
Country-level covariates			
Log GDP per capita			4.87 (−1.81, 11.54)
Log total health expenditure per capita			4.51 (2.05, 6.97)
Log government health expenditure per capita			−0.91 (−2.68, 0.87)
Pseudo R-squared	0.154	0.208	0.210
Polio3 (Third dose)			
FTE week of paid leave	0.61 (0.25, 0.98)	0.54 (0.19, 0.89)	0.28 (−0.08, 0.65)
Birth characteristics			
Gender/Male		0.33 (−0.33, 0.98)	0.34 (−0.32, 1)
Birth order			
Birth order# 1		2.26 (1.24, 3.27)	2.27 (1.24, 3.29)
Birth order# 2		1.43 (0.54, 2.31)	1.41 (0.51, 2.31)
Mother's age at birth			
19 and below		−3.55 (−4.82, −2.27)	−3.51 (−4.81, −2.22)
40 and above		1.44 (−0.08, 2.95)	1.37 (−0.16, 2.9)
Household-level covariates			
Mother's education		1.35 (1.24, 1.46)	1.35 (1.24, 1.46)
Household size		−0.22 (−0.35, −0.1)	−0.22 (−0.34, −0.09)
Urban		−1.53 (−2.59, −0.46)	−1.54 (−2.61, −0.47)
Attendance of skilled health personnel		4.44 (3.61, 5.28)	4.36 (3.51, 5.2)
Country-level covariates			
Log GDP per capita			22.45 (11.57, 33.34)
Log total health expenditure per capita			11.33 (6.95, 15.7)
Log government health expenditure per capita			−2.71 (−5.83, 0.41)
Pseudo R-squared	0.149	0.174	0.176
Sample weights	Y	Y	Y
Country fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y

Notes: Reported estimates are marginal effects calculated at the means of the independent variables; The estimated marginal effects are multiplied by 100; The values in parentheses are 95% confidence intervals.
[a] Zimbabwe was dropped from Model 3 due to missing information on total and government health expenditures.
[b] Similar results obtained when we included female labor-force participation in the model (see Table A.2, Model S).

leave varies substantially. Existing literature has already indicated the impact of maternity leave on reducing childhood morbidity and mortality, improving child development, breastfeeding uptake and health for mothers (Baker and Milligan, 2008; Chuang et al., 2010; McGovern et al., 1997; Ruhm, 2000; Staehelin et al., 2007). Our findings suggest that improvements in vaccination coverage for DTP may be one of the mechanisms explaining effects of maternity leave on child health in LMICs.

In order to promote childhood immunization we must adopt a multilevel strategy that addresses immunization barriers at parental, household, community, service delivery and country levels. The results of our study suggest that maternity leave policies might represent one approach for promoting vaccination uptake. As families take direct responsibility for ensuring that their children receive all the recommended vaccines, it is essential to address barriers to childhood immunization, including time off work for employed parents (Janicke et al., 2001; Lieu et al., 1994; Luman et al., 2003; Shefer et al., 1998; Taylor and Cufley, 1996; Watson and Kemper, 1995). Other approaches could include paid paternity leave, parental leave, and paid leave to meet children's health needs, which could similarly increase the availability of working parents, or increasing the availability of vaccines outside of clinics and working hours.

This study has several limitations. *First*, we limited our control variables to those available in DHSs in all of the selected countries. *Second*, we relied on maternal recall in the determination of their child's vaccination when the vaccination record card was not available (43 percent). While some studies (AbdelSalam and Sokal, 2004; Valadez and Weld, 1992) confirmed the validity of using maternal recall to determine childhood immunization status, it would be ideal to obtain this information using written record to avoid potential recall bias. Similar to other studies using DHS datasets to determine factors associated with childhood vaccination (e.g. Bondy et al., 2009), we were unfortunately unable to examine the potential measurement error resulting from the use of mother's recall in our study. *Third*, as the DHS collects immunization coverage of still living children at the time of the survey date, our study demonstrated the effect of paid leave on children who were alive at the time of survey. *Fourth*, our maternity leave variable is calculated based on legislated maternity leave and does not account for other leave (i.e., parental leave) that might also be available to mothers; further, it does not measure what percentage of mothers are not covered by legislated leave. *Fifth*, some time-varying covariates in our analysis are subject to measurement error because they are taken at the time of interview and assigned to all prior births. *Sixth*, our analysis is limited by potential unmeasured time-varying confounding; it is possible that another policy or program that influenced vaccination coverage coincided with changes in maternity leave policy. *Finally*, with the inclusion of sampling weights, our results are generalizable to the 20 LMICs included in our analyses; however, further extrapolation should be done cautiously.

In conclusion, our study suggested a positive effect of paid maternity leave on DTP vaccination coverage. These findings were consistent with the hypothesis that more generous paid maternity leave policies have the potential to improve vaccination coverage, particularly for immunizations like DTP that are not part of special immunizations campaigns and are delivered several weeks after birth when mothers might be expected to return to work. Further research is required to understand all the options that may affect working parents' ability to get their children vaccinated, including whether there are shared mechanisms across maternity leave, paternity leave, and paid leave to meet children's health needs.

Conflict of interest statement

We declare that we have no conflict of interest.

Authors' contributions

All authors contributed to the conception and design of the study, MH performed the statistical analysis, all authors interpreted results, MH drafted the manuscript, and JH, ES, SH and AN helped with drafting and revisions. All authors read and approved the final version of the manuscript.

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Appendix. Tables

Table A.1
Descriptive statistics of variables used in the study.

Variables		
Outcome variables		
BCG	0.87	0.33
DTP1	0.85	0.36
DTP2	0.81	0.39
DTP3	0.74	0.44
Polio1	0.91	0.29
Polio2	0.86	0.35
Polio3	0.75	0.43
Exposure variable		
FTE	10.35	3.23
Birth characteristics variables		
Gender		
Male	0.51	0.50
Female (ref.)	0.49	0.50
Birth order		
Birth order# 1	0.27	0.44
Birth order# 2	0.23	0.42
Birth order#2+ (ref.)	0.50	0.50
Mother's age at birth (years)		
19 and below	0.16	0.36
20 to 39 (ref.)	0.80	0.40
40 and above	0.04	0.20
Household-level covariates		
Mother's education	5.32	4.62
Household size	6.50	3.45
Residency status		
Urban	0.28	0.45
Rural (ref.)	0.72	0.45
Attendance of skilled health personnel	0.40	0.49
Country-level covariates		
Log GDP per capita	6.41	0.58
Log total health expenditure per capita	4.32	0.75
Log government health expenditure per capita	3.37	0.82
Female labor-force participation[a]	47.01	16.75

Note: *ref.* indicates the reference category in the regression analysis.
[a] This variable was used in the Model S.

Table A.2
Effect of an additional week of FTE, ILO Convention and PDR on the probability BCG vaccination, 2001–8; data from Demographic and Health Surveys for 20 low and middle-income countries: Logistic and LPM models results using different lags.

	Model 1	Model 2	Model 3[a]	Model S[a,b]
Logistic models				
FTE 1-year lead	**0.41 (0.18, 0.64)**	**0.17 (0.03, 0.32)**	**0.17 (0.03, 0.31)**	0.1 (−0.05, 0.26)
FTE zero-year lagged	**0.34 (0.09, 0.59)**	0.13 (−0.04, 0.29)	0.11 (−0.05, 0.27)	0.03 (−0.14, 0.2)
FTE 1-year lagged	**0.41 (0.14, 0.68)**	**0.2 (0.02, 0.38)**	0.16 (−0.02, 0.34)	0.08 (−0.11, 0.28)
FTE 2-year lagged	**0.41 (0.15, 0.68)**	**0.23 (0.04, 0.41)**	0.17 (−0.01, 0.35)	0.09 (−0.1, 0.28)
ILO Convention 1-year lead	**0.32 (0.14, 0.5)**	**0.14 (0.03, 0.25)**	**0.14 (0.04, 0.24)**	0.07 (−0.05, 0.19)
ILO Convention zero-year lagged	**0.27 (0.08, 0.46)**	0.1 (−0.02, 0.22)	0.1 (−0.01, 0.22)	0.02 (−0.11, 0.15)
ILO Convention 1-year lagged	**0.27 (0.07, 0.46)**	0.12 (−0.01, 0.24)	**0.13 (0.01, 0.24)**	0.05 (−0.09, 0.18)
ILO Convention 2-year lagged	**0.25 (0.07, 0.44)**	**0.13 (0.01, 0.26)**	**0.14 (0.02, 0.26)**	0.07 (−0.06, 0.19)
PDR 1-year lead	**0.38 (0.12, 0.63)**	0.14 (−0.02, 0.3)	**0.15 (0, 0.31)**	0.11 (−0.05, 0.27)
PDR zero-year lagged	0.27 (−0.02, 0.56)	0.06 (−0.13, 0.25)	0.07 (−0.12, 0.25)	0.03 (−0.16, 0.22)
PDR 1-year lagged	0.31 (−0.02, 0.65)	0.11 (−0.11, 0.34)	0.15 (−0.08, 0.37)	0.11 (−0.11, 0.34)
PDR 2-year lagged	0.27 (−0.08, 0.62)	0.1 (−0.14, 0.33)	0.12 (−0.1, 0.35)	0.09 (−0.13, 0.31)
Linear probability models				
FTE 1-year lead	0.21 (−0.02, 0.45)	0.07 (−0.14, 0.27)	0.10 (−0.11, 0.3)	0.06 (−0.14, 0.25)
FTE zero-year lagged	0.13 (−0.11, 0.37)	0 (−0.22, 0.22)	0.01 (−0.21, 0.24)	−0.03 (−0.24, 0.18)
FTE 1-year lagged	0.19 (−0.05, 0.43)	0.14 (−0.08, 0.36)	0.15 (−0.08, 0.37)	0.1 (−0.11, 0.31)
FTE 2-year lagged	0.21 (−0.01, 0.42)	**0.2 (0, 0.4)**	**0.2 (0.01, 0.39)**	0.15 (−0.03, 0.33)
ILO 1-year lead	0.17 (−0.02, 0.36)	0.07 (−0.1, 0.23)	0.11 (−0.05, 0.27)	0.06 (−0.09, 0.21)
ILO Convention zero-year lagged	0.1 (−0.09, 0.3)	0 (−0.18, 0.18)	0.05 (−0.12, 0.23)	−0.01 (−0.17, 0.16)
ILO Convention 1-year lagged	0.1 (−0.08, 0.28)	0.06 (−0.1, 0.23)	0.13 (−0.03, 0.3)	0.08 (−0.07, 0.23)
ILO Convention 2-year lagged	0.1 (−0.05, 0.26)	0.1 (−0.05, 0.25)	**0.19 (0.05, 0.33)**	**0.14 (0.01, 0.27)**
PDR 1-year lead	0.15 (−0.1, 0.4)	−0.01 (−0.23, 0.21)	0.05 (−0.17, 0.27)	0.04 (−0.17, 0.26)
PDR zero-year lagged	0.02 (−0.23, 0.28)	−0.12 (−0.35, 0.11)	−0.06 (−0.3, 0.19)	−0.06 (−0.3, 0.18)
PDR 1-year lagged	0.05 (−0.2, 0.31)	−0.01 (−0.25, 0.24)	0.11 (−0.15, 0.37)	0.1 (−0.15, 0.36)
PDR 2-year lagged	0.02 (−0.22, 0.26)	−0.01 (−0.23, 0.22)	0.12 (−0.1, 0.34)	0.11 (−0.11, 0.33)
Sample weights	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y

Notes: Reported estimates for Logistic models are marginal effects calculated at the means of the independent variables; The estimated coefficients and marginal effects are multiplied by 100; The values in parentheses are 95% confidence intervals.

[a] Zimbabwe was dropped from Models 3 and S due to missing information on total and government health expenditures.

[b] Model S includes all covariates included in Model 3 and female labor force participation.

Table A.3
Effect of an additional week of FTE, ILO Convention and PDR on the probability DTP vaccination, 2001–8; data from Demographic and Health Surveys for 20 low and middle-income countries: Logistic and LPM models using different lags.

	Model 1	Model 2	Model 3[a]	Model S[a,b]
DTP1				
Logistics models				
FTE 1-year lead	**0.28 (0.11, 0.45)**	0.1 (−0.03, 0.23)	**0.14 (0, 0.27)**	−0.02 (−0.18, 0.13)
FTE zero-year lagged	**1.15 (0.95, 1.35)**	**0.85 (0.69, 1.01)**	**1.16 (0.99, 1.33)**	**1.17 (0.98, 1.35)**
FTE 1-year lagged	**1.36 (1.13, 1.58)**	**1.04 (0.86, 1.22)**	**1.38 (1.18, 1.57)**	**1.37 (1.17, 1.58)**
FTE 2-year lagged	**1.04 (0.81, 1.27)**	**0.78 (0.59, 0.97)**	**1.01 (0.81, 1.22)**	**0.95 (0.74, 1.16)**
ILO Convention 1-year lead	**0.23 (0.09, 0.38)**	**0.08 (-0.04, 0.19)**	**0.12 (0, 0.23)**	−0.05 (−0.19, 0.08)
ILO Convention zero-year lagged	**0.96 (0.79, 1.14)**	**0.7 (0.56, 0.84)**	**0.87 (0.72, 1.02)**	**0.89 (0.73, 1.05)**
ILO Convention 1-year lagged	**1.15 (0.94, 1.35)**	**0.86 (0.69, 1.02)**	**1.08 (0.91, 1.26)**	**1.09 (0.9, 1.27)**
ILO Convention 2-year lagged	**0.88 (0.66, 1.1)**	**0.65 (0.47, 0.82)**	**0.79 (0.61, 0.96)**	**0.73 (0.55, 0.91)**
PDR 1-year lead	**0.29 (0.11, 0.46)**	0.1 (−0.04, 0.24)	0.13 (−0.01, 0.28)	0.02 (−0.14, 0.17)
PDR zero-year lagged	**1.26 (1.04, 1.49)**	**0.94 (0.76, 1.12)**	**1.31 (1.12, 1.51)**	**1.29 (1.09, 1.48)**
PDR 1-year lagged	**1.52 (1.24, 1.79)**	**1.16 (0.94, 1.38)**	**1.54 (1.31, 1.77)**	**1.52 (1.28, 1.75)**
PDR 2-year lagged	**1.24 (0.94, 1.54)**	**0.93 (0.69, 1.18)**	**1.1 (0.86, 1.34)**	**1.05 (0.82, 1.29)**
Linear probability models				
FTE 1-year lead	0.2 (−0.06, 0.47)	0.07 (−0.18, 0.32)	0.15 (−0.1, 0.39)	0.09 (−0.14, 0.33)
FTE zero-year lagged	**1.34 (1.05, 1.62)**	**1.22 (0.95, 1.49)**	**1.38 (1.12, 1.65)**	**1.37 (1.12, 1.63)**
FTE 1-year lagged	**1.53 (1.26, 1.8)**	**1.49 (1.23, 1.74)**	**1.71 (1.45, 1.97)**	**1.71 (1.46, 1.96)**
FTE 2-year lagged	**1.03 (0.79, 1.27)**	**1.03 (0.81, 1.26)**	**1.23 (1.01, 1.45)**	**1.21 (0.99, 1.42)**
ILO Convention 1-year lead	0.14 (−0.07, 0.36)	0.04 (−0.16, 0.24)	0.14 (−0.05, 0.32)	0.07 (−0.1, 0.25)
ILO Convention zero-year lagged	**1 (0.77, 1.22)**	**0.9 (0.69, 1.12)**	**0.96 (0.76, 1.17)**	**0.97 (0.78, 1.17)**
ILO Convention 1-year lagged	**1.05 (0.84, 1.25)**	**1.02 (0.82, 1.21)**	**1.14 (0.95, 1.32)**	**1.16 (0.98, 1.34)**
ILO Convention 2-year lagged	**0.63 (0.45, 0.8)**	**0.63 (0.46, 0.79)**	**0.84 (0.69, 1)**	**0.83 (0.67, 0.98)**
PDR 1-year lead	0.21 (−0.07, 0.49)	0.06 (−0.21, 0.33)	0.17 (−0.09, 0.44)	0.16 (−0.1, 0.42)

(*continued on next page*)

Table A.3 (*continued*)

	Model 1	Model 2	Model 3[a]	Model S[a,b]
PDR zero-year lagged	**1.42 (1.11, 1.73)**	**1.29 (1, 1.57)**	**1.63 (1.33, 1.93)**	**1.62 (1.33, 1.92)**
PDR 1-year lagged	**1.66 (1.36, 1.96)**	**1.61 (1.32, 1.89)**	**2.04 (1.74, 2.33)**	**2.03 (1.73, 2.33)**
PDR 2-year lagged	**1.19 (0.91, 1.47)**	**1.17 (0.91, 1.43)**	**1.37 (1.11, 1.62)**	**1.36 (1.11, 1.61)**
DTP2				
Logistic models				
FTE 1-year lead	0.22 (−0.03, 0.48)	0 (−0.22, 0.21)	0.06 (−0.16, 0.28)	−0.08 (−0.32, 0.16)
FTE zero-year lagged	**1.12 (0.84, 1.4)**	**0.83 (0.59, 1.08)**	**1.11 (0.86, 1.37)**	**1.11 (0.83, 1.38)**
FTE 1-year lagged	**1.52 (1.22, 1.82)**	**1.24 (0.98, 1.5)**	**1.62 (1.34, 1.91)**	**1.64 (1.34,1.94)**
FTE 2-year lagged	**1.19 (0.87, 1.5)**	**0.96 (0.68, 1.24)**	**1.27 (0.97, 1.56)**	**1.23 (0.92, 1.53)**
ILO Convention 1-year lead	0.15 (−0.06, 0.37)	−0.03 (−0.21, 0.15)	0.04 (−0.14, 0.21)	−0.12 (−0.33, 0.09)
ILO Convention zero-year lagged	**0.9 (0.66, 1.14)**	**0.66 (0.46, 0.87)**	**0.81 (0.61, 1.01)**	**0.82 (0.59, 1.05)**
ILO Convention 1-year lagged	**1.24 (0.98, 1.49)**	**0.99 (0.76, 1.21)**	**1.22 (0.99, 1.45)**	**1.26 (1.02, 1.5)**
ILO Convention 2-year lagged	**0.96 (0.69, 1.23)**	**0.76 (0.53, 1)**	**0.97 (0.74, 1.19)**	**0.94 (0.7, 1.17)**
PDR 1-year lead	0.25 (−0.02, 0.52)	0.01 (−0.22, 0.24)	0.07 (−0.16, 0.31)	−0.01 (−0.25, 0.23)
PDR zero-year lagged	**1.2 (0.89, 1.51)**	**0.9 (0.62, 1.17)**	**1.26 (0.97, 1.55)**	**1.23 (0.94, 1.52)**
PDR 1-year lagged	**1.66 (1.31, 2.01)**	**1.35 (1.04, 1.66)**	**1.81 (1.48, 2.14)**	**1.78 (1.45, 2.12)**
PDR 2-year lagged	**1.37 (0.97, 1.78)**	**1.11 (0.76, 1.47)**	**1.34 (0.98, 1.69)**	**1.3 (0.95, 1.65)**
Linear probability models				
FTE 1-year lead	0.21 (−0.11, 0.52)	0.06 (−0.24, 0.35)	0.13 (−0.16, 0.41)	0.08 (−0.2, 0.36)
FTE zero-year lagged	**1.19 (0.87, 1.52)**	**1.06 (0.75, 1.37)**	**1.16 (0.85, 1.47)**	**1.15 (0.85, 1.46)**
FTE 1-year lagged	**1.58 (1.26, 1.9)**	**1.53 (1.24, 1.83)**	**1.73 (1.43, 2.03)**	**1.74 (1.45, 2.04)**
FTE 2-year lagged	**1.13 (0.83, 1.43)**	**1.13 (0.85, 1.4)**	**1.32 (1.05, 1.59)**	**1.31 (1.04, 1.58)**
ILO Convention 1-year lead	0.13 (−0.12, 0.38)	0.02 (−0.22, 0.25)	0.11 (−0.11, 0.33)	0.06 (−0.17, 0.28)
ILO Convention zero-year lagged	**0.9 (0.64, 1.16)**	**0.8 (0.55, 1.05)**	**0.82 (0.59, 1.06)**	**0.83 (0.59, 1.07)**
ILO Convention 1-year lagged	**1.12 (0.88, 1.36)**	**1.08 (0.86, 1.3)**	**1.18 (0.97, 1.4)**	**1.23 (1.01, 1.45)**
ILO Convention 2-year lagged	**0.72 (0.51, 0.93)**	**0.73 (0.53, 0.92)**	**0.93 (0.74, 1.12)**	**0.94 (0.75, 1.13)**
PDR 1-year lead	0.23 (−0.1, 0.56)	0.06 (−0.25, 0.37)	0.17 (−0.14, 0.48)	0.16 (−0.15, 0.46)
PDR zero-year lagged	**1.24 (0.89, 1.59)**	**1.09 (0.76, 1.43)**	**1.34 (1, 1.68)**	**1.34 (1, 1.67)**
PDR 1-year lagged	**1.68 (1.33, 2.04)**	**1.62 (1.29, 1.95)**	**2.01 (1.66, 2.35)**	**2 (1.66, 2.35)**
PDR 2-year lagged	**1.27 (0.91, 1.63)**	**1.25 (0.92, 1.58)**	**1.41 (1.08, 1.74)**	**1.4 (1.07, 1.72)**
DTP3				
Logistic models				
FTE 1-year lead	**0.41 (0.04, 0.78)**	0.17 (−0.17, 0.52)	0.2 (−0.15, 0.55)	0.05 (−0.32, 0.43)
FTE zero-year lagged	**1.12 (0.73, 1.51)**	**0.9 (0.52, 1.27)**	**0.98 (0.59, 1.37)**	**0.89 (0.49, 1.3)**
FTE 1-year lagged	**1.99 (1.59, 2.4)**	**1.83 (1.44, 2.21)**	**2.17 (1.76, 2.58)**	**2.16 (1.73, 2.59)**
FTE 2-year lagged	**1.62 (1.22, 2.02)**	**1.51 (1.12, 1.89)**	**1.89 (1.48, 2.3)**	**1.83 (1.41, 2.25)**
ILO Convention 1-year lead	0.25 (−0.06, 0.55)	0.06 (−0.22, 0.34)	0.09 (−0.18, 0.36)	−0.09 (−0.4, 0.22)
ILO Convention zero-year lagged	**0.85 (0.53, 1.16)**	**0.68 (0.38, 0.97)**	**0.67 (0.38, 0.96)**	**0.58 (0.25, 0.9)**
ILO Convention 1-year lagged	**1.51 (1.19, 1.84)**	**1.38 (1.07, 1.68)**	**1.51 (1.2, 1.82)**	**1.53 (1.2, 1.86)**
ILO Convention 2-year lagged	**1.21 (0.89, 1.54)**	**1.12 (0.82, 1.43)**	**1.36 (1.06, 1.67)**	**1.33 (1.01, 1.64)**
PDR 1-year lead	**0.54 (0.14, 0.93)**	0.28 (−0.09, 0.65)	0.31 (−0.08, 0.69)	0.24 (−0.15, 0.63)
PDR zero-year lagged	**1.26 (0.83, 1.69)**	**1.01 (0.6, 1.43)**	**1.16 (0.72, 1.6)**	**1.12 (0.69, 1.56)**
PDR 1-year lagged	**2.26 (1.79, 2.74)**	**2.07 (1.62, 2.52)**	**2.5 (2.02, 2.98)**	**2.46 (1.98, 2.94)**
PDR 2-year lagged	**1.97 (1.47, 2.47)**	**1.82 (1.34, 2.3)**	**2.02 (1.53, 2.5)**	**1.97 (1.49, 2.46)**
Linear probability models				
FTE 1-year lead	0.21 (−0.11, 0.52)	0.06 (−0.24, 0.35)	0.13 (−0.16, 0.41)	0.08 (−0.2, 0.36)
FTE zero-year lagged	**1.08 (0.71, 1.45)**	**0.95 (0.59, 1.31)**	**0.93 (0.58, 1.29)**	**0.87 (0.51, 1.23)**
FTE 1-year lagged	**1.84 (1.48, 2.2)**	**1.79 (1.45, 2.13)**	**1.97 (1.62, 2.31)**	**1.94 (1.59, 2.29)**
FTE 2-year lagged	**1.46 (1.12, 1.79)**	**1.45 (1.14, 1.77)**	**1.66 (1.34, 1.98)**	**1.61 (1.29, 1.93)**
ILO Convention 1-year lead	**0.29 (0, 0.59)**	0.17 (−0.1, 0.45)	0.24 (−0.02, 0.5)	0.13 (−0.14, 0.41)
ILO Convention zero-year lagged	**0.83 (0.53, 1.13)**	**0.72 (0.43, 1.02)**	**0.66 (0.39, 0.94)**	**0.59 (0.3, 0.88)**
ILO Convention 1-year lagged	**1.35 (1.07, 1.63)**	**1.31 (1.05, 1.57)**	**1.36 (1.11, 1.62)**	**1.36 (1.1, 1.63)**
ILO Convention 2-year lagged	**0.99 (0.75, 1.24)**	**1 (0.77, 1.23)**	**1.19 (0.97, 1.42)**	**1.15 (0.92, 1.39)**
PDR 1-year lead	**0.53 (0.15, 0.92)**	0.36 (−0.01, 0.72)	**0.43 (0.07, 0.8)**	**0.41 (0.05, 0.78)**
PDR zero-year lagged	**1.15 (0.74, 1.55)**	**1 (0.61, 1.39)**	**1.08 (0.68, 1.47)**	**1.07 (0.68, 1.46)**
PDR 1-year lagged	**1.99 (1.58, 2.4)**	**1.93 (1.54, 2.31)**	**2.24 (1.84, 2.64)**	**2.23 (1.83, 2.63)**
PDR 2-year lagged	**1.65 (1.25, 2.06)**	**1.63 (1.26, 2.01)**	**1.74 (1.36, 2.11)**	**1.72 (1.35, 2.09)**
Sample weights	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y

Notes: Reported estimates for Logistic models are marginal effects calculated at the means of the independent variables; The estimated coefficients and marginal effects are multiplied by 100; The values in parentheses are 95% confidence intervals.

[a] Zimbabwe was dropped from Models 3 and S due to missing information on total and government health expenditures.

[b] Model S includes all covariates included in Model 3 and female labor force participation.

Table A.4
Effect of an additional week of FTE, ILO Convention and PDR on the probability Polio vaccination, 2001–8; data from Demographic and Health Surveys for 20 low and middle-income countries: Logistic and LPM models results using different lags.

	Model 1	Model 2	Model 3[a]	Model S[a,b]
Polio1				
Logistic models				
FTE 1-year lead	0.05 (−0.09, 0.19)	−0.01 (−0.13, 0.1)	−0.02 (−0.13, 0.09)	−0.11 (−0.23, 0.01)
FTE zero-year lagged	0.13 (−0.03, 0.29)	0.05 (−0.08, 0.18)	0.04 (−0.09, 0.17)	−0.04 (−0.18, 0.1)
FTE 1-year lagged	0.18 (−0.01, 0.36)	0.11 (−0.05, 0.26)	0.06 (−0.09, 0.22)	−0.01 (−0.18, 0.15)
FTE 2-year lagged	**0.23 (0.04, 0.41)**	**0.16 (0, 0.31)**	0.11 (−0.04, 0.26)	0.04 (−0.12, 0.19)
ILO Convention 1-year lead	0.03 (−0.09, 0.15)	−0.02 (−0.12, 0.08)	0 (−0.09, 0.08)	−0.1 (−0.2, 0)
ILO Convention zero-year lagged	0.09 (−0.04, 0.22)	0.03 (−0.07, 0.13)	0.05 (−0.05, 0.14)	−0.04 (−0.14, 0.06)
ILO Convention 1-year lagged	0.1 (−0.04, 0.24)	0.05 (−0.06, 0.16)	0.07 (−0.04, 0.18)	−0.01 (−0.13, 0.11)
ILO Convention 2-year lagged	**0.14 (0.01, 0.27)**	0.1 (−0.01, 0.21)	**0.12 (0.02, 0.22)**	0.05 (−0.06, 0.16)
PDR 1-year lead	0.01 (−0.15, 0.17)	−0.06 (−0.19, 0.08)	−0.04 (−0.17, 0.08)	−0.09 (−0.22, 0.03)
PDR zero-year lagged	0.06 (−0.12, 0.25)	−0.01 (−0.16, 0.14)	0.01 (−0.14, 0.16)	−0.03 (−0.18, 0.12)
PDR 1-year lagged	0.06 (−0.16, 0.29)	0 (−0.19, 0.18)	0.02 (−0.16, 0.21)	−0.01 (−0.2, 0.17)
PDR 2-year lagged	0.05 (−0.17, 0.27)	0 (−0.19, 0.18)	0.02 (−0.15, 0.19)	−0.01 (−0.18, 0.16)
Linear probability models				
FTE 1-year lead	0.01 (−0.17, 0.19)	−0.08 (−0.25, 0.09)	−0.09 (−0.27, 0.08)	−0.16 (−0.32, 0)
FTE zero-year lagged	0.1 (−0.09, 0.29)	0.02 (−0.16, 0.21)	−0.01 (−0.2, 0.18)	−0.07 (−0.25, 0.1)
FTE 1-year lagged	0.16 (−0.05, 0.37)	0.13 (−0.07, 0.33)	0.07 (−0.13, 0.28)	0 (−0.19, 0.2)
FTE 2-year lagged	**0.21 (0.02, 0.41)**	**0.21 (0.02, 0.4)**	0.16 (−0.02, 0.34)	0.09 (−0.08, 0.26)
ILO Convention 1-year lead	−0.01 (−0.16, 0.14)	−0.07 (−0.21, 0.07)	−0.05 (−0.18, 0.08)	**−0.14 (-0.26, -0.01)**
ILO Convention zero-year lagged	0.06 (−0.1, 0.22)	0 (−0.15, 0.15)	0.02 (−0.13, 0.17)	−0.07 (−0.21, 0.07)
ILO Convention 1-year lagged	0.08 (−0.08, 0.24)	0.06 (−0.1, 0.21)	0.09 (−0.06, 0.24)	0 (−0.14, 0.15)
ILO Convention 2-year lagged	0.12 (−0.02, 0.27)	0.12 (−0.02, 0.26)	**0.18 (0.05, 0.31)**	0.1 (−0.03, 0.23)
PDR 1-year lead	−0.05 (−0.24, 0.14)	−0.14 (−0.32, 0.04)	−0.14 (−0.32, 0.04)	−0.16 (−0.33, 0.02)
PDR zero-year lagged	0.01 (−0.19, 0.21)	−0.07 (−0.27, 0.12)	−0.06 (−0.26, 0.14)	−0.07 (−0.27, 0.13)
PDR 1-year lagged	0.01 (−0.22, 0.24)	−0.02 (−0.24, 0.2)	0.01 (−0.23, 0.25)	0 (−0.23, 0.24)
PDR 2-year lagged	0 (−0.21, 0.22)	−0.01 (−0.22, 0.2)	0.04 (−0.16, 0.24)	0.03 (−0.17, 0.23)
Polio2				
Logistic models				
FTE 1-year lead	0.21 (−0.01, 0.44)	0.08 (−0.11, 0.27)	0.04 (−0.15, 0.23)	−0.02 (−0.23, 0.19)
FTE zero-year lagged	0.18 (−0.06, 0.41)	0.05 (−0.15, 0.26)	−0.05 (−0.25, 0.16)	−0.12 (−0.33, 0.09)
FTE 1-year lagged	**0.44 (0.18, 0.7)**	**0.32 (0.09, 0.55)**	**0.24 (0.01, 0.48)**	0.19 (−0.06, 0.44)
FTE 2-year lagged	**0.48 (0.19, 0.77)**	**0.38 (0.13, 0.64)**	**0.35 (0.09, 0.61)**	**0.3 (0.03, 0.57)**
ILO Convention 1-year lead	0.13 (−0.05, 0.31)	0.03 (−0.13, 0.18)	0.02 (−0.13, 0.17)	−0.06 (−0.24, 0.12)
ILO Convention zero-year lagged	0.13 (−0.06, 0.32)	0.03 (−0.13, 0.2)	0 (−0.16, 0.15)	−0.09 (−0.26, 0.08)
ILO Convention 1-year lagged	**0.31 (0.11, 0.51)**	**0.22 (0.05, 0.39)**	**0.2 (0.04, 0.37)**	0.15 (−0.03, 0.34)
ILO Convention 2-year lagged	**0.36 (0.15, 0.58)**	**0.29 (0.11, 0.48)**	**0.31 (0.14, 0.49)**	**0.27 (0.09, 0.46)**
PDR 1-year lead	0.24 (−0.01, 0.49)	0.09 (−0.12, 0.31)	0.06 (−0.15, 0.26)	0.02 (−0.19, 0.24)
PDR zero-year lagged	0.14 (−0.12, 0.41)	0 (−0.23, 0.24)	−0.11 (−0.34, 0.12)	−0.13 (−0.36, 0.1)
PDR 1-year lagged	**0.4 (0.09, 0.7)**	0.26 (−0.01, 0.53)	0.21 (−0.07, 0.48)	0.18 (−0.09, 0.46)
PDR 2-year lagged	**0.37 (0.01, 0.73)**	0.27 (−0.05, 0.58)	0.22 (−0.09, 0.53)	0.2 (−0.11, 0.5)
Linear probability models				
FTE 1-year lead	0.16 (−0.1, 0.42)	0.05 (−0.19, 0.29)	−0.05 (−0.28, 0.19)	−0.07 (−0.32, 0.17)
FTE zero-year lagged	0.11 (−0.15, 0.36)	0.01 (−0.23, 0.26)	−0.17 (−0.41, 0.07)	−0.2 (−0.44, 0.04)
FTE 1-year lagged	**0.39 (0.12, 0.65)**	**0.35 (0.1, 0.61)**	0.21 (−0.06, 0.47)	0.18 (−0.08, 0.45)
FTE 2-year lagged	**0.42 (0.15, 0.68)**	**0.42 (0.17, 0.68)**	**0.35 (0.09, 0.6)**	**0.33 (0.08, 0.58)**
ILO Convention 1-year lead	0.08 (−0.13, 0.29)	0 (−0.2, 0.19)	−0.03 (−0.21, 0.15)	−0.07 (−0.26, 0.12)
ILO Convention zero-year lagged	0.07 (−0.14, 0.28)	0 (−0.2, 0.19)	−0.09 (−0.28, 0.1)	−0.14 (−0.33, 0.06)
ILO Convention 1-year lagged	**0.26 (0.05, 0.46)**	**0.23 (0.04, 0.43)**	**0.19 (0, 0.39)**	0.17 (−0.03, 0.36)
ILO Convention 2-year lagged	**0.3 (0.1, 0.49)**	**0.3 (0.12, 0.49)**	**0.34 (0.16, 0.52)**	**0.33 (0.15, 0.51)**
PDR 1-year lead	0.17 (−0.1, 0.44)	0.04 (−0.21, 0.3)	−0.04 (−0.3, 0.22)	−0.05 (−0.31, 0.21)
PDR zero-year lagged	0.04 (−0.23, 0.32)	−0.07 (−0.33, 0.2)	−0.25 (−0.51, 0.02)	−0.25 (−0.51, 0.02)
PDR 1-year lagged	**0.3 (0, 0.59)**	0.25 (−0.03, 0.54)	0.15 (−0.15, 0.45)	0.15 (−0.15, 0.45)
PDR 2-year lagged	0.26 (−0.06, 0.57)	0.25 (−0.05, 0.55)	0.19 (−0.11, 0.48)	0.18 (−0.11, 0.47)
Polio3				
Logistic models				
FTE 1-year lead	0.29 (−0.04, 0.63)	0.18 (−0.14, 0.49)	0.02 (−0.3, 0.33)	−0.03 (−0.37, 0.31)
FTE zero-year lagged	−0.08 (−0.42, 0.26)	**−0.19 (-0.52, 0.14)**	**−0.57 (-0.9, -0.23)**	**−0.65 (-1, -0.29)**
FTE 1-year lagged	**0.61 (0.25, 0.98)**	**0.54 (0.19, 0.89)**	0.28 (−0.08, 0.65)	0.25 (−0.13, 0.63)
FTE 2-year lagged	**0.65 (0.3, 1.01)**	**0.61 (0.27, 0.96)**	**0.5 (0.15, 0.86)**	**0.48 (0.11, 0.85)**
ILO Convention 1-year lead	0.15 (−0.12, 0.42)	0.07 (−0.19, 0.32)	−0.02 (−0.27, 0.22)	−0.09 (−0.37, 0.2)
ILO Convention zero-year lagged	−0.07 (−0.35, 0.21)	−0.15 (−0.42, 0.11)	−0.36 (−0.62, −0.1)	−0.47 (−0.76, −0.19)
ILO Convention 1-year lagged	**0.47 (0.19, 0.74)**	**0.41 (0.15, 0.67)**	**0.27 (0.01, 0.53)**	0.25 (−0.03, 0.53)
ILO Convention 2-year lagged	**0.55 (0.29, 0.81)**	**0.53 (0.28, 0.78)**	**0.51 (0.27, 0.76)**	**0.51 (0.25, 0.77)**
PDR 1-year lead	**0.39 (0.03, 0.75)**	0.26 (−0.08, 0.6)	0.07 (−0.27, 0.4)	0.04 (−0.3, 0.39)
PDR zero-year lagged	−0.1 (−0.48, 0.28)	−0.23 (−0.6, 0.14)	−0.71 (−1.09, −0.34)	−0.73 (−1.11, −0.35)
PDR 1-year lagged	**0.58 (0.16, 1.01)**	**0.49 (0.08, 0.9)**	0.17 (−0.26, 0.61)	0.16 (−0.28, 0.6)

(*continued on next page*)

Table A.4 (*continued*)

	Model 1	Model 2	Model 3[a]	Model S[a,b]
PDR 2-year lagged	**0.5 (0.06, 0.93)**	**0.43 (0.02, 0.85)**	0.19 (−0.23, 0.62)	0.18 (−0.24, 0.6)
Linear probability models				
FTE 1-year lead	0.25 (−0.08, 0.59)	0.14 (−0.17, 0.46)	−0.04 (−0.35, 0.27)	−0.07 (−0.39, 0.25)
FTE zero-year lagged	−0.13 (−0.46, 0.21)	−0.21 (−0.54, 0.11)	**−0.59 (-0.91, -0.27)**	**−0.64 (-0.97, -0.31)**
FTE 1-year lagged	**0.54 (0.2, 0.88)**	**0.51 (0.19, 0.84)**	0.25 (−0.08, 0.59)	0.23 (−0.10, 0.56)
FTE 2-year lagged	**0.58 (0.26, 0.9)**	**0.59 (0.29, 0.9)**	**0.47 (0.16, 0.78)**	**0.45 (0.13, 0.76)**
ILO Convention 1-year lead	0.13 (−0.14, 0.4)	0.05 (−0.2, 0.31)	−0.04 (−0.28, 0.2)	−0.09 (−0.35, 0.17)
ILO Convention zero-year lagged	−0.11 (−0.38, 0.17)	−0.17 (−0.44, 0.09)	−0.39 (−0.64, −0.13)	−0.47 (−0.74, −0.2)
ILO Convention 1-year lagged	**0.42 (0.16, 0.68)**	**0.4 (0.15, 0.65)**	**0.27 (0.02, 0.51)**	0.24 (−0.01, 0.5)
ILO Convention 2-year lagged	**0.5 (0.26, 0.73)**	**0.51 (0.28, 0.73)**	**0.5 (0.28, 0.72)**	**0.5 (0.27, 0.73)**
PDR 1-year lead	0.32 (−0.03, 0.68)	0.2 (−0.13, 0.54)	−0.01 (−0.34, 0.33)	−0.01 (−0.35, 0.32)
PDR zero-year lagged	−0.17 (−0.53, 0.19)	−0.27 (−0.63, 0.08)	**−0.73 (-1.08, -0.37)**	**−0.73 (-1.08, -0.38)**
PDR 1-year lagged	**0.46 (0.08, 0.85)**	**0.43 (0.06, 0.8)**	0.13 (−0.25, 0.52)	0.13 (−0.26, 0.52)
PDR 2-year lagged	**0.38 (0, 0.75)**	**0.37 (0.01, 0.73)**	0.17 (−0.19, 0.53)	0.16 (−0.2, 0.52)
Sample weights	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y

Notes: Reported estimates for Logistic models are marginal effects calculated at the means of the independent variables; The estimated coefficients and marginal effects are multiplied by 100; The values in parentheses are 95% confidence intervals.
[a] Zimbabwe was dropped from Models 3 and S due to missing information on total and government health expenditures.
[b] Model S includes all covariates included in Model 3 and female labor force participation.

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