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Association of increased duration of legislated paid maternity leave with childhood diarrhoea prevalence in low-income and middle-income countries: difference-in-differences analysis

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ABSTRACT

Background Diarrhoea is the second-leading infectious cause of death in children younger than age 5 years. The global burden of severe diarrhoeal disease is concentrated in Africa and Southeast Asia, where a significant percentage of the population resides in low-resource settings. We aimed to quantitatively examine whether extending the duration of legislated paid maternity leave affected the prevalence of childhood diarrhoea in low-income and middle-income countries (LMICs).

Methods We merged longitudinal data measuring national maternity leave policies with information on the prevalence of bloody diarrhoea related to 884 517 live births occurring between 1996 and 2014 in 40 LMICs that participated at least twice in the Demographic and Health Surveys between 2000 and 2015. We used a difference-in-differences approach to compare changes in the percentage of children with bloody diarrhoea across eight countries that lengthened their paid maternity leave policy between 1995 and 2013 to the 32 countries that did not.

Results The prevalence of bloody diarrhoea in the past 2 weeks was 168 (SD=40) per 10 000 children under 5 years in countries that changed their policies and 136 (SD=15) in countries that did not. A 1-month increase in the legislated duration of paid maternity leave was associated with 61 fewer cases of bloody diarrhoea (95% CI −98.86 to −22.86) per 10 000 children under 5 years of age, representing a 36% relative reduction.

Conclusion Extending the duration of paid maternity leave policy appears to reduce the prevalence of bloody diarrhoea in children under 5 years of age in LMICs.

INTRODUCTION

Globally, diarrhoea is the fourth leading cause of death and the second leading infectious cause of death in children under 5 years of age.[1 2] In 2015, an estimated 957.5 million episodes of diarrhoea occurred in children younger than the age of 5 years, of which 499 000 episodes led to death.[1] The burden of diarrhoeal disease is concentrated primarily in younger children. Diarrhoea incidence peaks before 1 year of age and then decreases with age.[3] A high proportion (72%) of deaths from diarrhoea occur in children younger than 2 years of age.[2] From 1990 to 2010, the incidence of diarrhoea in children under 5 years has decreased by 10.4%, with the fastest decrease in western and eastern sub-Saharan Africa.[1] Nevertheless, in low-income and middle-income countries (LMICs), acute diarrhoeal infection remains one of the most frequent childhood illnesses, and severe diarrhoea is among the most common reasons for hospital admission in children.[2]

Diarrhoea is both preventable and treatable. There are proven interventions that can go a long way toward reducing diarrhoea incidence and mortality.[4–10] A recent review estimated reductions in the risk of childhood diarrhoea of 48%, 17% and 36%, attributable to hand washing with soap, improved water quality and excreta disposal, respectively.[11] A review of 18 studies from LMICs indicated that not breastfeeding was associated with increases of 165% and 32% in the risk of diarrhoea among infants 0–5 months of age and 6–11 months of age, respectively, compared with exclusive breastfeeding.[12] Furthermore, preventive zinc supplementation was associated with a 13% reduction in diarrhoea incidence in children.[13]

Vaccine coverage might reduce diarrhoea incidence by lowering the risk of viral infection. A review of six randomised trials and quasi-experimental studies from LMICs demonstrated that the use of rotavirus vaccines was associated with 74% and 61% reductions in very severe rotavirus infection and severe rotavirus infection, respectively.[14] Similarly, a review of 12 randomised trials and quasi-experimental studies from LMICs showed that the use of the oral cholera vaccine was associated with a 52% reduction in the risk of cholera infection in children under 5 years of age.[15]

Despite extensive research on preventive and therapeutic interventions, the evidence for informing specific national social policy strategies to lower childhood diarrhoea prevalence through these mechanisms remains limited.[4 13 16] Extending the duration of legislated paid maternity leave has been associated with lower infant mortality in a sample of 18 Organisation for Economic Co-operation and Development countries[17–20] and a sample of 20 LMICs.[21] In addition, more generous paid maternity leave policies were associated with increased breastfeeding practices[22–27] and vaccination uptake.[28 29] To the best of our knowledge, the impacts of maternity leave policies on childhood diarrhoea have not been evaluated. In this study, using a novel database on nationally legislated maternity leave policies, we evaluated whether

paid maternity leave policy affects the prevalence of childhood diarrhoea in LMICs.

METHODS

Data sources

Longitudinal data measuring national maternity leave policies for each UN member state were made available by the University of California Los Angeles' WORLD Policy Analysis Center and then collected retrospectively to 1995 by McGill University's Policy-Relevant Observational Studies for Population Health Equity and Responsible Development project.[30] Further details regarding the collection and coding of global maternity leave policies are available elsewhere.[31]

Demographic and Health Surveys (DHS) were used to measure childhood diarrhoea and other individual-level covariates for children under 5 years of age. Many LMICs have conducted multiple DHS, often at a 5-year interval. These nationally representative household surveys provide a wide range of detailed health-related and demographic information focusing on maternal and child health. Standard DHS use a two-stage cluster sampling design, with the first stage selecting sample points (eg, clusters) and the second stage selecting households. Trained interviewers and structured questionnaires are used to interview selected married women and married men aged 15–49. In addition to collecting demographic information, the surveys also collected information on household assets and features of the dwelling units. Information on children younger than the age of 5 years in the household was also recorded. Standardised measurement techniques were used to ensure the comparability of surveys across countries and survey waves. Further details regarding the sampling and survey techniques are available elsewhere.[32 33]

Sample

For the analysis, we linked national maternity leave policies between 1995 and 2013 (inclusive) to information from 944 084 children under 5 years of age at the time of the interviews in 40 LMICs. These 40 countries were identified based on the availability of at least two DHS between 2000 and 2015 (inclusive), allowing for analyses of policy effects on changes in the prevalence of childhood diarrhoea occurring within countries over time. A 1-year lag was used to respect temporality between policy year and birth year, resulting in a sample of 884 517 children born between 1996 and 2014 (inclusive) from 114 DHS in 40 LMICs (table 1). In further analyses using full-time equivalent (FTE) weeks of paid maternity leave, Namibia was excluded because we lacked information on FTE weeks of paid maternity leave between 1995 and 2003. Thus, these analyses included 873 307 children born between 1996 and 2014 from 111 DHS across 39 LMICs (table 1). Treated and control countries were distinguished based on whether or not they experienced a change in national paid maternity leave policy.

Measures

Outcome variable

Our primary outcome variable was whether children had blood in their stools in the past 2 weeks at the time of the interview. We selected this measure of severe diarrhoea because the frequency of loose stools in breastfed infants can be difficult to distinguish from pathological diarrhoea due to an infection based on survey data. Information on bloody diarrhoea (clearly pathological) was extracted from at least two DHS for each sampled country. Briefly, mothers surveyed in the DHS were asked to provide information on the prevalence of diarrhoea for all children under the age of 5 years in the household. If a child had diarrhoea in the past 2 weeks, mothers were additionally asked whether there was blood in the stools.

Exposure variables

The exposure of interest was the legislated length of paid maternity leave for each sampled country between 1995 and 2013 (inclusive). We first recorded the legislated weeks of paid leave available to mothers only. We then calculated the FTE weeks of paid leave by multiplying the legislated weeks of leave by the wage replacement rate. Further details regarding calculation of FTE weeks of paid maternity leave are available elsewhere.[31] To reduce exposure misclassification, as well as ensure temporality between exposure and outcome, each child was assigned the legislated length of paid maternity leave 1 year prior to the birth year. We did not distinguish between leave that could be taken before or after birth.

Control variables

Research on the epidemiology of diarrhoea in children[2 4 12] was used to identify determinants of childhood diarrhoea in LMICs at the household, maternal and child levels. Covariates at the household level included the number of listed household members, number of children under 5 years of age living in the household, place of residence (eg, urban or rural) and an indicator for drinking water source (unimproved or improved), which was created by using the new scale for household drinking water used by the WHO and the UNICEF.[34] We also included the asset-based DHS household wealth index, which was created by and used as a standard by the DHS and UNICEF Multiple Indicator Cluster Surveys to capture the within-country relative wealth standing of each household. At the maternal and child level, covariates included mother's education received in years, mother's age at delivery, mother's number of living children, child's sex, child's age at interview and child's birth order.

In addition, to minimise confounding on the country level, we measured country-level characteristics that may be associated with changes to paid maternity leave policies and with childhood diarrhoea incidence from the World Bank's World Development Indicators and Global Development Finance databases.[35] These variables included gross domestic product (GDP) per capita (constant 2011 international dollar) based on purchasing power parity (PPP), female labour force participation rate (percentage of female population ages 15–64 years), percentage of unemployed female labour force, government health expenditures per capita based on PPP (constant 2011 international dollar) and total health expenditure (percentage of GDP).

Statistical analysis

Effect of paid maternity leave

We estimated the effect of a 1-month increase in paid maternity leave policy on the prevalence of bloody diarrhoea using the following logistic regression model:

$$logit(Y_{ijt} = 1) = \beta_0 + \beta_1 * M_{jt-1} + \sum \beta_n * Z_{ijt} + \sum \beta_k * C_{jt-1} + \lambda_j + \delta_t,$$

where Y_{ijt} represents the outcome (ie, whether the child had blood in the stools in the past 2 weeks at the time of the interview) for child i born in country j in year t, and M_{jt-1} is the calculated months of paid maternity leave in country j 1 year before the birth year (t–1). In the first model, we included fixed effects for country

Table 1 Policy and household survey characteristics from treated and control countries

Country	Effective year of paid maternity leave policy extension	Length of paid maternity leave before and after the extension (weeks)	DHS survey years before policy change	DHS survey years after policy change	Birth years available (min–max)	Sample size	Average bloody diarrhoea cases per 10 000 children in the past 2 weeks*	Female formal employment as percentage of total non-agricultural employment
Bangladesh	2006	12 to 16	2004	2007, 2011, 2014	1999–2014	24 922	45	12.6%
Kenya	2008	8.6 to 12.9	2003–2008	2014	1998–2014	19 121	149	–
Lesotho	2005, 2007, 2009	0, 2, 6, 12	2004	2009–2014	1999–2014	8584	129	63.9%
Malawi	2000	0 to 8	2000	2010	1996–2010	25 663	164	32.7%
Uganda	2006	4.3 to 12	2000–2006	2011	1996–2011	18 605	379	13.7%
Zambia	2002–2006	12, 12.8, 17.1	2001	2007–2013	1996–2014	22 150	192	19.9%
Zimbabwe	2006	12.9 to 14	2005	2010–2015	2000–2014	13 373	114	34.1%
All treated countries†						132 418	168 (SD=40)	
Armenia	–	20	2000–2005	2010	1996–2010	4023	20	80.9%
Benin	–	14	2001	2006–2011	1996–2012	29 157	59	4.2%
Bolivia	–	12.9	2003	2008	1998–2008	15 299	273	23.1%
Burkina Faso	–	14	2003	2010	1998–2010	20 546	122	6.2%
Cameroon	–	14	2004	2011	1999–2011	15 027	293	13.3%
Chad	–	14	2004	2014	1999–2014	19 141	292	12.1%
Colombia	–	12	2000–2005	2010	1996–2010	32 369	145	43.1%
Congo	–	15	2005	2011	2000–2012	8426	218	17.9%
Democratic Republic of Congo	–	14	2007	2013	2002–2014	23 081	224	10.0%
Dominican Republic	–	12	2002	2007–2013	1997–2013	22 414	76	43.8%
Egypt	–	12.9	2000–2005	2008–2014	1996–2014	43 128	37	73.7%
Ethiopia	–	12.9	2000–2005	2011	1996–2011	24 084	142	–
Gabon	–	14	2000	2012	1996–2012	8393	143	–
Ghana‡	–	12	2003	2008–2014	1998–2014	10 955	159	10.1%
Guinea	–	14	2005	2012	2000–2012	10 700	189	–
Haiti	–	12	2000–2005	2012	1997–2012	14 558	279	–
Honduras	–	12	2005	2011	2000–2012	20 265	126	24.4%
Indonesia	–	12.9	2002	2007–2012	1997–2012	43 149	5	18.1%
Jordan	–	10	2002	2007–2012	1997–2012	24 323	52	76.5%
Liberia	–	12.9	2007	2013	2002–2013	11 434	452	13.5%
Madagascar	–	14	2003	2008	1998–2009	15 788	63	15.0%
Mali	–	14	2001–2006	2012	1996–2013	28 504	67	9.3%
Mozambique	–	8.6	2003	2011	1998–2011	17 561	88	–
Namibia§	–	12	2000–2006	2013	1996–2013	11 210	169	38.1%
Nepal	–	7.4	2001–2006	2011	1996–2012	14 696	134	13.4%
Niger	–	14	2006	2012	2001–2012	17 546	212	5.8%
Nigeria	–	12	2003	2008–2013	1998–2013	56 178	170	6.8%
Peru	–	12.9	2000–2004	2007, 2009, 2010, 2011, 2012	1996–2012	73 651	141	35.4%
Philippines	–	8.6	2003	2008–2013	1998–2013	18 845	36	29.8%
Rwanda	–	12	2000–2005	2010–2014	1996–2014	27 203	108	22.0%
Senegal	–	14	2005	2010, 2012, 2014, 2015	2000–2014	35 944	163	8.7%
Sierra Leone	–	12	2008	2013	2003–2013	14 868	267	14.3%
Tanzania	–	12	2004	2010–2015	1999–2014	19 633	69	25.1%
All control countries¶						752 099	136 (SD=15)	

*Average weighted by DHS weight.
†Treated countries are countries that experienced a change in the duration of paid maternity leave between 1995 and 2013.
‡Ghana was added to the 'treated' group in the analysis on FTE weeks of paid maternity leave.
§Namibia was excluded in the analysis on FTE weeks of paid maternity leave.
¶Control countries are countries that did not experience a change in the duration of paid maternity leave between 1995 and 2013.
DHS, Demographic and Health Survey; FTE, full-time equivalent.

(λ_j) and year (δ_t) to account for, respectively, unobserved time-invariant confounders that vary across countries and temporal trends in the outcome shared across countries. In the second model, we additionally adjusted for individual-level and household-level characteristics, represented by the vector Z_{ijt}. In the third model, which is the preferred specification shown previously, we further controlled for time-varying, country-level confounders measured 1 year before birth (t–1), represented by the vector C_{jt-1}. Average marginal effects were calculated from logistic regression models to obtain estimates on the additive scale.

All three models incorporated respondent-level sampling weights to account for individual survey sampling designs and cluster-robust SEs to account for clustering at the country level. Per DHS guidelines, we applied the denormalisation of the standard weight approach described in the DHS Sampling and Household Listing Manual using information on the number of women aged 15–49 years in each survey year from the Population Division of the United Nations.[36 37] Statistical analyses were performed using STATA software V.15.

Table 2 Sociodemographic characteristics of the study sample, 1996–2014, N=884 517

Household-level and individual-level covariates	
Mean (SD) number of listed household members	6.74 (0.33)
Mean (SD) number of children under 5 years of age living in household	2.00 (0.09)
Household wealth	
Poorest	228 277 (25.81%)
Poorer	195 332 (22.08%)
Middle	176 042 (19.90%)
Richer	153 770 (17.38%)
Richest	131 104 (14.82%)
Drinking-water source	
Unimproved source	315 220 (35.64%)
Improved source	569 305 (64.36%)
Place of residence	
Urban	314 394 (35.54%)
Rural	570 131 (64.46%)
Mean (SD) mother's education (years)	5.26 (0.53)
Mean (SD) mother's age at childbirth (years)	26.97 (0.17)
Mean (SD) mother's number of living children	3.29 (0.10)
Mother's current work status	
No	413 088 (46.70%)
Yes	471 437 (53.30%)
Child's sex	
Male	446 971 (50.53%)
Female	437 554 (49.47%)
Mean (SD) child's age at interview (years)	1.97 (0.01)
Mean (SD) child's birth order	3.35 (0.12)
Country-level covariates	
Mean (SD) GDP per capita, PPP (constant 2011 international $)	3840.61 (573.61)
Mean (SD) health expenditure, total (% of GDP)	10.13 (1.23)
Mean (SD) health expenditure per capita, PPP (constant 2011 international $)	40.95 (3.73)
Mean (SD) labour force participation rate, female (% of female population ages 15+ years)	57.43 (3.29)
Mean (SD) unemployment female (% of female labour force)	8.95 (1.25)

Mean values are weighted by Demographic and Health Survey weight.
Values are numbers (percentages) unless stated otherwise.
GDP, gross domestic product; PPP, purchasing power parity.

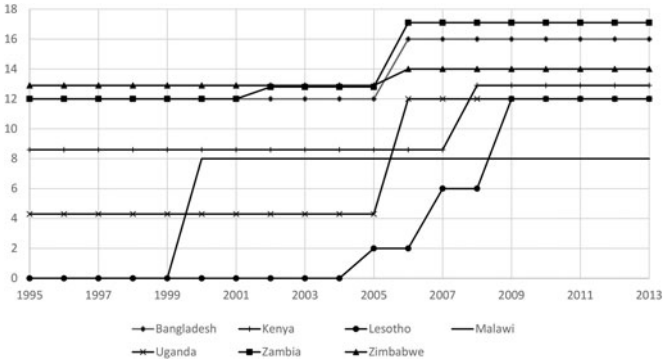

Figure 1 Legislated length of paid maternity leave in weeks in sampled countries that changed policies, 1995–2013.

Sensitivity and ancillary analyses

To examine the robustness of the main estimates, sensitivity analyses testing for lead effects using exposures at different times were performed. Specifically, the length of paid maternity leave in weeks or in FTE weeks during the birth year (t), and one (t+1), two (t+2), and 3 years after birth (t+3), was used to test whether policy effects could be detected before the actual year of implementation, which would be inconsistent with the inference that paid maternity leave has a causal effect on the prevalence of diarrhoea.

In addition, we conducted stratified analysis to examine heterogeneity in effect estimates by household socioeconomic status, measured by the wealth index. We also stratified the sample based on whether mothers were working at the time of the interview, as a proxy for whether the mother was employed in the prenatal period. We used tests of homogeneity to provide statistical evidence of whether effects were similar across strata.

RESULTS

Descriptive statistics

In the preintervention period prior to reforms occurring in any of the treated countries, the prevalence of bloody diarrhoea in the past 2 weeks at the time of interview was 168 (SD=40) per 10 000 children under 5 years in countries that changed their policies compared with 136 (SD=15) in countries that had not (table 1).

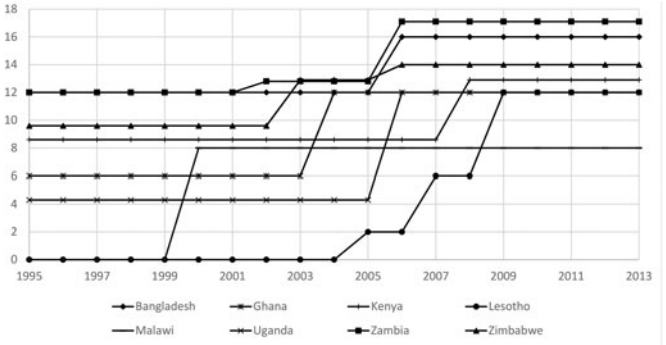

Figure 2 Legislated length of paid maternity leave in full-time equivalent weeks in sampled countries that changed policies, 1995–2013.

Table 3 Effect of a 1-month increase in the length of paid maternity leave on the prevalence of bloody diarrhoea per 10 000 children under age 5 years, N=884 517

	Model 1	Model 2	Model 3
1-month increase in legislated length of paid maternity leave (lagged 1 year, t−1)	−55.08 (−93.11 to −17.05)	−50.24 (−89.38 to −11.11)	−60.86 (−98.86 to −22.86)
Concurrent, t			−79.74 (−127.65 to −31.82)
Lead 1 year, t+1			−49.53 (−118.20 to 19.14)
Lead 2 years, t+2			−31.20 (−105.25 to 42.84)
Lead 3 years, t+3			21.27 (−89.69 to 132.22)
1-month increase in FTE length of paid maternity leave (lagged 1 year, t−1)	−58.14 (−98.30 to −17.98)	−53.40 (−94.50 to −12.31)	−64.21 (−102.64 to −25.77)
Concurrent, t			−82.17 (−129.77 to −34.58)
Lead 1 year, t+1			−49.82 (−120.30 to 20.66)
Lead 2 years, t+2			−34.43 (−106.46 to 37.60)
Lead 3 years, t+3			13.23 (−90.34 to 116.80)

CIs are in parentheses.
Model 1 includes country and year fixed effects.
Model 2 additionally controlled for measured individual-level and household-level characteristics.
Model 3 additionally controlled for country-level characteristics.
Reported estimates are average marginal effects, which were multiplied by 10 000.
FTE, full-time equivalent.

On average, each household had seven listed members and two children under 5 years of age. Over 64% of households in the sampled countries had improved drinking water sources, and 64% were located in rural areas. The mean age of mothers in the sample was 27 years, with three living children on average (table 2).

Between 1995 and 2013, the average weeks and FTE weeks of paid maternity leave among the 33 countries that did not change the duration of leave available were 12.8 and 12.2, respectively (see online supplementary appendix figure 1). Among the seven countries (ie, Bangladesh, Kenya, Lesotho, Malawi, Uganda, Zambia and Zimbabwe) that changed the duration of leave available, paid maternity leave increased on average from 7.1 weeks in 1995 to 13.1 weeks in 2013 (figure 1). Eight countries (ie, Bangladesh, Ghana, Kenya, Lesotho, Malawi, Uganda, Zambia and Zimbabwe) were included in the treated group for the analysis of paid maternity leave in FTE weeks (figure 2). Ghana did not increase the length of paid maternity leave but raised the wage replacement rate from 50% to 100% in 2004, thereby doubling FTE weeks of paid maternity leave from 6 to 12 in 2004. Zimbabwe raised the wage replacement rate from 75% to 100% in 2003 and increased the length of paid maternity leave from 12.9 to 14 weeks in 2006, leading to increases in FTE weeks of paid maternity leave in 2003 and 2006.

Examination of parallel trends assumption

One of the primary assumptions in the difference-in-differences approach is the parallel trends assumption[38]; that is, in the absence of treatment, trends in outcomes between treated and control groups remain the same over time. In our study, we examined the tenability of the assumption by fitting event study models,[39] in which we replaced the main exposure variable with a set of binary variables representing leads of paid maternity leave policy change ranging from 5 or more years before to 1 year before the policy change (the 'reference period').

Online supplementary appendix figure 2 presents the estimates from the event study model. The regression model is identical to model 3 presented in the main text, except the exposure variable is replaced by a set of binary variables representing the birth year relative to the year of policy change. Observations from a country without policy change were coded as 0 for each of these binary variables. The estimates represent the difference in the prevalence of bloody diarrhoea for each lead, ranging from 5 or more years prior to the policy change to 2 years prior to the actual policy change, relative to the reference period, between observations from treated countries that experienced a policy change versus control countries that did not. The dotted blue lines represent 95% CIs, which account for clustering at the country level. The

Table 4 Effect of a 1-month increase in the legislated length of paid maternity leave on the prevalence of bloody diarrhoea per 10 000 children under age 5 years, by household wealth index

	Household wealth index				
	Poorest (n=227 442)	Poorer (n=195 329)	Middle (n=169 840)	Richer (n=147 423)	Richest (n=122 096)
1-month increase in legislated length of paid maternity leave	−76.95 (−127.12 to −26.78)	−73.36 (−125.03 to −21.70)	−52.60 (−94.26 to −10.94)	−73.72 (−110.48 to −36.96)	−27.19 (−55.03 to 0.66)

CIs are in parentheses.
Models includes country and year fixed effects and additionally controlled for individual-, household-, and country-level characteristics.
Reported estimates are average marginal effects, which were multiplied by 10 000.

Table 5 Effect of a 1-month increase in the legislated length of paid maternity leave on the prevalence of bloody diarrhoea per 10 000 children under age 5 years, by mother's current work status

	Mother's current work status	
	Currently working (n=471 437)	Currently not working (n=413 080)
1-month increase in legislated length of paid maternity leave	−82.01 (−125.42 to −38.60)	−20.15 (−61.53 to 21.22)

CIs are in parentheses.
Models includes country and year fixed effects and additionally controlled for individual-, household-, and country-level characteristics.
Reported estimates are average marginal effects, which were multiplied by 10 000.

estimates shown in online supplementary appendix figure 2 do not provide evidence of non-parallel preintervention trends in the prevalence of bloody diarrhoea.

Effect of weeks of paid maternity leave

Table 3 shows the effect of a 1-month increase in the length of paid maternity leave on the change in the prevalence of bloody diarrhoea per 10 000 children under 5 years of age. The fully adjusted model (model 3) indicated that a 1-month increase in the legislated duration of paid maternity leave was associated with 61 fewer cases of bloody diarrhoea (95% CI −98.86 to −22.86) per 10 000 children under five, reflecting a 36% relative reduction.

Effect of FTE week of paid maternity leave

Paid maternity leave measured in FTE weeks showed similar effects on the prevalence of childhood diarrhoea (table 3). In the fully adjusted model (model 3), a 1-month increase in legislated paid maternity leave in FTE units was associated with 64 fewer cases of bloody diarrhoea (95% CI −102.64 to −25.77) per 10 000 children under 5 years, reflecting a 38% relative reduction.

Sensitivity and ancillary analyses

Extending the duration of paid maternity leave was associated with a reduced prevalence of bloody diarrhoea when the policy was measured in the same year as the child's birth year (table 3). As expected, the results of analyses using a policy that changed 1, 2 or 3 years after birth were compatible with the null (table 3). Additionally, online supplementary appendix figure 2 shows similar aggregated trends in the proportion of children experiencing diarrhoea for treated and control countries in the preintervention period, suggesting the control countries were valid. Overall, the results of these analyses support a temporal association between changes in paid maternity leave policy and our outcome.

Overall, the effect of 1-month increase in the legislated duration of paid maternity leave was stronger among poorer households, based on the wealth index (table 4). We estimated 77 fewer cases of bloody diarrhoea (95% CI −127.12 to −26.78) per 10 000 children under 5 years among the poorest households, compared with about 27 fewer cases of bloody diarrhoea (95% CI −55.03 to 0.66) per 10 000 children among the richest households. The estimates were statistically different across strata (p=0.022).

A stronger effect of a 1-month increase in the legislated duration of paid maternity leave was found among children whose mothers were currently working at the time of the interview (table 5). There were nearly 82 fewer cases of bloody diarrhoea (95% CI −125.42 to −38.60) per 10 000 children among children whose mothers were currently working at the time of the interview, compared with 20 fewer cases among children whose mothers were not working at the time of the interview. The effects were statistically different across strata (p<0.001).

DISCUSSION

This quasi-experimental study offers new evidence on how public polices such as paid maternity leave could contribute to reducing childhood diarrhoea in LMICs. By merging longitudinal data on the legislated duration of paid maternity leave between 1995 and 2013 to a multilevel panel of 884 517 children included in the DHS in 40 LMICs, we found that a 1-month increase in the legislated duration of paid maternity leave was associated with 61 fewer cases of bloody diarrhoea (95% CI −98.86 to −22.86) per 10 000 children under 5 years, reflecting a 36% relative reduction. Given an estimated global burden of 34.6 million severe diarrhoea episodes primarily concentrated among children under 5 years in Africa and Southeast Asia, this represents a substantial population-level impact.

Several limitations of this study should be noted. First, the parallel trends assumption is difficult to check visually in the generalised fixed-effects difference-in-differences design, with multiple countries with policy changes at multiple time points.[38] We lacked longitudinal measurements on our outcome for all sampled countries, as some countries had only one DHS available before policy reform. However, the observation of similar aggregated trends in the proportion of children experiencing diarrhoea for treated and control countries in the preintervention period provided some evidence that the assumption was not violated (see online supplementary appendix figure 2). Nonetheless, we cannot conclude that the two groups are in fact exchangeable. Second, having specified a comprehensive set of covariates at the child, household and country levels does not rule out the possibility of residual confounding. Factors that influence childhood diarrhoea —for example, social attitudes toward breastfeeding practices or hygiene practices or interventions promoting preventive care— may represent unmeasured confounders if they change coincidentally with reforms to paid maternity leave policies. Third, we did not account for population-level changes to other public policies that may coincide with changes in paid maternity leave. For instance, reforms to policies legislating breastfeeding breaks at work, which may have affected breastfeeding practices, or reforms to healthcare policy, which may have affected access to preventive interventions, could also affect childhood diarrhoea incidence. Fourth, information related to our outcome variable (eg, whether there was blood in the stools of children who had diarrhoea in the past 2 weeks) was collected based on maternal recall. However, recall bias is less of a concern because mothers were recalling a significant event that had happened in the past 2 weeks. Fifth, while we did not account for other types of leave (eg, parental leave) that might be available to mothers or distinguish whether paid maternity leave can be taken before and after birth, misclassification of exposure is unlikely because the majority of paid maternity leave is taken subsequent to birth in LMICs, and paid parental leave is relatively short (eg, less than 4 weeks) among the sampled countries. Sixth, the diarrhoea information was only collected on children who were alive at the time of the interview, and therefore there is the possibility of survivor bias if diarrhoea-related mortality is also prevented by extending the duration of paid maternity leave. Seventh, due to the lack of information on policy compliance and implementation, the intent-to-treat estimate obtained in our study may be downwardly biassed.

Furthermore, International Labour Organization reported that 92% of employed women in low-income countries and 85% of employed women in lower-middle countries were in informal employment by 2016.[40] Women in informal economy, who are the most socioeconomically vulnerable and experience the poorest health outcomes, may not be protected by paid maternity leave, depending on the structure of the social policy. In addition, the high percentage of female employment in the informal sector, along with probable non-compliance in formal employment settings, makes it likely that only a fraction of the population received the benefit. As a result, the average population effect may underestimate the true effect of paid maternity leave. Finally, the generalisation of our results may be limited to countries with similar sociodemographic profiles to the 40 sampled countries.

Previous work has found that longer paid maternity leave policy lowers infant mortality in LMICs.[21] Since diarrhoea is the fourth-leading cause of death and second-leading infectious cause of death in children under 5 years of age, our findings suggest a possible instrument through which paid maternity leave might improve child survival. From a policy planning perspective, further studies are needed to examine the impact of paid maternity leave on other aspects of family health to develop a comprehensive early life-policy framework that ensures the maximum health benefits for families in LMICs.

What is already known on this subject

- The global burden of severe diarrhoeal disease for children younger than the age of 5 years is concentrated in LMICs.
- Despite extensive research on preventive and therapeutic interventions, evidence for informing specific national social policy strategies to lower childhood diarrhoea prevalence remains limited.
- Recent studies have suggested that extending the duration of legislated paid maternity leave is associated with increased breastfeeding practices, increased vaccination uptake, and lower infant mortality in LMICs.

What this study adds

- In nationally representative samples from 40 LMICs, a 1-month increase in the legislated duration of paid maternity leave was associated with 61 fewer cases of bloody diarrhoea (95% CI −98.86 to 22.86) per 10 000 children under 5 years, representing a 36% relative reduction.

Contributors AN and JH led the development of the policy databases on which this analysis is based. All authors contributed to the conception and design of the study. YC performed the statistical analysis and drafted the manuscript. All authors reviewed the results and edited and approved the final version of the manuscript.

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