

# USA aid policy and induced abortion in sub-Saharan Africa: an analysis of the Mexico City Policy

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## Summary

**Background** The Mexico City Policy, first announced by US President Ronald Reagan and since lifted and reinstated by presidents along partisan lines, prohibits US foreign assistance to any organisation that performs or provides counselling on abortion. Many organisations affected by this policy are also providers of modern contraception. If the policy reduces these organisations' ability to supply modern contraceptives, it could have the unintended consequence of increasing abortion rates.

**Methods** We empirically examined patterns of modern contraception use, pregnancies, and abortion among women in 26 countries in sub-Saharan Africa in response to the reinstatement and subsequent repeal of the Mexico City Policy across three presidential administrations (William Clinton, George W Bush, and Barack Obama). We combine individual-level data on pregnancies and abortions from 743 691 women, country-year data on modern contraception use, and annual data on development assistance for family planning and reproductive health in a difference-in-difference framework to examine relative changes in use of modern contraception, pregnancy, and abortion in response to the policy.

**Findings** We found that when the Mexico City Policy was in effect (2001–08), abortion rates rose among women in countries highly exposed to the policy by 4·8 abortions per 10 000 woman-years (95% CI 1·5 to 8·1,  $p=0\cdot0041$ ) relative to women in low-exposure countries and relative to periods when the policy was rescinded in 1995–2000 and 2009–14, a rise of approximately 40%. We found a symmetric reduction in use of modern contraception by 3·15 percentage points (relative decrease of 13·5%; 95% CI  $-4\cdot9$  to  $-1\cdot4$ ;  $p=0\cdot0006$ ) and increase in pregnancies by 3·2 percentage points (relative increase of 12%; 95% CI 1·6 to 4·8;  $p<0\cdot0001$ ) while the policy was enacted.

**Interpretation** Our findings suggest that curbing US assistance to family planning organisations, especially those that consider abortion as a method of family planning, increases abortion prevalence in sub-Saharan African countries most affected by the policy.

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## Introduction

Decisions about the allocation of global health resources from the USA—the world's largest donor of development assistance in absolute terms—are closely linked to domestic abortion politics. In particular, the Mexico City Policy has guided family planning aid from the USA since 1984. First announced in Mexico City by the Reagan administration at the International Conference on Population, the policy requires all non-governmental organisations operating abroad to refrain from performing or counselling women about abortion as a strict prerequisite for receiving US federal funding. To date, the Mexico City Policy has been adopted and rescinded by executive order along strictly partisan lines in the first week of a new presidential administration—it was rescinded by Democratic President William Clinton on Jan 22, 1993, reinstated by Republican President George W Bush on Jan 22, 2001, rescinded again by Democratic President Barack Obama on Jan 23, 2009, and reinstated again by Republican President Donald J Trump on Jan 23, 2017.<sup>1–4</sup>

The implications of the policy for fertility behaviour and maternal health are ambiguous and unclear. On the one hand, the policy's restrictions on abortion funding imply an intended goal to reduce abortions. On the other hand, if the policy curtails the operations of organisations that provide family planning services, it could also limit the supply of modern contraception. This in turn may have the unintended consequence of increasing abortions because modern contraception and abortion are substitutes in some contexts: lower modern contraceptive use might lead to more unintended pregnancies, and more abortions.<sup>5</sup> When the policy is enacted, many family planning and reproductive health organisations face a difficult choice: comply with the policy and retain US federal assistance, or maintain organisational missions that conflict with the policy and forego US funding. Two of the largest international family planning organisations, International Planned Parenthood Federation and Marie Stopes International, have historically refused to sign the policy, forfeiting a substantial amount of support.<sup>6,7</sup> A 2017 analysis suggests

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**Research in context****Evidence before this study**

The Mexico City Policy is a US policy prohibiting federal funding for overseas family planning and reproductive health organisations that provide abortion services or counselling. The policy has been enacted and rescinded along party lines in the first week of every new US presidential administration since first announced in 1984. We searched PubMed and Embase for “Mexico City Policy” between Aug 1, 1984, and Oct 1, 2016. Despite the policy’s long history and potential health impacts, few studies have empirically examined the policy’s consequences. Surveys, news reports, and qualitative studies of family planning and reproductive health organisations indicate that funding shortfalls accompany enactment of the policy. However, the extent to which these funding shortfalls affect the provision of modern contraception or the incidence of abortions remains largely unknown. Two previous empirical studies estimated the impact of the policy on abortions through 2008 in a smaller set of countries, providing a limited empirical understanding of the policy’s implications.

**Added value of this study**

We provide new empirical evidence on the impact of the Mexico City Policy on modern contraceptive use, pregnancies, and abortions in Africa. We add to the existing evidence by using many countries (26 sub-Saharan African countries), a broad set of outcomes, a long time period (1995–2014), and an analysis over two policy transitions over three

presidential administrations (William Clinton, George W Bush, and Barack Obama administrations). These contributions provide estimates of the policy’s impact that have not, to our knowledge, been quantified in any existing study of the policy to date. We trace the effects of the policy by measuring our three primary outcomes in person-level survey data from 743 691 women (3 821 691 woman-years) who provided information on pregnancy outcomes during the study period and country-year data on contraceptive use for 520 country-year observations.

**Implications of all the available evidence**

We show that the restrictions imposed by the policy are reflected in a reduction in modern contraceptive use (14% lower prevalence of modern contraception use), an increase in pregnancies (12%), and an increase in abortions (40%) among women living in countries highly affected by the policy during periods when the Mexico City Policy was enacted. We also observe that the policy’s effects reverse after the policy’s repeal (2009–14), providing further evidence for the policy’s role in the observed patterns. Access to abortion services is both important for women’s health and a charged political topic. However, regardless of one’s political view, curtailing unsafe abortions is a desirable outcome. To our knowledge, our analysis is the first to show that the Mexico City Policy is followed by increased abortions, which are likely to be unsafe abortions, and that this outcome is reversible with greater support for family planning organisations.

that the current expanded application of the policy—which conditions any US global health funding on endorsement of the policy (not just family planning and reproductive health funding)—subjects US\$8 billion in US development assistance for health to the policy.<sup>8</sup>

Despite the policy’s uncertain implications, it has been subjected to few systematic empirical analyses.<sup>9,10</sup> One study found that women in Ghana were relatively more likely to conceive—and abort—a pregnancy when the policy was active.<sup>10</sup> In our previous work analysing 20 countries in sub-Saharan Africa, we found that the policy’s reinstatement under President George W Bush was associated with a relative increase in abortions (and relative reduction in modern contraceptive prevalence) among women living in countries more heavily affected by the policy.<sup>9</sup>

Whether the policy’s effects are stable in large populations and over time, and whether they are reversible when the policy is rescinded, remain crucial open questions. We aimed to study the effects of the Mexico City Policy on the use of modern contraception and on pregnancies and abortions among women living in sub-Saharan Africa, a region where aid from the USA is a dominant component of family planning financing.

**Methods****Study design**

We combined four data sources for this analysis: individual-level survey data from 26 countries in sub-Saharan Africa (Benin, Burkina Faso, Burundi, Comoros, eSwatini, Ethiopia, The Gambia, Ghana, Guinea, Kenya, Liberia, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Uganda, Zambia, and Zimbabwe) from the Demographic and Health Surveys (DHS);<sup>11</sup> country-year data on US development assistance for family planning compiled by the Organization for Economic Cooperation and Development’s (OECD) Creditor Reporting System;<sup>12</sup> the UN Population Division’s World Contraceptive Use database;<sup>13</sup> and country-year World Development Indicator data from the World Bank.<sup>14</sup> Our difference-in-difference estimation framework isolated changes in the probability of having an induced abortion under the policy by comparing women living in countries with varying exposure to the policy during the active period (2001–08) with the inactive periods (1995–2000; 2009–14). Specifically, our approach tested for relative changes in contraceptive use, pregnancies, and abortion trends in countries with varying exposure to the Mexico City Policy (high exposure vs low exposure). Below we detail the data sources, data

preparation process, primary models, and robustness tests.

### Data sources

To measure use of modern contraception, we used the UN Population Division's World Contraceptive Use dataset (2016 version),<sup>13</sup> focusing on any modern method of contraception. Modern methods of contraception included female and male sterilisation, oral hormonal pills, the intra-uterine device, the male condom, injectables, implantables, vaginal barrier methods, the female condom, and emergency contraception. In each year of the dataset, 10–40% of our study countries contained observed contraceptive data, and we imputed missing data using last observation carried backwards (and carried forward for any remaining missing observations).

The primary data source for abortions and pregnancies is the DHS. These two-stage nationally representative household surveys are an important foundation of epidemiological information in most countries in sub-Saharan Africa.<sup>11</sup> We used every survey from sub-Saharan Africa with a fertility calendar, yielding a sample of 26 countries (67 surveys). In the fertility calendars, respondent women report if they were pregnant and if the pregnancy ended in a livebirth or a termination of pregnancy for every month in the past 5–6 years (depending on the timing of the interview). Using this information, we create a longitudinal record for each woman with an indicator for whether the woman was pregnant and whether she terminated a pregnancy in each calendar year. The countries in which the fertility calendars were conducted as part of the DHS is limited before 1995 and after 2014, leading us to restrict our sample to the years 1995–2014 for the primary analysis. However, we show results for alternative start and end years (1994–2016) in the appendix (pp 16–18). To distinguish spontaneous from induced terminations (abortions) we applied an algorithm that was developed and tested using the DHS fertility calendar data.<sup>15</sup> A termination was classified as induced if it occurred following contraceptive failure, if the terminated pregnancy was unwanted (ie, the pregnancy occurred after a livebirth that was reported as unwanted), or if the woman was under age 26 years and was not married or in a union. Terminations were not classified as induced if they occurred in the third trimester, if the woman indicated that contraception had been discontinued to allow for pregnancy, or if the woman was married or in a union with no children.

Abortions are often under-reported in survey data, and the DHS is no exception.<sup>16</sup> We recognise that the number of abortions reported in the DHS are several orders of magnitude lower than other estimates for the region.<sup>17</sup> Although we have no direct way of knowing if this under-reporting is correlated with the timing of the Mexico City Policy or countries' exposure to the policy, we explored

the potential consequences of random and non-random under-reporting of abortions with sensitivity analyses in the appendix (pp 20–25).

We used the OECD Creditor Reporting System database to construct a country-level measure of exposure to the Mexico City Policy.<sup>12,18</sup> The Creditor Reporting System contains information on bilateral development assistance from OECD member countries, categorised by type, including aid for family planning and reproductive health. We calculated average annual per-capita development assistance for family planning and reproductive health from the USA during the Obama administration (between 2009–16) to each of the 26 sub-Saharan African countries included in our analysis. We classify each country's exposure to the Mexico City Policy as high (above the median per-capita assistance; Benin, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Rwanda, Senegal, Tanzania, Uganda, and Zambia) or low (below the median per-capita assistance; Burkina Faso, Burundi, Comoros, eSwatini, Ethiopia, The Gambia, Lesotho, Mozambique, Namibia, Niger, Nigeria, Sierra Leone, and Zimbabwe; appendix p 4). We used aid during the Obama administration to measure exposure because the policy was inactive during these years, hence representing how much a country potentially had to lose under the policy. Although the policy was also inactive during the Clinton administration, data on disbursements before 2000 were less reliable and incomplete in the Creditor Reporting System.<sup>19</sup> In the appendix (pp 3–4) we show annual per-capita aid for family planning and reproductive health broken down by US sources and non-US sources, separately for high and low-exposure country groups. We also show the effect of possible misclassification of the exposure (appendix p 8), and we also use quartiles of average annual per-capita aid from the USA between 2009 and 2016 for exposure to the Mexico City policy (appendix p 13).

### Statistical analysis

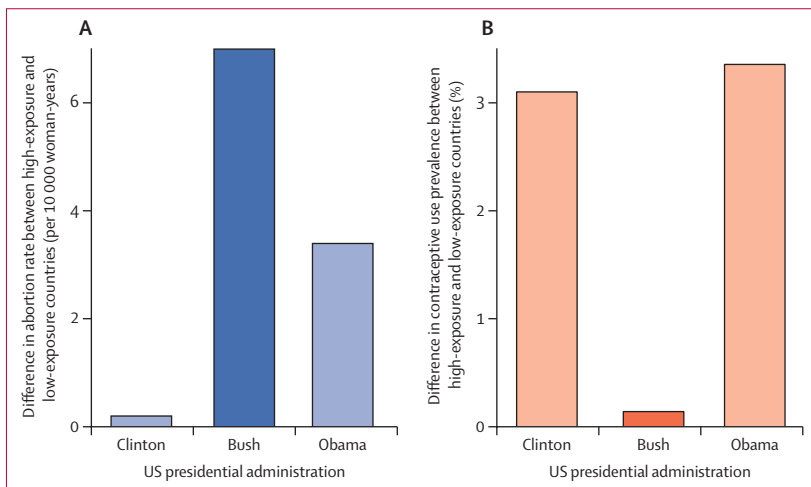
Our difference-in-difference econometric approach tested for differential changes in modern contraceptive use, pregnancy, and abortion trends in countries with varying exposure to the Mexico City Policy across two abrupt policy changes: the re-introduction of the policy in January, 2001, and its repeal in January, 2009. Testing for patterns following the policy's introduction and repeal was analogous to Robert Koch's postulates for testing the causal link between a microorganism and a disease by observing symptoms following re-inoculation of a putative causal organism. Similar study designs that also include comparison groups have been promoted in the social sciences.<sup>20</sup> A key feature of this study design is its use of both policy implementation and repeal during the study window, facilitating the isolation of policy effects from a wide variety of monotonic (linear or non-linear) background trends. Specifically, we estimated variants

See Online for appendix

	President Clinton administration (1995–2000)		President Bush administration (2001–08)		President Obama administration (2009–14)		Totals		Overall	
	High-exposure countries	Low-exposure countries	High-exposure countries	Low-exposure countries	High-exposure countries	Low-exposure countries	High-exposure countries	Low-exposure countries		
Women, n	84 327	41 619	248 577	238 192	280 937	202 246	430 011	313 680	743 691	
Woman-years, n	264 192	98 462	893 252	798 226	1 028 807	738 752	2 186 251	1 635 440	3 821 691	
Abortion										
Per 10 000 woman-years	7.7	11.0	11.5	7.6	12.8	12.2	11.7	9.9	10.9	
Per 1000 women	2.4	2.6	4.1	2.5	4.7	4.5	5.9	5.1	5.6	
Abortions, n	203	108	1029	605	1319	900	2551	1613	4164	
Contraceptive use	13%	18%	19%	24%	28%	29%	20%	24%	22%	
Pregnancy rate, per 10 000 woman-years	45.3	38.5	32.3	27.4	26.0	25.5	30.9	27.2	29.3	
US family planning and reproductive health aid per capita, US\$	0.24	0.05	0.29	0.05	1.17	0.15	0.54	0.08	0.31	

Sample data includes years 1995–2014. Data sources include the Demographic and Health Surveys for the 26 countries in the sample, Organisation for Economic Co-operation and Development Creditor Reporting Service, the World Bank World Development Indicators, and the UN World Contraceptive Use database. Exposure to the Mexico City Policy was classified as high or low according to whether the level of per capita financial assistance provided to the country for family planning and reproductive health by the USA was above or below the median during the Obama Administration when the policy was not in effect (2009–16). Contraceptive use is presented as the percentage of women who are practising, or whose sexual partners are practising, at least one modern method of contraception at the country level. Modern methods of contraception include female and male sterilisation, oral hormonal pills, the intra-uterine device, the male condom, injectables, implantables, vaginal barrier methods, the female condom and emergency contraception.

**Table 1: Sample characteristics by exposure to the Mexico City Policy**



**Figure 1: Adjusted difference in abortion rates and prevalence of contraceptive use between high-exposure and low-exposure countries of the Mexico City Policy across three presidential administrations (1995–2014)** Each exposure group’s estimates were obtained after regressing abortions (A) or contraceptive use (B) on country and year fixed effects and the full set of respective controls, and obtaining the exposure group’s residual mean in each US presidential administration. Exposure to the Mexico City Policy was classified as high or low according to whether the level of per capita financial assistance provided to the country for family planning and reproductive health by the USA was above or below the median during the President Obama Administration. Each bar represents the difference (high exposure minus low exposure) in either average adjusted (A) abortion rates or (B) prevalence of modern contraceptive use during each presidential administration.

of the following difference-in-difference model using ordinary least-squares regression

$$Y_{ict} = \alpha + \beta Policy_t \times High_c + \eta X_{ict} + \delta_c + \gamma_t + \epsilon_{ict}$$

where  $Y_{ict}$  is the outcome (whether the woman had an abortion or became pregnant) for woman  $i$  living in country  $c$  in year  $t$ ;  $Policy_t$  is an indicator variable for

whether or not the policy was active in year  $t$ ;  $High_c$  is an indicator variable for whether or not country  $c$  is a high-exposure country;  $X_{ict}$  is a vector of individual-level covariates (including the woman’s age, if she had completed primary school, if she lived in a rural area as defined by the DHS, and her household’s wealth status<sup>21</sup>), and  $\delta_c$  and  $\gamma_t$  represent country and year fixed effects, absorbing unobserved time-invariant country differences and common changes across all study countries over time. We calculated robust standard errors throughout, clustered at the DHS region level. The main parameter of interest is  $\beta$ , the percentage point change in probability of an abortion (or pregnancy) associated with the policy. We presented specifications first with country and year fixed effects, and we then re-estimated these specifications including a full set of controls.

Our analysis of modern contraceptive used the same statistical framework shown in the equation. However, because the dependent variable is modern contraceptive prevalence by country-year, we included time-varying country-level controls (gross domestic product per capita, population size, life expectancy, and female literacy rate from the World Bank World Development Indicator) rather than individual-level covariates and calculated robust standard errors, rather than cluster-robust. In sensitivity analyses that use woman-level information we used a similar framework to the equation above with use of modern contraception from the fertility calendars.

We also investigated the sensitivity of our results along a variety of dimensions. First, in addition to showing unadjusted and adjusted estimates, we also show results of leave-one-out analyses (appendix p 7) in which we leave each country out of the analysis, one by one, to

	Abortion (n=3 821 691)		Contraceptive use (n=520)		Pregnancy (n=3 821 691)	
	Fixed effect only model	Fixed effect model with controls	Fixed effect only model	Fixed effect model with controls	Fixed effect only model	Fixed effect model with controls
Policy effect (high-exposure vs low-exposure countries)	4.86 (1.20 to 8.51)	4.83 (1.54 to 8.11)	-2.14 (-3.99 to -0.29)	-3.15 (-4.94 to -1.37)	0.032 (0.01 to 0.05)	0.032 (0.02 to 0.05)
Individual characteristics						
Rural resident	..	-2.48 (-3.75 to -1.21)	..	..	..	0.044 (0.04 to 0.05)
Age, years	..	0.55 (0.48 to 0.62)	..	..	..	-0.002 (-0.00 to -0.00)
Attained primary education	..	4.40 (3.14 to 5.66)	..	..	..	-0.071 (-0.08 to -0.06)
Wealthier resident	..	3.43 (2.46 to 4.40)	..	..	..	-0.060 (-0.06 to -0.06)
Country characteristics						
GDP per capita, US\$ per person	..	..	..	0.0038 (0.00 to 0.01)	..	..
Population, millions	..	..	..	-0.23 (-0.36 to -0.10)	..	..
Life expectancy at birth, years	..	..	..	0.70 (0.42 to 0.98)	..	..
Literacy, %	..	..	..	0.093 (-0.03 to 0.21)	..	..

Estimates for all outcomes are the percentage point change (95% CI) in the outcome among women in high-exposure countries while the policy was on relative to periods when the policy was off and to women in low-exposure countries (per 10,000 women-years for abortions, per country-year for contraceptives, and per woman-year for pregnancies). Exposure to the Mexico City Policy was classified as high or low according to whether the level of per capita financial assistance provided to the country for family planning and reproductive health by the USA was above or below the median during the Obama administration, when the policy was not in effect. We include two primary specifications, first with year and country fixed effects and second with the addition of controls to fixed effect analyses. Controls for abortion and pregnancy outcomes come from the Demographic Health Survey (DHS) data and include an indicator variable for whether the respondent resides in a rural area, age, an indicator variable for whether the respondent has completed at least some education, and an indicator variable for women who resided in households in the top three wealth quintiles in their country at the time of the survey (as defined by the DHS wealth asset index). For the specifications with contraceptive use as the outcome, country-year level controls were included from the World Bank World Development Indicator data and include per capita GDP, population, life expectancy at birth, and the literacy rate. All specifications for the abortion and pregnancy outcomes were run as a linear probability model with robust standard errors, adjusted for clustering at the DHS region level. Transformed coefficients (multiplied by 10 000) are reported as percentage points for the abortion outcome. For the contraceptive use outcome, specifications were run using ordinary least-squares regression with robust standard errors. Sample data includes years 1995–2014. GDP=gross domestic product.

**Table 2: Effects of the Mexico City Policy on abortion, contraceptive use, and pregnancies, 1995–2014**

assess the sensitivity of our findings to any single country's data. Second, we also show our main abortion results using both probit and logit models instead of linear models (appendix pp 14–15). Third, we show our main results varying the years included in our sample (appendix pp 16–18). Fourth, we assessed the sensitivity of our estimates compared with the use of alternative modern contraception data sources (appendix p 19). Fifth, we show results from an extensive set of simulations assessing possible bias due to random and non-random under-reporting of abortions (appendix pp 20–25). Finally, we tested the robustness of the main effect on abortion to misclassification of the treatment (both exposure to the Mexico City Policy and the timing of the policy; appendix p 8). The complete analytic code is available on request from the authors; all analyses and figures were conducted using Stata (version 15) and R (version 3.5.0).

### Role of the funding source

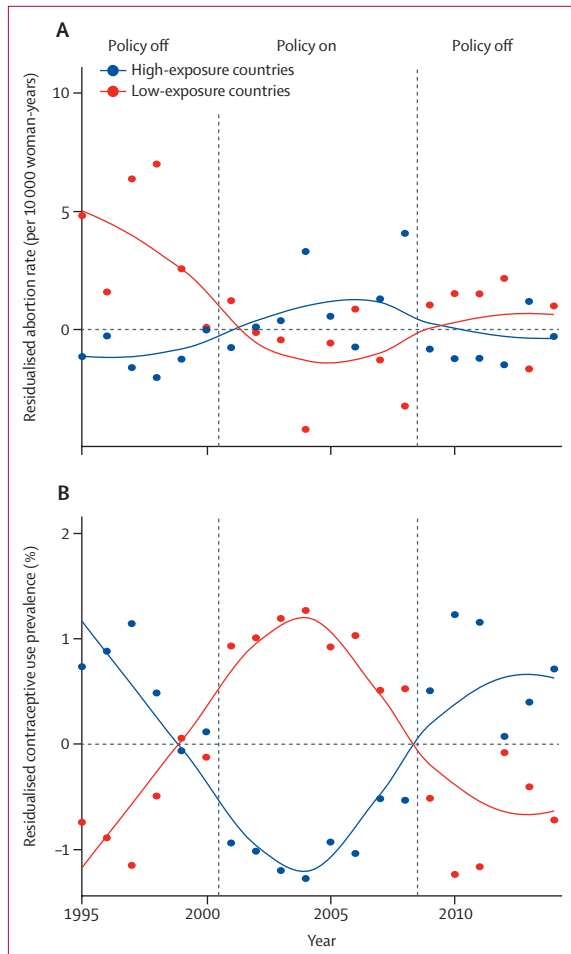
The funding organisations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

### Results

Our sample contained 3 821 691 woman-year observations between January, 1995, and December, 2014 (see table 1 for descriptive statistics). Detailed information

showing country-specific and year-specific data availability, woman-years of observation, and abortion rates are available in the appendix (pp 6, 11–12). Development assistance for FPRH from the USA increased from 2008 (appendix p 3), but more so for the high-exposure countries: from \$0.15 per capita between 1995 and 2000 (\$0.06 for low-exposure countries and \$0.23 for high-exposure countries) to \$0.65 per capita between 2009 and 2016 (\$0.15 for low-exposure countries and \$1.17 for high-exposure countries). The USA was also the dominant provider of FPRH assistance to the countries in our sample, providing an average of 30% of all FPRH aid between 1995 and 2014 (appendix p 11).<sup>12</sup> Although changes to FPRH aid by other donors in response to the policy were difficult to identify, we did not observe changes in FPRH disbursements from non-US sources or private, non-governmental sources when the policy was active between 2001 and 2009 that fully compensated for reductions in US funding (appendix pp 3–4). In our sample of 743 691 women (430 011 in high-exposure countries and 313 680 in low-exposure countries), the average abortion rate between 1995 and 2014 was 10.9 per 10 000 woman-years (11.7 in high-exposure countries and 9.9 in low-exposure countries; prevalence 5.6 per 1000 women; table 1).

Figure 1 shows the dynamics between modern contraceptive use and abortion using raw data: the differences between high-exposure and low-exposure countries in modern contraceptive use and abortion move in opposite directions—and reverse depending on



**Figure 2: Annual relative induced abortion rates and contraceptive use prevalence in countries with high or low exposure to the Mexico City Policy (1995–2014)**

For both panels, residuals were obtained from regressing abortions (A) or contraceptive use prevalence (B) on country and year fixed effects and all controls. The residuals were then summarised by year and exposure to the Mexico City Policy. The two curves were generated from the annual means of the residuals using locally-weighted scatter-plot smoothing (lowest function).

whether the policy is in effect (2001–08) or not (1995–2000 and 2009–14).

Our regression estimates show that relative to women in low-exposure countries, women living in high-exposure countries used less modern contraception, had more pregnancies, and had more abortions when the policy was in place compared with when the policy was rescinded (table 2). Put differently, when US support for international family planning organisations was conditioned on the policy, coverage of modern contraception fell and the proportion of women reporting pregnancy and abortions increased, in relative terms, among women in countries more reliant on US funding.

The magnitude of the increase in abortion was 4·8 per 10 000 woman-years (95% CI 1·5–8·1;  $p=0\cdot0041$ ) when adjusted for individual-level covariates (or

4·9 unadjusted; table 2), a rise of approximately 40% in relation to the average abortion rate per 10 000 woman-years in high-exposure countries when the policy is not in effect (12 per 10 000 woman-years; table 2). This corresponds to an odds ratio of 1·62 (95% CI 1·2–2·3; appendix p 15). We posit that the observed changes in abortion could be due to changing availability of modern contraception, and that a change in the use of modern contraception would be expected to result in a change in pregnancy rates.

Table 2 shows that the patterns in these two intermediate endpoints—modern contraception use and probability of pregnancies—are congruent in direction and magnitude with the putative mechanism of the policy's impact. We observed a 3·5 percentage point decrease (or 13·5% decrease) in the prevalence of modern contraceptive use with the policy (95% CI  $-4\cdot9$  to  $-1\cdot4$ ;  $p=0\cdot0006$ ) and a 3·2 percentage point increase (or 12% increase) in pregnancies per 100 woman-years (95% CI 1·6–4·8;  $p<0\cdot0001$ ) among women living in highly exposed countries when the policy was active. Although the degree to which abortions increase when contraceptive supply is curtailed is poorly characterised, one analysis estimated that, depending on the total fertility of the population, a 10% decline in contraceptive use would lead to a 20–90% increase in abortions.<sup>22</sup> Our findings are robust to alternative policy exposure measures, functional forms, start and end years, and potential misclassification of exposure (appendix pp 13–19).

Figure 2 shows the differences in abortion rates (figure 2A) and modern contraceptive use (figure 2B) between women living in high-exposure and low-exposure countries (adjusted for the full set of controls used in table 2; appendix p 14 shows raw trends), suggesting that the timing of changes coincides with changes in the Mexico City Policy. The pattern of differences closely agrees with the estimates in table 2: women in high-exposure countries experienced a relative increase in abortion (and decrease in modern contraceptive use) when the policy was enacted and a relative decrease in abortion (and increase in modern contraceptive use) when the policy was rescinded.

In sensitivity analyses, we show results of two other modern contraception analyses: a complete-case analysis using only unimputed observations in the World Contraceptive Use dataset and a woman-level analysis using longitudinal records from the DHS fertility calendars (appendix p 19). Each data source has its advantages and limitations, but the effect sizes fall within the confidence bounds of our preferred estimates in all analyses. Finally, we explored the potential of abortion under-reporting in the DHS using simulations that increase the reporting rate using different assumptions about the source of under-reporting (appendix pp 20–25). Although we cannot rule out bias in our estimates, we find that the likelihood of substantial bias is low. For example, one pathway by which abortions are

under-detected could be that our algorithm for identifying abortions over-classifies pregnancy terminations as spontaneous terminations (miscarriages). When we simulate re-classifying some ostensibly spontaneous terminations as abortions, our effect size increases by 1.5–5.3 times our original effect size, and with all simulations the *p* value remains <0.01. Additional simulations are explained in the appendix (pp 20–25).

## Discussion

In our analysis, we have extended our previous empirical work<sup>9</sup> to study the Mexico City Policy over a period of 20 years from 1995 to 2014 (importantly, spanning two policy transitions—a reinstatement in 2001 and a subsequent repeal in 2009) and across 26 countries in sub-Saharan Africa. We have done this analysis using survey data from 743 691 women who provided information about the outcome of each pregnancy over the 5–6-year period before each survey (more than 3.8 million woman-year observations). A strength of our analysis is not only its span of many countries over two decades, but its analysis of both reinstatement and subsequent repeal—improving our ability to rule out confounding background trends in abortion, modern contraception, and fertility behaviour generally.

Our paper finds a substantial increase in abortions across sub-Saharan Africa among women affected by the US Mexico City Policy. This increase is mirrored by a corresponding decline in the use of modern contraception and increase in pregnancies under the policy. This pattern of more frequent abortions and lower contraceptive use was also reversed after the policy was rescinded. These alternating patterns during periods when the policy is in place versus periods when the policy is rescinded both strengthen the case for the role played by the policy and suggest that the effects of the policy are reversible. In examining the Mexico City Policy, we have noted that the full consequences of the policy include additional potential harms to maternal health that we do not capture. Because abortions are an important cause of maternal mortality, the increase in abortion that we find might also increase maternal deaths—and possibly disproportionately given that abortions under the policy could be less safe if they were less likely to be performed or guided by experienced organisations and providers.<sup>23,24</sup> Our estimates of excess abortion under the policy therefore provide only a partial estimate of the policy's potential harm to maternal health.

When the USA reinstated and expanded the scope of the Mexico City Policy in January, 2017, several other countries pledged greater support for organisations forfeiting support by refusing to comply with the policy.<sup>25</sup> Although the proposed commitments make up less than half of the aid withdrawn by the USA, this nonetheless represents a potentially important strategy for mitigating the policy's harmful consequences.<sup>25,26</sup>

More generally, because our analysis provides evidence that abortion increases when the supply of modern contraceptives is reduced (ie, they are substitutes in economic terms), increasing the supply and uptake of modern contraception could be an important policy lever for reducing abortion globally.

Our analysis has several limitations that deserve explicit discussion. First, abortions are under-reported in the DHS. Estimates of abortion from other sources, although not directly comparable, are several times higher than the estimates presented here.<sup>18,27</sup> We also recognise that the algorithm for separating induced from spontaneous abortions likely introduces measurement error in our construction of abortion. However, we note that these measurement issues will bias our estimates of the association between the Mexico City Policy and abortion only if they are jointly correlated with both the policy timing and with our measure of policy exposure. Alternatively, if there is under-reporting of abortion but this is not correlated with the timing of changes to the Mexico City Policy and our measure of policy exposure, then it will not bias our estimates. A particularly salient concern might be that the imposition of the Mexico City Policy could have led women to under-report abortions more than might be usual—and disproportionately more so in countries exposed to the policy. We consider this scenario unlikely, but even if it occurred, it would attenuate our results, leading us to underestimate the true magnitude of the policy's effects. Although abortion is under-reported in DHS data (and we are unaware of alternative sources of representative abortion data collected in a comparable way across countries in sub-Saharan Africa), this is unlikely to drive or undermine our main findings.

Second, we use aggregate country-year measures of FPRH funding to measure exposure to the Mexico City Policy. This is an ecological measure, and we do not know how much of this funding ultimately supports affected organisations or at-risk women. The affected organisations are not fully known, because the policy affects not only direct recipients, but also subrecipient organisations operating in affected nations. We assume that the ultimate pass-through of funds is proportionate to our measure of exposure, but countries might repurpose aid and be affected by the policy even without a meaningful shortfall in overall family planning aid disbursements. We nonetheless observe a substantial reduction in aid from the USA and incommensurate compensatory increases by non-US and private sources (appendix pp 3–4), suggesting that our measure is reasonably capturing exposure to the Mexico City Policy.

Third, we used country-year panel data on modern contraception prevalence. We chose country-year estimates because those were available for more years, came from multiple nationally representative surveys (including DHS), and because of concerns over the accuracy of calendar contraception data.<sup>28</sup> However, our

results are robust through the use of individual-level information on contraceptive use from the DHS fertility calendar (appendix p 19).

Finally, as with any difference-in-difference analysis, attribution of contraception, pregnancy, and abortion estimates to the policy assumes that there are no unobserved confounders correlated with both the timing of the policy and our measure of policy exposure. Although this assumption is not directly testable, we controlled for time-invariant country differences, secular time trends, relevant individual-level characteristics, and time-varying country characteristics to address these concerns.

We have shown how a US policy that aims to restrict federal funding for abortion services can lead, unintentionally, to more—and potentially riskier—abortions in poor countries. Regardless of one's political preferences or beliefs about the ethics of abortion, these results represent undesirable and unintended—but reversible—consequences of the Mexico City Policy.

#### Contributors

EB and GM conceived the research idea. NB, EB, and GM contributed to the analytic design, data analysis, and interpretation. All authors contributed to the drafting and revising of the manuscript.

#### Declaration of interests

We declare no competing interests.

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