Maternal Deaths Averted by Contraceptive Use: Results from a Global Analysis of 172 countries

Saifuddin Ahmed, Qingfeng Li, Li Liu, Amy Tsui
Population, Family and Reproductive Health Department
Johns Hopkins University Bloomberg School of Public Health

Corresponding author:
Saifuddin Ahmed, MBBS, PhD
Department of Population, Family and Reproductive Health
Bloomberg School of Public Health
Johns Hopkins University
615 North Wolfe Street #E4642
Baltimore, MD 21205
Tel:(410) 614-4952
e-mail: sahmed@jhsph.edu

Abstract

Family planning is considered as one of the four pillars of safe motherhood program for reducing high maternal mortality in developing countries. Early attempts to estimate the effect of family planning on maternal mortality were fraught with gross data paucity. With the recent availability of maternal mortality data from several countries and time-series data on contraceptive use, we aim to reliably estimate the effect of contraceptive use on maternal mortality reduction at the global level. We apply an innovative, counterfactual modeling approach replicating the WHO's maternal mortality estimation method, and estimate maternal deaths averted by contraceptive use in 172 countries. We further examine the sensitivity of the results using a simpler births averted approach by exploiting the relationship between contraceptive use and fertility decline in directly estimating the number of maternal deaths averted. We use several data sources for this analysis: WHO's database for maternal mortality estimation; survey data on contraceptive use; and information on births, female population size aged-15 to 49 years, and general fertility rates from the United Nations World Population Prospects database, 2010. We estimate that in the absence of contraceptive use the number of maternal deaths would be almost 266,000 higher than the current level. In terms of maternal mortality reduction, this is equivalent of stating that contraceptive use reduced maternal mortality by almost 44%. The percent reduction in maternal deaths attributable to contraceptive use across the countries ranges between 7% and 60%. We estimate a maternal deaths averted ratio (MDAR) of 27 per 100,000 women using contraceptive methods per year. Increase in contraceptive prevalence rate in low performing countries could further decline maternal deaths by 25% and reduce the burden on maternal health system for serving more women effectively and efficiently in resource poor settings as skilled birth attendance is likely increase in near future.

Introduction

Recent studies suggest that contraceptive use reduces almost 230 million births every year and family planning remains as the major primary prevention strategy for unwanted pregnancies (Liu, Becker et al. 2008; Singh, Darroch et al. 2009). The rapid reduction of global fertility level in recent years from a total fertility rate (TFR) of 4.7 in early 1970s to 2.6 in late 2000s is predominately credited to increased contraceptive use rate. Although organized family planning programs were introduced in early 1950s in developing countries primarily with a demographic target to reduce population growth, soon the program emerges as a major public health intervention in improving women's health and survival of their children (Seltzer 2002).

Several studies examined the non-contraceptive health benefits of family planning methods on women. Oral contraceptive is shown to reduce at least eight serious diseases and other gynecological morbidities (Ory 1982; Jensen and Speroff 2000; Dayal and Barnhart 2001). Contraceptive use is also shown to improve child survival through optimal child spacing, lengthening birth intervals, and reducing sibling competition for scarce family and maternal resources (Potts 1990; Rutstein 2005; DaVanzo, Hale et al. 2007; DaVanzo, Hale et al. 2008; Yeakey, Muntifering et al. 2009)

The Safe Motherhood Initiative, launched in 1987 as a vertical program, proposed family planning as one of the four pillars besides antenatal care, safe delivery, and postnatal care as a strategic public health intervention to reduce maternal mortality in developing countries where 99% of global maternal deaths occur. The 1994 Cairo International Conference on Population and Development (ICPD) reiterated the importance of family planning for improving women health and directly linked the value of family planning to the reproductive health of individual

women (AbouZahr 1999). It is now widely acknowledged that family planning reduces maternal mortality – both directly and indirectly (Stover and Ross 2010).

There are at least four causal mechanisms through which family planning can directly reduce maternal deaths: reduce exposure to incidence of pregnancy, reduce vulnerability to abortion risks, postpone pregnancies during prematurity of pelvis development by delaying the first birth, and reduce the hazards of frailty from high parity pregnancies. Firstly contraceptive use reduces the incidence of pregnancies and thus exposure to any risk of life threatening pregnancy complications (*exposure reduction*). Second, contraceptive use reduces the risks of abortions due to the reduction in the number of unwanted/unplanned pregnancies (*vulnerability reduction*). Every year 50 million of the 190 million women who become pregnant resort to abortions for terminating unwanted pregnancies and about 13% of maternal deaths are due to abortion complications. These two reasons are the main causes attributable to family planning contribution for reducing maternal mortality rate (MMRate), which measures the maternal mortality *risk per woman.*

Contraceptive use also lowers the *risk-per-birth*, measured by maternal mortality ratio (MMR), through modifying the excessive hazards associated with pregnancies "too early, too late, too many, too close" (O'Loughlin 1997). Maternal mortality risk is higher at younger age (below 18) when pelvic development may not have completed yet, and at older ages, and women with high parity experience elevated risk. Empirical data in Matlab, Bangladesh show that eliminating all births below 19 years and above 40 years would reduce maternal mortality by 34% and eliminating births above parity 5 would reduce the number of maternal deaths by another 26 percent(Fortney 1987). An early estimation by Population Council shows that by eliminating births during the "ages of reproductive inefficiency" and limiting births between ages

18-35 in the developing countries, it would be possible to reduce maternal mortality by 20% (Berelson 1972). Some earlier studies, however, raised concern that the effect of family planning on maternal mortality could be not substantial through theses mechanisms (Trussell and Pebley 1984; Winikoff and Sullivan 1987).

There are at least three other indirect mechanisms through which contraceptive use may reduce maternal mortality: promote enabling in accessing maternity care; preserve healthy status; and improve economic wellbeing of the family. Studies have shown that contraceptive users are more likely to use antenatal care and safe delivery care from health professions (Jamieson and Buescher 1992; Ahmed and Mosley 2002). A large number of studies in the past 20 years have documented positive impact of family planning on women's physical health and well-being. Women with high parity are more likely to experience anemia during pregnancy (Al-Farsi, Brooks et al. 2011) and carry higher risks of dying from postpartum hemorrhage. A study in India found that the contraceptive adopters had better standard of living (Avasarala 2009). Improved economic status of family means less economic competition for family expenditures on children (education, medical care, food, and clothing) and in case of need for emergency obstetric care their family may be in a better position to meeting catastrophic out-of-pocket expenses and willing to seek care.

Although significant progress has been made in reducing global maternal mortality from 546,000 in 1990 to 358,000 in 2008, in many countries Millennium Development Goal (MDG) 5 - reducing maternal mortality three-quarters by 2015 - may not be achieved in many countries (World Health Organization, UNICEF et al. 2010). Of the 358,000 maternal deaths, only 1700 deaths occur in developed countries where contraceptive use rate is very high (72.4%).

In this paper we estimate the effect of family planning on reducing maternal mortality in 172 countries. We estimate the numbers of maternal deaths averted by contraceptive use (family planning) at each country and globally for a recent year 2008 for which WHO published maternal mortality estimates. We also present the results of a simulation analysis to show the expected changes in maternal mortality reduction from the current level if we could increase contraceptive prevalence rate (CPR) to a certain target level in countries with low prevalence.

Methods

Data sources

The data set for this analysis was compiled from three sources. We use WHO's maternal mortality estimation database which was used in reporting of the "Trends in Maternal Mortality: 1990 to 2008: Estimates developed by WHO, UNICEF, UNFPA and The World Bank" (World Health Organization, UNICEF et al. 2010). The database was compiled by the Maternal Mortality Estimation Inter-Agency Group (MMEIG). Based on the original sources of maternal death information, the countries are divided in to three groups. Group A countries have complete civil registration with good attribution of cause of death information. There were 63 countries, mostly developed, belonged to this category. There were 85 countries in Group B which had incomplete vital registration data, and maternal death data were mostly from surveys. Twenty four countries had no maternal deaths data, and were categorized in to Group C.

Contraceptive use data were derived from United Nations World Contraceptive Use 2010 database. The database compiled contraceptive use data from 193 countries and territories, mostly based on population level surveys. The observation for the trend data covers the period from 1950 to 2010. The most common surveys used in the database were Demographic and Health Surveys (217 records), World Fertility Surveys (43), Contraceptive Prevalence Surveys (48), CDC's Reproductive Health Surveys (35), UNICEF's Multiple Indicator Cluster Surveys (MICS, 85 records), and national surveys (405).

Information on births, female population size aged-15 to 49 years, and general fertility rates (GFR) were collected from the United Nations World Population Prospects database, 2010. The number of women married or in union was compiled from United Nations World Contraceptive Use wall chart report.

Statistical model

We use two methods to estimate the number of maternal deaths averted by contraceptive use. *Model 1:* First, we apply a counterfactual modeling approach replicating the WHO's maternal mortality estimation method conducted by Maternal Mortality Estimation Inter-Agency Group (MMEIG) (Wilmoth, Zureick et al. 2010; World Health Organization, UNICEF et al. 2010). MMEIG estimates MMR for 113 countries by using a multilevel regression model. The model is specified as:

$$\log(PMDF_i) = \beta_0 + \beta_1 \log(GDP_i) + \beta_2 \log(GFR_i) + \beta_3 SAB_i + \alpha^c_{j[i]} + \alpha^R_{j[i]} + \log(1 - a_i) + \varepsilon_i$$

Where, PMDF is the proportion of maternal deaths among all female deaths of reproductive age, GDP is the gross domestic product per capita in 2005 PPP dollars, SAB is proportion of women received skilled attendance at birth, and α terms are random intercepts for the country and geographical regions, respectively, and a_i is the proportion of AIDS deaths among total deaths to women aged 15-49.

We have respecified this model and included a term for contraceptive use (CU) as:

$$\log(PMDF_i) = \beta_0 + \beta_1 \log(GDP_i) + \beta_2 \log(GFR_i) + \beta_3 SAB_i + \beta_3 CU_i + \alpha^c_{j[i]} + \alpha^R_{j[i]} + \log(1 - a_i) + \varepsilon_i$$

Our preliminary examination of data suggests a non-linear relationship between CU and PMDF (Fig. 1), and as a result, we also included a quadratic term of CU in the model. Note that a similar approach was adopted by IHME in estimating maternal mortality published in the Lancet where a term for AIDS prevalence was used to examine the impact of HIV on maternal mortality (Hogan, Foreman et al. 2010). Because the number of categories in the region was small, which is likely to violate the normality assumption of random-term variance, we used the regions as fixed-effects.

WHO prefers to use PMDF, rather than directly modeling maternal deaths or maternal mortality ratio in the equation. It is considered that PMDF is more reliable and stable than MMR. The maternal mortality ratio (MMR) is estimated by the multiplying the PMDF with D/B, where D is the number of female deaths at ages 15-49 and B is the number of live births from UN population estimates.

MMEIG estimates MMR for countries which lack reliable maternal mortality data from the above prediction model, but use the observed MMR estimates with a correction factor (for correcting underestimation in VR) for countries with good civil registration system (Group A), with minor exceptions. Because of our respecification of the original model, we need to use results from prediction model for all the countries because our interest is to examine the counterfactual effect of contraceptive use on maternal mortality. As a result, our MMR estimation differs slightly from the original reported MMR in the WHO report.

Data on contraceptive use were available only for the survey years and to match with the years for maternal mortality data availability, we extrapolated CPR for the corresponding years using demographic projection method with a random-effects model with splines. The corresponding observed and predicted CPRs are shown in Fig. 2. The correlation between observed and predicted CPR was 0.993.

Model-II: Our second approach is based on the early work of Liu, Becker, Tsui and Ahmed (2008) for births averted estimation. In this simpler approach we first estimated births averted by contraceptive use and then directly estimated the number of maternal deaths averted by applying the MMR estimated reported by WHO. In this method, we exploit the relationship between population level fertility and contraceptive use. Figure 3 shows the inverse relationship between general fertility rate (GFR), number of births per 1,000 women of reproductive age, and contraceptive use.

Liu *et al*. (2008) used a linear quadratic model to quantify the extent of the relationship by using the following equation:

$$GFR_i = \beta_0 + \beta_1 CPR + \beta_3 CPR^2 + \varepsilon_i$$

and estimated potential GFR as:

$$GFR_i^{Potential} = GFR_i^{Observed} - (\beta_0 + \beta_1 CPR + \beta_3 CPR^2).$$

However, we recognize that the relationship between GFR and contraceptive use is contextual dependent.GFR in a county is also affected the extent of sexual union, fecundity, and the availability of abortion services. Moreover, contraceptive use effectiveness varies significantly across the countries, depending on the use rates of more effective methods like sterilization and IUD. In many countries the use sterilization is very low or almost absent. To address heterogeneity, we fitted a random-coefficient model as follows:

$$GFR_{it} = \beta_0 + \beta_1 CPR_{it} + \beta_3 CPR_{it}^2 + \upsilon_i CPR + \nu_i + \varepsilon_{ti}$$

The numbers of births averted (BA_i) were estimated by:

$$BA_i = [(GFR_i^{Potential} - GFR_i^{Observedl}) / 1000 * W_{15-49}$$

And the numbers of maternal deaths averted (MDA) were estimated by:

$$MDA_i = BA_i * MMR_i / 100{,}000$$

All statistical analyses were performed with Stata (version 11).

Results

Table 1 shows the Model-I estimation of MMR, current numbers of maternal deaths, expected (hypothetical) numbers of maternal deaths in the absence of contraceptive use, and the numbers of maternal deaths averted for each country, including the input data on contraceptive prevalence rate (CPR). Our estimated number of maternal deaths (342,545) based on the revised model specification are slightly lower than the WHO's reported number of global maternal deaths (358,000).The maternal mortality estimation for the corresponding period by IHME was 342,900 maternal deaths.

We estimate that in the absence of contraceptive use the number of maternal deaths would be 608,534, almost 78% higher than the current level. In terms of maternal mortality reduction, this is equivalent of stating that contraceptive use reduced maternal mortality by almost (1-342,545/608,534)= 44%. The percent reduction attributable to contraceptive use across the countries ranges between 7% to 60%. Interesting, an examination of the relationship between CPR and percent reduction, shown in Fig. 4, suggests that the gain in maternal mortality reduction plateau after CPR of 60%. This graph further suggests that the countries with low CPR will achieve most gains in the improvement of maternal mortality reduction with improved CPR. Most of these countries are located in sub-Saharan Africa.

Approximately 1,016 million women of reproductive age use contraceptive methods worldwide, and we estimate that approximately 27 maternal deaths are prevented by every 100,000 women using a contraceptive method during a year.

Table 2 presents the results from Model-II analyses. The results are similar to the results from Model-I, with slight lower effect on mortality reduction (42%).

We additionally examine the hypothetical effect of improving contraceptive prevalence rates in low prevalence countries. Table 3 shows that 46 of the 167 countries for which data were available, 46 countries have CPR 70% or more. In contrast, there are still several countries in which CPR levels are below 10%. In 25 countries, contraceptive use rate is still below 20, and a total of 51 countries have CPR less than 40%. Many developing countries, even with limited socioeconomic development, such as Bangladesh, significantly improved CPR. We next examine the potential effect of improving CPR in low prevalence countries on maternal mortality reduction.

Fig. 5 shows the expected reduction in global maternal deaths if low level countries attain at least a specified CPR target (with the countries with higher CPR levels kept constant). The graph suggests that attaining contraceptive prevalence rate at least 40% by countries with lower levels would reduce the number of maternal deaths to below 300,000 from the estimated current level. About 25% maternal mortality reduction is anticipated with the achievement of 50% CPR.

Conclusion

The difference in the reproductive health status of women in developed and developing countries is vast. Worldwide about 358,000 women and 3 million newborn babies die every year because of complications related to pregnancy and childbirth. Almost all these deaths (99%) occur in developing countries and are potentially preventable.

In this paper we examine the effect of family on reducing maternal mortality and our results suggest that family planning potentially reduced over almost 44% of maternal death globally. In the absence of family planning program and contraceptive use, maternal mortality would be 77% higher.

The leading causes of maternal mortality are hemorrhage, hypertensive disorders, sepsis, obstructed labor and complications from unsafe abortion, and all of these conditions need emergency medical care to prevent deaths. It is now recognized that the life threatening complications during pregnancy may not be anticipated in advance and screening during antenatal period is ineffective in predicting or preventing maternal complications. Providing universal access to quality maternal health services and ensuring skilled attendance at delivery are the key action strategies for safe motherhood initiative. More than two-thirds of women, however, still deliver at home, and progress in improving delivery care by skilled birth attendants (SBA) remains very slow. To reduce maternal mortality ratio, we must improve access to quality of maternal health care, skilled birth attendance at birth, and access to emergency obstetric care. But, let's not forget that in many countries fertility level is still high and women are repeatedly exposed to the risks of life threatening maternal complications and are vulnerable to higher risk. It is possible to reduce such shocks with effective contraceptive use. In the countries where maternal mortality ratios are highest, contraceptive prevalence rates are also low.

The paper provides evidence of using contraceptives in tackling maternal mortality problems in developing countries. As rightfully family planning has been included in the Safe Motherhood Initiative as one of the four pillars, we consider that promoting contraceptive use, especially in low prevalence countries, should be major tenet in targeting overall improvement in women's wellbeing as a public health agenda.

Figures

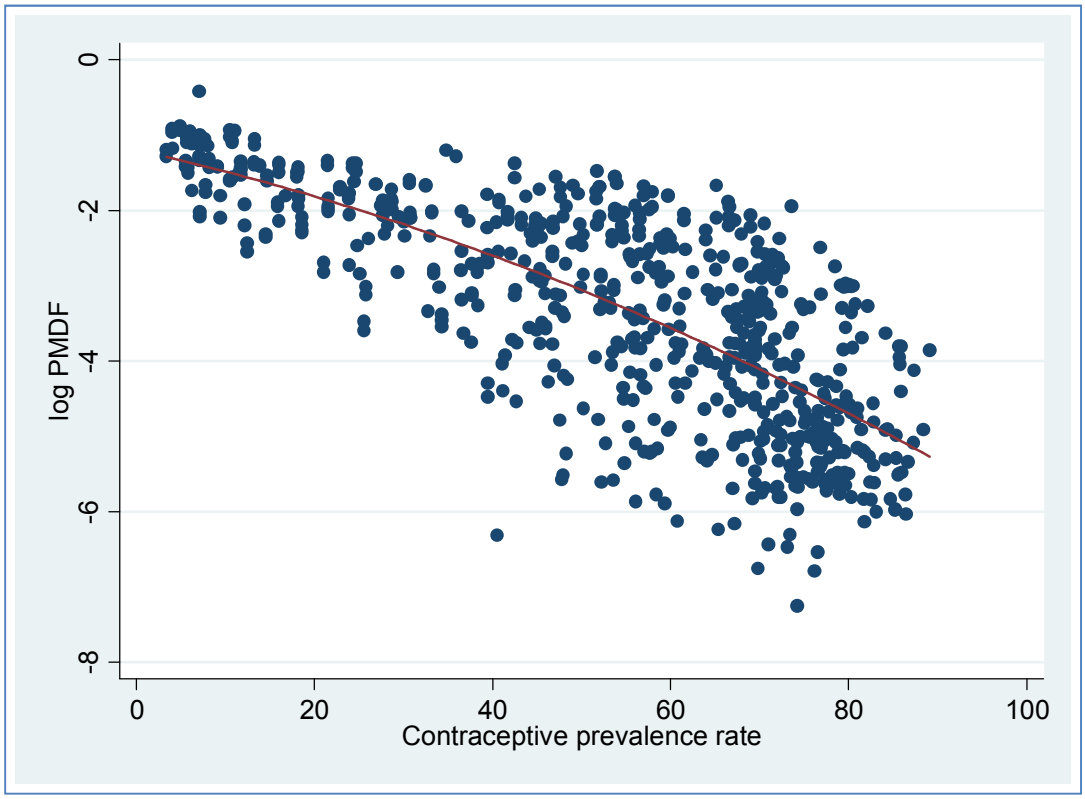

Figure 1: The relationship between contraceptive prevalence rate (CPR) and log of PMDF (proportion Maternal among Female Deaths aged 15-49)

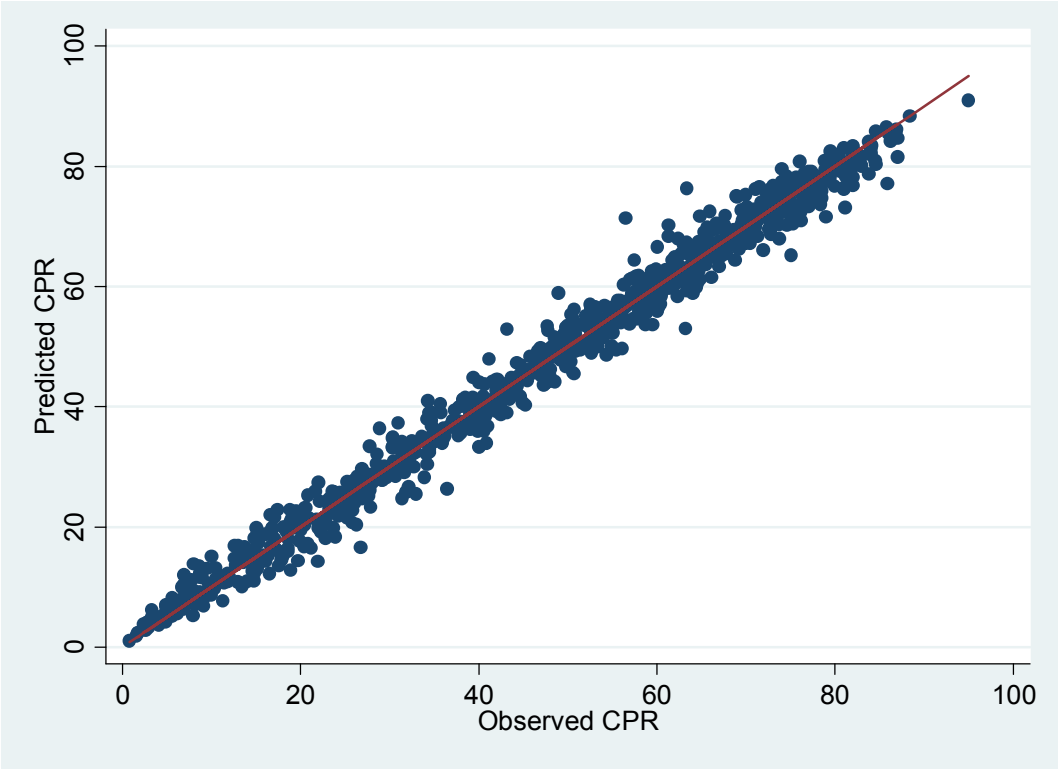

Figure 2: The relationship between observed contraceptive prevalence rate (CPR) and predicted CPR

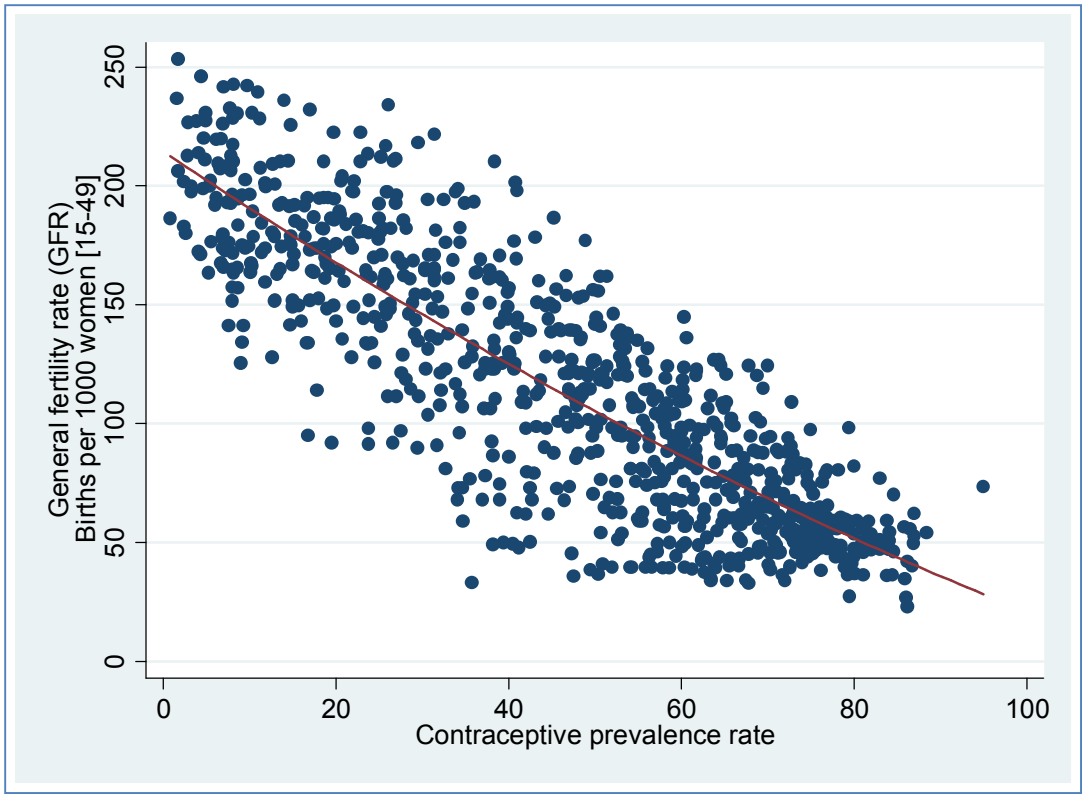

Figure 3: The relationship between contraceptive prevalence rate (CPR) and general fertility rate (GFR)

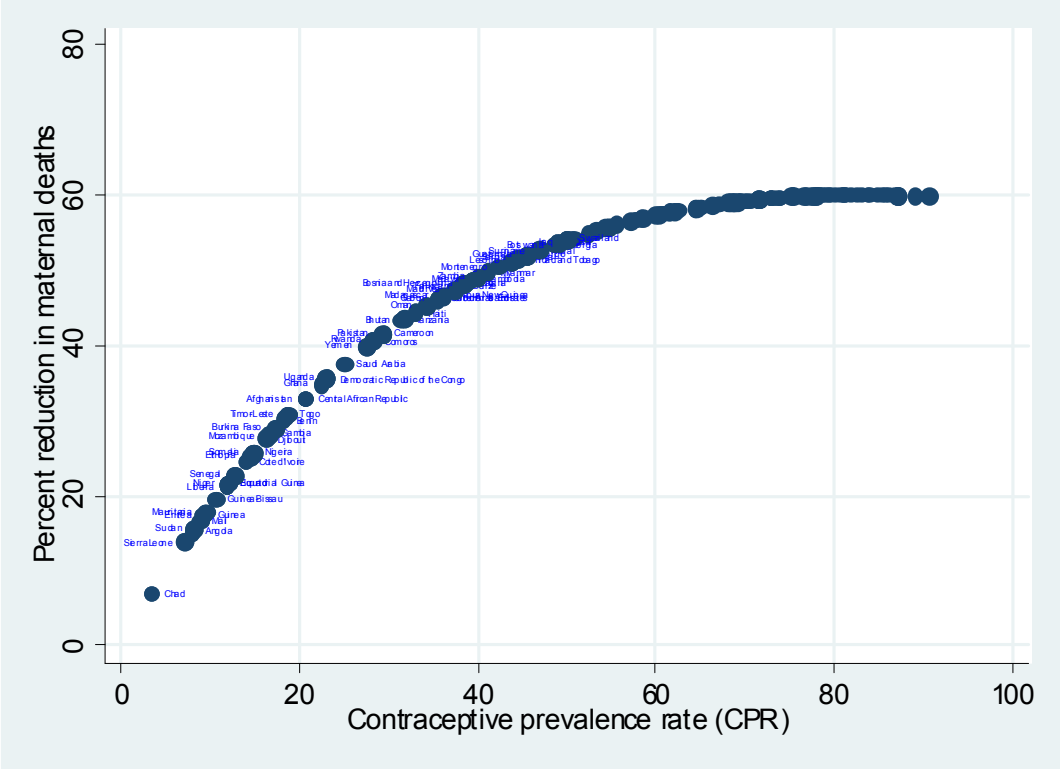

Figure 4: The relationship between contraceptive prevalence rate (CPR) and the rate of maternal mortality reduction

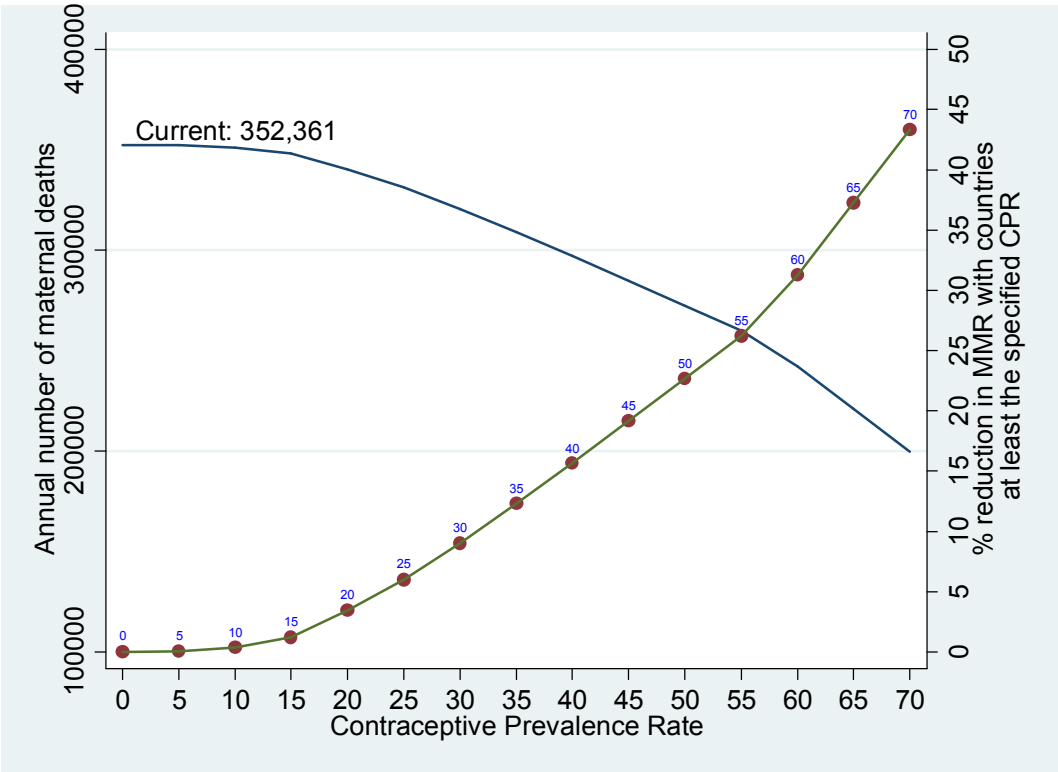

Figure 5: Expected reduction in global maternal deaths if low level countries attain at least a specified CPR target (countries with higher CPR levels kept constant)

Tables

Table 1: Maternal deaths averted by contraceptive use in 172 countries estimated by Model-I.

Country	CPR	MMR	Observed Maternal Deaths	Expected Deaths without contraceptive Use	Maternal deaths averted	Expected % of maternal deaths averted
Afghanistan	20.5	1364	17332	25887	8555	33.0
Albania	68.0	31	14	35	21	59.1
Algeria	61.5	130	929	2199	1270	57.8
Angola	7.8	609	4725	5577	852	15.3
Argentina	68.1	49	336	820	485	59.1
Armenia	55.5	29	14	31	18	56.1
Australia	73.5	8	20	51	30	59.8
Austria	59.8	5	4	9	5	57.3
Azerbaijan	53.2	39	63	142	79	55.3
Bahamas	75.4	36	2	5	3	59.9
Bahrain	70.2	19	3	6	4	59.4
Bangladesh	57.6	319	10974	25354	14380	56.7
Barbados	69.9	65	2	5	3	59.3
Belarus	72.9	23	22	55	33	59.7
Belgium	76.5	5	6	15	9	60.0
Belize	38.0	72	5	10	5	48.0
Benin	18.0	409	1395	1998	603	30.2
Bhutan	31.7	235	35	62	27	43.5
Bolivia	60.4	162	426	1002	576	57.5
Bosnia and Herzegovina	38.4	10	3	6	3	48.2
Botswana	48.7	77	36	78	42	53.6
Brazil	81.0	74	2303	5786	3483	60.2
Brunei Darussalam	52.3	22	2	4	2	55.0
Bulgaria	77.8	19	13	34	20	60.1
Burkina Faso	17.1	493	3530	4970	1440	29.0
Burundi	11.7	863	2394	3052	658	21.6
Cambodia	39.4	256	924	1804	881	48.8
Cameroon	29.2	727	5108	8736	3628	41.5
Canada	77.5	7	23	58	35	60.1
Cape Verde	62.2	44	5	13	7	57.9
Central African Republic	20.5	1052	1620	2421	801	33.1
Chad	3.3	1468	7313	7863	550	7.0

Chile	64.8	27	68	163	95	58.5
China	85.7	36	6450	16189	9739	60.2
Colombia	79.4	76	702	1762	1060	60.2
Comoros	28.0	206	44	74	30	40.5
Congo	45.4	509	636	1327	691	52.1
Costa Rica	83.0	35	26	66	40	60.2
Cote d'Ivoire	13.8	531	3835	5091	1255	24.7
Croatia	86.0	8	4	9	5	60.1
Cuba	73.8	43	51	127	76	59.8
Cyprus	54.5	13	1	3	2	55.7
Czech Republic	75.3	7	7	18	11	59.9
Democratic People's Republic of Korea	71.3	121	396	979	583	59.5
Democratic Republic of the Congo	22.9	539	15560	24166	8606	35.6
Denmark	87.1	5	3	8	5	60.1
Djibouti	16.1	336	81	112	31	27.7
Dominican Republic	68.8	86	192	470	278	59.2
Ecuador	73.8	131	367	913	546	59.8
Egypt	60.8	60	1210	2852	1642	57.6
El Salvador	71.5	119	148	365	218	59.6
Equatorial Guinea	11.8	323	81	103	22	21.7
Eritrea	9.1	385	698	846	148	17.5
Estonia	78.1	21	3	8	5	60.1
Ethiopia	14.2	410	12660	16923	4262	25.2
Fiji	71.3	22	4	10	6	59.5
Finland	86.6	5	3	7	4	60.1
France	78.5	8	62	155	93	60.1
Gabon	35.5	392	155	289	134	46.3
Gambia	16.4	325	198	276	78	28.2
Georgia	48.4	46	24	52	28	53.4
Germany	80.1	7	43	109	66	60.2
Ghana	22.3	376	2839	4366	1527	35.0
Greece	75.3	3	4	9	5	59.9
Guatemala	45.4	83	374	781	407	52.1
Guinea	9.2	710	2784	3382	598	17.7
Guinea-Bissau	10.4	841	546	679	133	19.6
Guyana	38.4	225	31	59	29	48.2
Haiti	32.9	311	849	1528	680	44.5
Honduras	66.3	87	175	425	249	58.8
Hungary	87.0	10	10	26	16	60.1
Iceland	78.0	5	0	1	0	60.1
India	57.6	240	64531	149086	84555	56.7

Indonesia	60.2	277	11686	27460	15774	57.4
Iran	76.6	39	537	1342	806	60.0
Iraq	49.8	59	553	1203	650	54.0
Ireland	69.1	4	3	6	4	59.2
Israel	81.0	7	10	25	15	60.2
Italy	70.4	4	22	55	33	59.4
Jamaica	71.5	80	42	103	62	59.6
Japan	54.1	8	83	188	104	55.6
Jordan	58.4	58	91	211	120	56.9
Kazakhstan	54.0	77	231	520	289	55.6
Kenya	44.4	377	5654	11670	6015	51.5
Kuwait	58.4	7	4	8	5	57.0
Kyrgyzstan	50.6	80	96	211	115	54.3
Lao	38.7	294	500	968	468	48.4
Latvia	75.2	29	7	17	10	59.9
Lebanon	60.6	25	16	39	22	57.5
Lesotho	43.9	742	441	906	465	51.3
Liberia	11.6	983	1429	1819	390	21.4
Libyan Arab Jamahiriya	54.5	73	107	241	134	55.7
Lithuania	60.7	18	5	13	7	57.6
Luxembourg	78.0	8	0	1	1	60.1
Madagascar	36.0	342	2348	4403	2055	46.7
Malawi	39.3	594	3558	6947	3389	48.8
Malaysia	64.4	27	151	362	211	58.4
Maldives	37.2	41	2	5	2	47.4
Mali	8.6	872	4721	5664	943	16.6
Malta	90.5	8	0	1	0	59.9
Mauritania	9.3	621	669	815	145	17.8
Mauritius	78.3	35	6	16	9	60.1
Mexico	73.1	62	1268	3149	1881	59.7
Mongolia	68.7	83	41	101	60	59.2
Montenegro	42.3	16	1	2	1	50.5
Morocco	65.0	125	804	1939	1135	58.5
Mozambique	16.4	709	6215	8639	2425	28.1
Myanmar	41.1	231	2350	4684	2334	49.8
Namibia	54.8	184	108	244	137	55.9
Nepal	46.7	393	2883	6094	3211	52.7
Netherlands	69.3	9	16	39	23	59.3
New Zealand	81.1	11	6	16	10	60.2
Nicaragua	72.8	102	142	353	211	59.7
Niger	11.7	772	6090	7767	1677	21.6
Nigeria	14.6	815	49053	65986	16933	25.7
Norway	89.0	6	3	9	5	60.0

Oman	34.1	25	15	28	13	45.3
Pakistan	29.3	258	13778	23602	9824	41.6
Panama	73.0	69	48	120	71	59.7
Papua New Guinea	36.2	227	469	882	413	46.8
Paraguay	77.4	110	169	423	254	60.1
Peru	72.8	90	547	1356	810	59.7
Philippines	50.7	100	2242	4911	2670	54.4
Poland	82.6	8	28	70	42	60.2
Portugal	87.1	7	8	19	12	60.1
Puerto Rico	85.3	16	8	21	13	60.2
Qatar	49.0	13	2	4	2	53.7
Republic of Korea	80.8	12	56	140	85	60.2
Republic of Moldova	69.3	39	17	43	25	59.3
Romania	71.5	38	81	201	120	59.6
Russian Federation	81.8	54	837	2103	1266	60.2
Rwanda	28.2	331	1333	2247	914	40.7
Saudi Arabia	24.9	24	142	228	86	37.6
Senegal	12.5	420	1969	2550	580	22.8
Serbia	44.5	12	14	28	14	51.6
Sierra Leone	7.0	963	2146	2491	344	13.8
Singapore	68.6	8	3	7	4	59.2
Slovakia	83.9	8	4	11	7	60.2
Slovenia	84.9	8	1	4	2	60.2
Solomon Islands	35.7	93	15	27	13	46.4
Somalia	14.7	798	3154	4254	1100	25.9
South Africa	62.1	220	2401	5704	3303	57.9
Spain	68.4	4	20	49	29	59.1
Sri Lanka	69.4	35	129	317	188	59.3
Sudan	8.0	672	8706	10324	1618	15.7
Suriname	46.8	117	11	24	13	52.7
Swaziland	49.9	200	70	153	83	54.1
Sweden	80.6	4	5	11	7	60.2
Switzerland	87.3	5	4	9	6	60.1
Syrian Arab Republic	57.7	42	246	569	323	56.8
TFYR Macedonia	57.1	15	3	8	4	56.6
Tajikistan	38.2	40	77	149	72	48.1
Tanzania	31.4	674	11929	21040	9110	43.3
Thailand	76.7	22	217	543	326	60.0
Timor-Leste	18.5	359	158	227	70	30.7
Togo	18.6	501	1067	1543	476	30.9
Trinidad and Tobago	43.6	51	10	21	11	51.2
Tunisia	62.0	65	107	254	147	57.9
Turkey	72.8	23	310	769	459	59.7

Turkmenistan	64.3	52	57	138	81	58.4
Uganda	22.9	275	4025	6255	2230	35.7
Ukraine	67.0	42	194	471	277	58.9
United Arab Emirates	35.3	14	9	16	7	46.2
United Kingdom	83.6	7	55	138	83	60.2
United States of America	78.2	13	575	1443	867	60.1
Uruguay	78.8	31	15	39	23	60.1
Uzbekistan	66.8	30	169	410	241	58.9
Venezuela	73.7	61	366	910	544	59.8
Viet Nam	79.2	44	662	1661	999	60.2
Yemen	27.4	212	1793	2986	1193	39.9
Zambia	39.9	286	1552	3050	1498	49.1
Zimbabwe	61.2	827	3128	7394	4266	57.7
Total			**342,545**	**608,534**	**265,989**	43.7

Table 2: Maternal deaths averted by contraceptive use in 167 countries estimated by Model-II.

Country	MMR	Current maternal deaths	Maternal deaths averted	Expected % of maternal deaths averted
Afghanistan	1400	18643	4033	17.79
Albania	31	13	43	77.26
Algeria	120	854	1570	64.78
Angola	610	4549	295	6.08
Argentina	70	476	927	66.07
Armenia	29	14	35	72.18
Australia	8	20	63	75.75
Austria	5	4	15	78.44
Azerbaijan	38	66	141	68.11
Bahamas	49	3	4	58.48
Bahrain	19	3	3	53.44
Bangladesh	340	10565	13702	56.46
Barbados	64	3	7	71.74
Belarus	15	16	75	82.69
Belgium	5	6	19	77.16
Belize	94	7	5	40.80
Benin	410	1377	302	17.99
Bhutan	200	31	23	42.35
Bolivia	180	470	409	46.53
Bosnia and Herzegovina	9	3	10	77.19
Botswana	190	88	87	49.74
Brazil	58	1806	4391	70.85
Bulgaria	13	9	36	80.10
Burkina Faso	560	3766	782	17.19
Burundi	970	2602	411	13.65
Cambodia	290	930	1247	57.29
Cameroon	600	4147	1699	29.06
Canada	12	40	158	79.80
Cape Verde	94	10	14	58.03
Central African Republic	850	1273	368	22.44
Chad	1200	5147	156	2.95
Chile	26	64	184	74.19
China	38	6351	21047	76.82
Colombia	85	773	1233	61.46
Comoros	340	82	29	26.00
Congo	580	791	424	34.92
Costa Rica	44	35	47	57.59
Cote d'Ivoire	470	3104	608	16.39
Croatia	14	9	23	72.38
Cuba	53	62	262	80.72
Czech Republic	8	7	31	81.16
DR Congo	670	18573	3332	15.21
Denmark	5	3	11	79.79
Djibouti	300	75	28	27.01
Dominican Republic	100	218	308	58.61
Ecuador	140	425	551	56.43
Egypt	82	1522	1922	55.81

El Salvador	110	139	221	61.31
Equatorial Guinea	280	61	9	12.39
Eritrea	280	438	51	10.47
Estonia	12	2	7	78.25
Ethiopia	470	12310	2951	19.34
Fiji	26	5	3	38.30
Finland	8	5	16	76.37
France	8	62	181	74.58
Gabon	260	101	63	38.37
Gambia	400	238	54	18.56
Georgia	48	26	87	77.18
Germany	7	56	219	79.70
Ghana	350	2628	1166	30.74
Greece	2	2	10	81.97
Guatemala	110	471	210	30.78
Guinea	680	2582	308	10.65
Guinea-Bissau	1000	567	80	12.43
Guyana	270	38	73	65.71
Haiti	300	800	620	43.67
Honduras	110	221	166	42.93
Hungary	13	16	57	78.22
India	230	62723	82119	56.70
Indonesia	240	10714	22980	68.20
Iran (Islamic Republic of)	30	364	684	65.28
Iraq	75	809	362	30.93
Ireland	3	2	4	70.49
Israel	7	7	9	56.36
Italy	5	26	101	79.30
Jamaica	89	49	75	60.46
Japan	6	65	255	79.67
Jordan	59	90	82	47.90
Kazakhstan	45	150	243	61.75
Kenya	530	7668	2849	27.09
Korea DPR	250	948	2185	69.75
Kuwait	9	4	5	55.00
Kyrgyzstan	81	101	125	55.37
Lao PDR	580	835	890	51.59
Latvia	20	4	21	84.15
Lebanon	26	18	31	63.37
Lesotho	530	320	311	49.24
Liberia	990	1440	218	13.15
Libyan Arab Jamahiriya	64	74	94	56.17
Lithuania	13	6	17	72.23
Madagascar	440	3070	1371	30.88
Malawi	510	3109	690	18.16
Malaysia	31	166	168	50.30
Maldives	37	2	3	61.85
Mali	830	5644	502	8.17
Malta	8	0	1	73.18
Mauritania	550	623	95	13.18
Mauritius	36	7	18	71.63
Mexico	85	1926	3149	62.05

Mongolia	65	40	71	63.62
Montenegro	15	1	3	70.43
Morocco	110	681	1275	65.19
Mozambique	550	4641	972	17.32
Myanmar	240	2030	4436	68.61
Namibia	180	108	101	48.47
Nepal	380	2782	3037	52.19
Netherlands	9	17	54	76.20
New Zealand	14	8	21	72.83
Nicaragua	100	139	160	53.47
Niger	820	5784	632	9.85
Nigeria	840	50616	9550	15.87
Norway	7	4	13	75.82
Oman	20	10	9	47.64
Pakistan	260	12132	8045	39.87
Panama	71	42	31	42.31
Papua New Guinea	250	510	325	38.95
Paraguay	95	146	157	51.93
Peru	98	590	930	61.17
Philippines	94	2179	2174	49.95
Poland	6	31	89	74.34
Portugal	7	7	31	81.06
Puerto Rico	18	10	27	73.95
Qatar	8	1	1	50.67
Republic of Korea	18	86	400	82.36
Republic of Moldova	32	14	52	78.41
Romania	27	59	279	82.53
Russian Federation	39	637	2899	81.99
Rwanda	540	2180	932	29.95
Saudi Arabia	24	136	89	39.40
Senegal	410	1845	312	14.48
Serbia	8	9	22	70.21
Sierra Leone	970	2171	250	10.34
Singapore	9	5	14	74.07
Slovakia	6	4	15	80.63
Slovenia	18	4	15	81.07
Solomon Islands	100	17	9	35.25
Somalia	1200	4694	811	14.73
South Africa	410	4556	6200	57.64
Spain	6	29	109	78.81
Sri Lanka	39	150	302	66.77
Sudan	750	10388	1289	11.04
Suriname	100	10	17	63.28
Swaziland	420	145	126	46.50
Sweden	5	5	16	78.19
Switzerland	10	8	31	78.87
Syrian Arab Republic	46	214	245	53.38
Tajikistan	64	120	107	47.31
Thailand	48	419	1516	78.34
Timor-Leste	370	156	36	18.71
Togo	350	664	176	20.97
Trinidad and Tobago	55	11	22	66.88

Tunisia	60	107	231	68.43
Turkey	23	303	561	64.93
Turkmenistan	77	83	125	60.02
Uganda	430	6164	1220	16.52
Ukraine	26	125	542	81.20
United Arab Emirates	10	5	3	41.38
United Kingdom	12	89	296	76.81
United Republic of Tanzania	790	13757	4168	23.25
United States of America	24	1018	2874	73.84
Uruguay	27	14	30	67.84
Uzbekistan	30	174	293	62.71
Venezuela	68	386	443	53.45
Viet Nam	56	824	2163	72.41
Yemen	210	1814	599	24.82
Zambia	470	2570	547	17.56
Zimbabwe	790	2923	1814	38.30
Total maternal deaths averted		***352,361***	***251,624***	***41.7%***

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