

Facility-based treatment for medical complications resulting from unsafe pregnancy termination in the developing world, 2012: a review of evidence from 26 countries

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With changing conditions affecting receipt of postabortion care, an updated estimate of the incidence of treatment for complications from unsafe pregnancy termination is needed to inform policies and programmes. National estimates of facility-based treatment for complications in 26 countries form the basis for estimating treatment rates in the developing world. An estimated seven million women were treated in the developing world for complications from unsafe pregnancy termination in 2012, a rate of 6.9 per 1000 women aged 15–44 years. Regionally,

rates ranged from 5.3 in Latin America and the Caribbean to 8.2 in Asia. Results inform policies to improve women's health.

Keywords Developing world, pregnancy termination, postabortion care.

Tweetable abstract An estimated 7 million women were treated in the developing world for complications of unsafe TOP in 2012.

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Introduction

Unsafe terminations of pregnancy (TOP) continue to be an important cause of maternal mortality and morbidity. Recent estimates, using different methodologies, show that at a minimum, unsafe TOP accounts for 8% of maternal deaths¹ and possibly as much as 15% of these deaths.² At the same time, the number of maternal deaths has declined steadily worldwide,³ and the number of deaths due to unsafe TOP has also dropped, along with the case-fatality rate from unsafe TOP.⁴ In the case of morbidity due to unsafe TOP, the limited evidence shows that it remains prevalent.⁵ (In this paper, a TOP is defined as a procedure for terminating an unwanted pregnancy before independent viability, typically defined as before 22 weeks; this procedure is referred to as unsafe if it is carried out 'by persons lacking the necessary skills or in an environment lacking minimal medical standards or both.'⁶ We use the term post-abortion or abortion complications to refer to complications arising from either an unsafe TOP or miscarriage;

postabortion care is the treatment of these complications at either a public or private health facility.)

A previous study estimated that in 2005, five million women were treated in facilities for complications of unsafe TOP in the developing world, based on country-specific studies.⁷ With the changing conditions under which women have accessed pregnancy termination services over the past 10 years, a comparable, updated estimate of the magnitude of treatment of complications from unsafe TOP is needed to inform policies and programmes. Because treatment for complications from unsafe TOP is an important indicator of the health consequences of unsafe TOP, and because providing treatment for these complications has significant cost implications for health systems, it is relevant and useful to establish best estimates of the incidence of treatment for these complications.

Treatment for complications from unsafe TOP is not covered in surveys conducted by agencies such as the Demographic Health Surveys (DHS) Program, Centers for Disease Control or United Nations Children's Fund, largely

because of the difficulty of obtaining accurate reporting on the sensitive and stigmatized topic of pregnancy termination in face-to-face interviews with women. As a result, available data on this issue come from two sources. The first is country-specific facility-based studies that measure the number of women provided with postabortion care (PAC) in health facilities. A second source is national health statistics in countries that have good-quality health systems data. Fortunately, the evidence base has expanded in the past decade, providing a substantial body of country-level data on PAC in health facilities. These data form the basis for calculating updated estimates of the annual number and rate of women treated for TOP-related complications in the developing world and for major regions.

Since 2005, the conditions under which women access pregnancy termination services in the developing world have changed considerably. The most important change has been in the increased availability of misoprostol, a drug that can be used to terminate a pregnancy with a clinical effectiveness rate of approximately 85%, when used correctly.⁸ The current availability and use of misoprostol varies across countries, but overall, this trend is likely to have reduced the severity of complications as women switch from more damaging methods to using this medication.^{9–11} On the other hand, based on some evidence showing no decline and some increases in the rate of women treated in facilities (number treated per 1000 women of reproductive age),^{10,12} it appears that at least in the short run, women often do not have the information they need to use the medication correctly and/or that the drug that they are obtaining is substandard.¹³ Although some women may seek follow-up care as the medication takes effect (even in the absence of a complication) there is little evidence on this, while there is some evidence that knowledge of the correct protocol is extremely poor among pharmacists and women.^{14,15}

Another trend that might have affected treatment rates is increased access to health facilities, due to improvements in the public sector's service capacity and expansion of the private sector in many countries. Hence, a larger proportion of women who need care for complications might obtain it now compared with a decade ago. These trends, and the fact that the most recent estimates of treatment for complications from TOP in the developing world are for 2005, highlight the need for current estimates.

Data sources and methods

Country-specific data on post-abortion care

We group our sources into two categories: published studies and health systems data. This is partly because of differences in how the data are collected, but more importantly, because published studies have in general already made

needed adjustments and applied indirect techniques to estimate cases due to complications of TOP. For health systems data, these adjustments were made using comparable methods, described below.

Published studies

The primary data source for this investigation is a series of published studies that provide national estimates of the number of women treated for complications of pregnancy termination in health facilities.^{12,16–28} To be included in our calculations, estimates needed to be nationally representative and provide data for 2000 or later. In addition, although this was a nonsystematic review, we consulted with a range of experts in the field to ensure that we were not omitting any nationally representative estimates of facility-based care; as part of this process, we identified a small group of unpublished manuscripts that also fitted our selection criteria and included these as well (Fetters T and Prada E, Personal communications). Reference years for the selected studies range from 2000 to 2013, and all but two (Guatemala and the Philippines) fall within a more recent period (2008–2013). Two countries (Mexico and Cambodia) included only the public sector, and for these an adjustment was made (discussed later in this section).

Although these studies used slightly different data collection approaches, they all obtained comparable data on the number of women who received postabortion care. Ten of these studies relied on a nationally representative Health Facility Surveys (Bangladesh, Burkina Faso, Colombia, Guatemala, Nigeria, Pakistan, Rwanda, Senegal, Tanzania and Uganda). In these studies, a senior staff member at each sampled facility was asked to provide two estimates of the number of women treated for complications resulting from pregnancy termination—the number treated in the past month and the average month; these estimates were then averaged and multiplied by 12 to provide estimates of the annual caseload. The studies in an additional three countries (Ethiopia, Kenya and Malawi) have comparable data based on two sources: the standard Health Facility Survey and a prospective survey of PAC patients over a 1-month period. The study in Cambodia relied only on a prospective survey of patients from a nationally representative sample of health facilities. In Mexico and the Philippines, where official hospital statistics on the number of women treated for postabortion complications were available and of adequate quality, these statistics were used and adjusted as needed for shortfalls in geographic coverage or classification by diagnosis. Detailed descriptions of each studies' methodology are available elsewhere.^{12,16–29}

These studies obtained the total number of women treated for complications (from both pregnancy terminations and

Table 1. Countries for which health systems data was separately collected, including source of data, reference year, and adjustments made

Region, country	Source	Year	Adjustments*
Africa			
Mauritius ⁴⁰	Ministry of Health and Quality of Life, Health Statistics Report 2012.	2012	<i>b</i>
Asia			
Myanmar ³⁴	Department of Health Planning, Annual Hospital Statistics Report 2009.	2009	<i>b,p</i>
Sri Lanka ³⁷	Medical Statistics Unit, Indoor Morbidity and Mortality Report 2010.	2010	<i>b,p</i>
Latin America			
Argentina ³⁶	Dirección de Estadísticas e Información de Salud (DEIS), Egresos de establecimientos oficiales por diagnóstico – año 2010.	2010	
Brazil ³⁹	Ministério da Saúde, Sistema de Informações Hospitalares do SUS – SIH/SUS.	2012	<i>s</i>
Chile ³⁵	Departamento de Estadísticas e Información de Salud (DEIS) Egresos Hospitalarios de mujeres, según previsión y causas. Chile, 2011.	2011	<i>b</i>
Costa Rica ³²	CCSS System Data, Egresos Hospitalarios según diagnóstico principal.	2012	<i>p</i>
Dominican Republic ⁴¹	La Oficina Nacional de Estadística, Dominicana en Cifras 2014.	2012	<i>b,p</i>
Peru ³³	Ministerio de Salud del Perú (MINSA), Principales causas de morbilidad de hospitalización por sexo, Peru, 2013.	2013	<i>b,p</i>
Venezuela ³⁸	Ministerio del Poder Popular para la Salud, Anuario de morbilidad 2011.	2011	<i>b,p</i>

*The type of adjustments made are identified by the following symbols: *b*, when detailed data on type of pregnancy loss by diagnostic code were not available, the proportion due to biological factors such as ectopic pregnancy was estimated and subtracted from the total number of cases treated; *p*, when data were only available from the public sector, the proportion of cases treated in the private sector was estimated based on the proportion of births delivered in private facilities; and *s*, whereas data were available from both the public and private sectors in Brazil, no information on PAC cases paid for with supplemental insurance could be obtained; this proportion was estimated based on the per cent of live births paid for with supplemental insurance.

miscarriage), because it is difficult for providers to separately estimate for these two categories of complications given the similarity in symptoms between complications from less damaging pregnancy termination methods and miscarriage; also, respondents may be unwilling to provide estimates related to pregnancy terminations given the potential legal consequences. Health systems data on abortion complications (discussed below), which are often miscoded for similar reasons, have the same limitation.³¹

In each study, study authors used a comparable indirect estimation method to separate these total numbers into miscarriage and pregnancy termination complications. The number of women treated in health facilities for complications from miscarriage was estimated on the basis that of all women having miscarriages, only those who do so at a later gestation (13–21 completed weeks) are expected to need medical care in a facility. In addition, only some of these women will actually obtain care in health facilities, given that access to health care is not universal. Clinical studies provide data on the distribution of spontaneous pregnancy loss by gestation, and allow estimation of the proportion of all pregnant women who would have late miscarriages.^{30,31} Of women who have a late miscarriage, the proportion who will obtain hospital care is estimated as

equal to the proportion of women who deliver in a health facility (available from national surveys). In a few countries with very low proportions delivering in health facilities, this assumption was modified to take into account the likelihood that women are more likely to seek treatment for a miscarriage (an illness) than for delivery (a healthy process for most women). The countries in which this adjustment was made are: Ethiopia, Kenya, Nigeria, Tanzania and Uganda. In addition, in the case of one study (Cambodia), which did not separate the total caseload into cases due to pregnancy termination and cases due to miscarriage, we applied the standard approach used by the other studies to do so.

Health systems data

Official statistics are a second source of data on the number of women treated in health facilities for abortion complications. We obtained treatment data for ten countries spanning the years 2009–2013 (Table 1), from published government reports or databases of health systems statistics.^{32–41} Health systems data were included if they were either publicly available or available upon request from government sources. In all cases, some adjustments were needed to account for gaps in coverage and other

issues of misclassification (see Table 1 and discussion below).

Removing complications due to biological factors

In the tenth revision of the International Classification of Diseases (ICD-10), the codes used to identify women treated for abortion complications are O00–O08.⁴² Previous studies have typically excluded cases coded as O00 (ectopic pregnancy), O01 (hydatidiform mole) or O02 (other abnormal products of conception)—as they are unrelated to miscarriage or pregnancy termination. However, in recent years, specialists in obstetrics and gynaecology have observed that the incorrect use of misoprostol to induce pregnancy termination can result in cases that are diagnosed and classified as codes O02.0 (blighted ovum and nonhydatidiform mole) or O02.1 (retained products of conception).¹⁹ Hence, some proportion of cases receiving these two subcodes should be classified as pregnancy termination cases. For Argentina and Costa Rica, countries in which we had hospitalization data by detailed ICD-10 codes, we followed the approach used in a recent study in Mexico¹⁹ and categorized 35% of O02.0 cases and 55% of O02.1 cases as complications from unsafe TOP. Brazil also has data by detailed codes; however, a recent study found that the ratio of the number of women treated for these complications to the number of births declined from its peak level of 2.44 in 1992 to 1.34 in 2009, approximating biological levels;⁴³ therefore in the case of Brazil all patients with codes O00–O02 were excluded from the total of postabortion cases.

For Chile, the Dominican Republic, Mauritius, Myanmar, Peru, Sri Lanka and Venezuela, data by detailed diagnostic code were not available. Instead, numbers of PAC cases treated were grouped together in a generic ‘abortion’ category (which typically refers to cases coded as ICD-10 codes O00–O08). We estimated the proportion of this generic category treated for codes O00–O02 based on data for one country with good quality data and applied this proportion to remove these cases from the total number reported for these countries. (We made this adjustment as follows: we estimated the ratio of ectopic pregnancies, hydatidiform mole or other abnormal products of conception to live births using data from Chile in 1982 [before misoprostol became widely used in Latin America and the Caribbean].⁴⁴ This number is 1.7 cases per every 100 live births. For the purpose of this estimation, we assume that this ratio is constant or varies very little across populations or over time. We then applied this ratio to the number of births in each country, and took into account the fact that not all women who have these complications will receive care in a health facility [using the assumption that the proportion getting care for these complications is equivalent to the proportion of women who deliver in facilities], to

arrive at the number of women treated in facilities for ‘biological’ pregnancy complications. We then subtracted this number from the total number treated to obtain the number treated for all postabortion complications [miscarriage and TOP].)

Removing miscarriages

We used the same indirect estimation methodology as was applied in the published studies described above to estimate the number of miscarriages treated in health facilities. In general, the number of births was obtained from the 2012 revision of World Population Prospects.⁴⁵ The proportion of women giving birth who deliver in a health facility was obtained from either country DHS reports (Dominican Republic, Peru and Sri Lanka),^{46–48} government reports and surveys (Argentina and Myanmar)^{49,50} or WHO statistics (Brazil, Chile, Costa Rica and Mauritius).⁵¹ Venezuela has no recent surveys estimating the proportion of women delivering at health facilities; in the absence of other information, we used the regional proportion for Latin America and the Caribbean.⁵²

Accounting for treatment in the private sector

In the majority of countries for which we collected health systems statistics, data were only available for the public sector. This was the case in Costa Rica, the Dominican Republic, Myanmar, Peru, Sri Lanka and Venezuela. In the absence of other data, we estimated the number of cases in the private sector in these countries by assuming that the ratio between the proportion of women delivering in private facilities and the proportion of women delivering in public facilities (as measured in national surveys) was the same as the ratio between the proportion of women obtaining care for postabortion complications in these two settings. This approach was also used to adjust the estimates for Cambodia and Mexico. In Brazil, a similar adjustment was made to account for cases paid for with supplemental insurance coverage, using the ratio between births paid for with government insurance and supplemental insurance to estimate the number of postabortion cases paid for with the latter. In Argentina, although data were only available for the public sector, a recent study suggested that treatment of postabortion cases in the private sector is rare. Based on this information, no adjustment was made.⁵³

Regional estimates

Regional rates are estimated as the weighted average of treatment rates for countries with data in that region: weights are the number of women aged 15–44 years in 2012, the selected reference year, as this is the most recent year of data for a number of countries. The annual PAC caseload due to TOP in 2012 in each region is estimated as

the product of the regional treatment rate and the number of women aged 15–44 years in 2012, divided by 1000. Although we do not present estimates for Northern Africa, Southern Africa and Western Asia because of a lack of data for these subregions, they are included in population totals for their respective regions. Southern Africa and Northern Africa are assigned the average treatment rate for Africa; Western Asia is assigned the average treatment rate for Asia. In addition, Eastern Asia as well as other individual countries with legal, accessible pregnancy termination services have been excluded in calculating the number of women treated for complications and the treatment rate for all developing regions and subregions; given the state of pregnancy termination services in these countries, it is unlikely that they have significant numbers of TOP complications. (The determination of which countries to exclude was based on the Center for Reproductive Right's online World Abortion Laws Map, as well as consultation with experts knowledgeable in the field. In total, 21 countries with liberal laws and universal or near-universal access to safe abortion services were excluded in the calculation of treatment rates [see Table 4].⁵⁴) Finally, given the absence of data from India on treatment for postabortion complications, we assign it the treatment rate for Bangladesh, a neighbouring country that also has a form of approved pregnancy termination (menstrual regulation) as well as large gaps in provision of safe services (menstrual regulation in Bangladesh and pregnancy termination in India).^{55–57}

Coverage of each region was calculated as the number of women aged 15–44 years in countries for which we have data divided by the number of women aged 15–44 in the region overall (excluding those countries that have legal and accessible TOP). Coverage was relatively high in Latin America and the Caribbean, at 87%, and moderate in Sub-Saharan Africa, at 50%. Because of lack of data for India, coverage of Asia (excluding eastern Asia) was relatively low, at 22% overall. We assess the impact of key assumptions on our estimates in the *Limitations and sensitivity analysis* section (below).

We present two estimates of the overall rate in the developing world: the annual number of women treated for complications from unsafe TOP per 1000 women aged 15–44 (a) excluding Eastern Asia; and (b) excluding Eastern Asia as well as countries with legal and accessible TOP services.

Results

Table 2 presents estimated treatment rates for TOP complications in the 26 countries with data. The estimated annual treatment rates range from a relative low of 2.4 in Brazil to a high of 14.6 per 1000 women aged 15–44 in Pakistan. In

Table 2. Estimates of number of women treated for pregnancy termination complications and treatment rates per 1000 women 15–44, in 26 countries, 2000–13, according to source of estimate and region

Region, country, by source of data*	Annual number of women treated in health facilities for pregnancy termination complications	Annual treatment rate for pregnancy termination complications per 1000 women aged 15–44
Africa		
Burkina Faso, 2008 ^a **	22 948	7.4
Ethiopia, 2008 ^a	52 607	3.2
Kenya, 2012 ^a **	119 912	13.4
Malawi, 2009 ^a	18 686	10.2
Mauritius, 2012 ^b	1096	3.9
Nigeria, 2012 ^a **	211 959	6.0
Rwanda, 2009 ^a	16 748	7.0
Senegal, 2012 ^a	16 722	5.5
Tanzania, 2013 ^a **	66 641	6.4
Uganda, 2013 ^a	91 960	11.8
Asia		
Bangladesh, 2010 ^a ***	309 367	8.7
Cambodia, 2010 ^a ****	32 504	9.1
Myanmar, 2009 ^b	38 763	2.9
Pakistan, 2012 ^a **	622 564	14.6
Philippines, 2000 ^a	78 901	4.5
Sri Lanka, 2010 ^b	30 892	6.4
Latin America		
Argentina, 2010 ^b	39 970	4.4
Brazil, 2012 ^b	113 164	2.4
Chile, 2011 ^b	18 264	4.6
Colombia, 2008 ^a	93 336	9.1
Costa Rica, 2012 ^b	3970	3.4
Dominican Republic, 2012 ^b	24 882	10.3
Guatemala, 2003 ^a	21 625	8.6
Mexico, 2009 ^a ****	219 430	8.1
Peru, 2013 ^b	28 652	3.9
Venezuela, 2011 ^b	21 918	3.1

Treatment is defined as the provision of PAC to treat complications that occur or develop due to use of unsafe methods of pregnancy termination. These include less severe complications such as an incomplete procedure or excessive haemorrhage, and/or more severe complications such as sepsis or uterine perforation.

^aEstimate from published study; ^bestimate based on independently collected health systems data.

**Treatment rate recalculated based on population of women aged 15–44 years.

***Includes complications from legal menstrual regulation.

****Published estimates adjusted to account for contribution of private sector (see text for details).

Africa, Kenya has the highest rate, at 13.4; Malawi and Uganda also have relatively elevated rates, at 10.2 and 11.8, respectively. In Latin America, the Dominican Republic has

Table 3. Distribution of estimated treatment rates by region and subregion, 2000–13

Region and subregion	Estimated treatment rate per 1000 women 15–44			
	1–3	4–6	7–9	10+
Africa				
Sub-Saharan Africa				
Eastern Africa	Ethiopia, Mauritius	Tanzania	Rwanda	Kenya, Uganda, Malawi
Western and Middle Africa		Senegal, Nigeria	Burkina Faso	
Northern Africa				
Asia (excluding Eastern Asia)				
South-Central Asia		Sri Lanka	Bangladesh	Pakistan
South-Eastern Asia	Myanmar	Philippines	Cambodia	
Western Asia				
Latin America and the Caribbean				
Caribbean				Dominican Republic
Central America	Costa Rica		Guatemala, Mexico	
South America	Venezuela, Brazil, Peru	Argentina, Chile	Colombia	

Treatment is defined as the provision of postabortion care (PAC) to treat complications that occur or develop due to use of unsafe methods of pregnancy termination. These include less severe complications such as an incomplete procedure or excessive hemorrhage, and/or more severe complications such as sepsis or uterine perforation.

the highest rate, at 10.3, whereas Brazil has the lowest; in Asia, Pakistan has the highest rate (14.6) and Myanmar has the lowest (2.9).

To get a better sense of the range within regions, Table 3 presents countries' estimated treatment rates grouped into four categories (1–3, 4–6, 7–9 and 10+ per 1000 women aged 15–44 years). There is no clear pattern by region or sub-region. Every region, and many subregions, have countries in almost every category. In Sub-Saharan Africa, Ethiopia and Mauritius are in the lowest category, whereas Kenya, Uganda and Malawi are in the highest. Tanzania, Senegal, Rwanda, Nigeria and Burkina Faso have rates in the middle ranges of 4–6 and 7–9. In Asia, Pakistan is in the highest category (10+), followed by Bangladesh and Cambodia in the second highest (7–9). Myanmar is the only country in the lowest category (1–3) in this region, whereas Sri Lanka and the Philippines have rates in the 4–6 range. In Latin America and the Caribbean, Costa Rica, Peru, Venezuela and Brazil are all in the lowest category, whereas the Dominican Republic is in the highest; Argentina, Chile, Guatemala, Mexico and Colombia all have rates in the middle groups.

We estimate that in 2012 almost seven million women were treated for complications of unsafe TOP in the developing world (Table 4). This would be an annual rate of 6.9 per 1000 women in all developing countries, or 7.4 if we exclude countries in which TOP is legal and widely accessible (both estimates exclude Eastern Asia). The results indicate that the regional rate is likely to be highest in Asia at 8.2 per 1000 women (4.6 million women per year), driven

largely by high rates in South–Central Asia. It is followed by Africa, with an average regional rate of 6.7 (around 1.6 million women per year), and Latin America and the Caribbean, with a regional rate of 5.3 (757 000 women per year).

Limitations and sensitivity analysis

The estimates we provide have several significant limitations. They are based on a small number of countries and their reliability therefore depends on the assumption that these countries can be used to represent the incidence of treatment for TOP-related complications, at the aggregate regional and subregional levels.

In addition, we have used two main sources of data—published studies and health systems data. In all but a few countries for which we obtained health systems statistics, information on the coverage of these data was sparse or unavailable; if our adjustments for incomplete coverage are insufficient, treatment rates will be somewhat underestimated. In addition, some countries with legal, safe and accessible TOP services (such as the countries of central Asia) may nevertheless have small numbers of complications resulting from poor quality services;⁴ our estimates omit these complications. Also, it is likely that a small proportion of women with first-trimester pregnancy losses do obtain care in a health facility. This would mean that the number treated in facilities for complications from a miscarriage would be slightly larger than estimated and the number treated for TOP-related complications would be somewhat overestimated.

Table 4. Estimates of number of women treated in health facilities for pregnancy termination complications each year, and annual treatment rates per 1000 women aged 15–44, by major world regions and sub-regions, 2012

Region and subregion	Total female population 15–44 (number in 000s) United Nations estimates, 2012	Estimated annual treatment rate per 1000 women 15–44	Annual number of women treated at health facilities for pregnancy termination complications
Developing Countries (excluding Eastern Asia)	1 011 484	6.9	6 947 733
Excluding countries in which abortion is legal and accessible*	942 088	7.4	6 947 733
Africa			
Sub-Saharan Africa	190 026	6.7	1 276 543
Eastern Africa	78 848	7.5	590 274
Western and Middle Africa	96 623	6.1	588 494
Total**	236 882	6.7	1 591 313
ASIA (excluding Eastern Asia)			
South-Central Asia	406 773	9.3	3 799 651
South-Eastern Asia	123 757	4.4	541 154
Total**	562 194	8.2	4 599 877
Latin America And the Caribbean			
Caribbean	7120	10.3	73 612
Central America	40 499	8.0	324 986
South America	95 393	3.8	357 946
Total	143 012	5.3	756 543

Treatment is defined as the provision of postabortion care (PAC) to treat complications that occur or develop due to use of unsafe methods of pregnancy termination. These include less severe complications such as an incomplete procedure or excessive hemorrhage, and/or more severe complications such as sepsis or uterine perforation.

*In addition, countries with legal and accessible pregnancy termination services are excluded from all regional totals; given the accessibility of pregnancy termination services in these countries, it is unlikely that they have significant numbers of complications due to pregnancy termination. These countries, by region are: Africa: Cape Verde and Tunisia; Asia: Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Israel, Kazakhstan, Kyrgyzstan, Singapore, Tajikistan, Turkey, Turkmenistan, Uzbekistan, and Vietnam; Latin America and the Caribbean: Barbados, Belize, Cuba, Guyana, and Saint Vincent and Grenadines.

**The sub-regions of Northern Africa and Western Asia are included in population totals for their respective regions; in absence of reliable data, they are assigned the regional treatment rate.

Finally, we have made several key assumptions regarding countries for which we lack data. The majority of these assumptions affect the final estimates only slightly; some

however may have larger effects. For example, lacking recent data, Southern Africa was assigned the regional rate for Africa (6.7) because unsafe TOP in South Africa is prevalent despite a liberal law. We tested an alternative assumption—that safety had improved and the treatment rate for South Africa had declined to 5.0. Under this assumption, the rate for Africa would be 6.6 (instead of 6.7) and the rate for the developing world would be 6.8 (instead of 6.9). This is a very small impact. Northern Africa was also assigned the regional treatment rate for Africa; alternatively, we could have assumed that the estimated rate for Northern Africa remained unchanged from the previous 2005 estimates (which were based largely on older data for Egypt, from 1996). Under this assumption, the regional rate for Africa would be 7.8, and the rate for the developing world would be 7.1.

India was assigned the rate of Bangladesh in our analysis (8.7), given the two countries' similar mix of safe and unsafe TOP services. If we had instead assigned India the average rate for other countries in South-Central Asia, the estimate for this subregion would increase substantially (from 9.3 to 11.5); the rate for Asia as a whole would increase from 8.2 to 9.8, while the estimate for the developing world would increase from 6.9 to 7.8. Because of this, estimates for Asia, and South-Central Asia in particular, should be treated with caution, as new data from India may affect these estimates substantially.

Discussion

The incidence of treatment for complications from unsafe TOP continues to be high. An estimated 6.9 million women were treated for such complications in 2012, an annual treatment rate of 6.9 per 1000 women aged 15–44 years. These results indicate that unsafe TOP remains a significant source of morbidity for women in the developing world in 2012.

Treatment rates are a function of both the underlying levels of morbidity associated with unsafe TOP, and access to postabortion care at health facilities; low rates, for example, could therefore be a reflection of either low levels of morbidity, and/or low levels of access to care. The percentage of women delivering in health facilities (which we use as a proxy measure for access to care) ranges from 91% in Latin America and the Caribbean to 51% in Africa (Asia falls between these two regions, at 70%).⁵² Although treatment rates for Latin America largely approximate true levels of underlying morbidity, those for Africa probably represent only a proportion of women with complications. Nevertheless, treatment rates are a useful measure of the load borne by health systems in the developing world from complications caused by unsafe TOP.

It is important to bear in mind, however, that the morbidity burden from unsafe TOP is much greater than indicated by the data on treatment alone. Based on estimates made by health professionals (averaged across several surveys conducted between 2000 and 2008), about 60% of women with TOP complications were expected to obtain care in health facilities and 40% would not get such care.⁵⁸ Assuming that the situation in 2012 was similar, the overall magnitude of complications resulting from unsafe TOP would be substantially higher (1.67 times the estimates presented here for 2012). Even if improvements in access to health care in the past decade have increased the proportion obtaining needed postabortion care, total morbidity from unsafe TOP would be substantially greater than the number treated for these complications.

The 2012 estimated rate for the developing world represents around a 20% increase from the rate estimated in 2005. This is largely accounted for, however, by increases in the regional rate in South-Central Asia, which more than doubled from 4.0 in 2005 to 9.3 in 2012. It is likely that some of this increase is due to the broad worldwide trend towards better access to health services;⁵² but in addition, specific to this subregion, better data coverage in recent studies also accounts for some of the increase in the treatment rate as the previous estimate for this subregion was based on studies that covered only the public sector. Even though the private sector has grown over the past decade, and now has a larger role in healthcare provision than before in this subregion, the omission of this sector in the 2005 estimate makes it difficult to definitively conclude whether the incidence of treatment for complications from unsafe TOP has increased, and if so by how much.

The estimated regional rate for Sub-Saharan Africa dropped slightly, from 7.4 in 2005 to 6.7 in 2012. However, in 2012 a larger number (ten) and a more heterogeneous mix of countries are included compared with 2005 (three countries, two in common with 2012) (see Table S1). As a result, comparison of the 2005 and 2012 treatment rates probably does not provide a reliable estimate of trends for this region.

The estimated regional rate for Latin America dropped substantially, from 7.7 in 2005 to 5.3 in 2012. Although we are limited in our capacity to formally assess trends (in part due to the lack of reliable confidence intervals around the regional estimates for both years), we hypothesize that there has been a real decrease in morbidity, as access to postabortion care in this region is unlikely to have changed drastically over the time period measured, and in many countries, may have improved. (The proportion of women delivering in health facilities in Latin America and the Car-

ibbean increased from 87% in 2008 to 91% in 2012.⁵²) Unlike in Sub-Saharan Africa, the mix of countries used to estimate this rate is largely unchanged from 2005; in particular, data were available at both points in time for the countries with the largest populations in the region (Brazil, Mexico and Colombia).

The data presented here do not measure the severity of complications. Even though the number of women treated remains large, the proportion with severe complications may have declined. The decline in the case fatality rate due to unsafe TOP is one piece of evidence that supports the conclusion that the severity of TOP-related complications has declined.⁴ Factors that might contribute to this trend include increased use of medication for pregnancy termination, substituting for use of more invasive and dangerous methods, and a shift in reliance on dilatation and curettage to manual vacuum aspiration. However the evidence on trends in severity of TOP-related morbidity is very limited, lacking comparable population-based studies over time needed to measure this trend.

In addition to the morbidity burden for women, treatment of complications from unsafe TOP also results in substantial costs to health systems and to women and their families. In the developing world as a whole, an estimated US \$232 million dollars are spent by health systems each year on postabortion care.⁵² This estimated cost does not include quality care for the women treated in facilities and it also excludes the 40% of women who need facility-based postabortion care and are not receiving it. If all women needing postabortion care obtained WHO-recommended levels of care, the cost would be an estimated \$562 million. Complications from unsafe TOP can also represent a substantial burden to households; a recent study in Uganda found that complications from unsafe TOP often led to substantial losses in productivity, negative consequences for children, and subsequent deterioration in women's economic circumstances.⁵⁹

Conclusions

The large number of women treated for complications of unsafe TOP each year in the developing world—estimated at seven million in 2012—need quality care. At a minimum, this includes appropriate medical procedures on an emergency basis, as well as contraceptive counselling and services, as a required component of postabortion care, to prevent future unintended pregnancies. Broader access to safe TOP services is an additional effective preventive measure. Reducing unsafe TOP would benefit women's health and the wellbeing of their families. It would also yield net economic gains by improving women's productivity and by reducing the costs of postabortion care.

Disclosure of interests

None declared. Completed disclosure of interests form available to view online as supporting information.

Contribution to authorship

Both authors contributed to all aspects of the article, including conceptualization, analysis, drafting and revision.

Details of ethics approval

As the article is a review of previously published or public data, and does not involve human subjects or individual medical records, no additional ethics approval was required.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Countries used in calculations of regional and global estimates, in Singh 2006 and in present study. ■

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