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.

Linked article This article is commented on by D Shaw, p. 1499 in this issue. To view this article mini commentary visit http://dx.doi.org/10.1111/1471-0528.13627.

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 deaths and possibly as much as 15% of these deaths. At the same time, the number of maternal deaths has declined steadily worldwide, and the number of deaths due to unsafe TOP has also dropped, along with the case-fatality rate from unsafe TOP. In the case of morbidity due to unsafe TOP, the limited evidence shows that it remains prevalent. 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. We use the term postabortion 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. 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 and 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. 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.

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), 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. 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.

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. 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.

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

### 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 | Ministry of Health and Quality of Life, Health Statistics Report 2012. | 2012 | b |
| **Asia** | | | |
| Myanmar | Department of Health Planning, Annual Hospital Statistics Report 2009. | 2009 | b,p |
| | Medical Statistics Unit, Indoor Morbidity and Mortality Report 2010. | 2010 | b,p |
| **Latin America** | | | |
| Argentina | Dirección de Estadísticas e Información de Salud (DEIS), Egresos de establecimientos oficiales por diagnóstico – año 2010. | 2010 |
| Brazil | Ministério da Saúde, Sistema de Informações Hospitalares do SUS – SIH/SUS. | 2012 | s |
| Chile | Departamento de Estadísticas e Información de Salud (DEIS), Egresos Hospitalarios de mujeres, según prevision y causas. Chile, 2011. | 2011 | b |
| Costa Rica | CCSS System Data, Egresos Hospitalarios según diagnóstico principal. | 2012 | p |
| Dominican Republic | La Oficina Nacional de Estadística, Dominicana en Cifras 2014. | 2012 | b,p |
| Peru | Ministerio de Salud del Perú (MINSA), Principales causas de morbilidad de hospitalización por sexo, Peru, 2013. | 2013 | b,p |
| Venezuela | Ministerio del Poder Popular para la Salud, Anuario de morbilidad 2011. | 2011 | b,p |

*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.
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. 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 non-hydatidiform mole) or O02.1 (retained products of conception). 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 Mexico 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; 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]. 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. 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), government reports and surveys (Argentina and Myanmar) or WHO statistics (Brazil, Chile, Costa Rica and Mauritius). 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.

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.

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]. 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)35–37.

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

| 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**                         | **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** |
| Burkin Faso, 2008** **             | 22 948                                        | 7.4                                           |
| Ethiopia, 2008*                     | 52 607                                        | 3.2                                           |
| Kenya, 2012** **                   | 119 912                                       | 13.4                                          |
| Malawi, 2009*                      | 18 686                                        | 10.2                                          |
| Mauritius, 2012*                   | 1096                                          | 3.9                                           |
| Nigeria, 2012** **                 | 211 959                                       | 6.0                                           |
| Rwanda, 2009*                      | 16 748                                        | 7.0                                           |
| Senegal, 2012*                     | 16 722                                        | 5.5                                           |
| Tanzania, 2013** **                | 66 641                                        | 6.4                                           |
| Uganda, 2013*                      | 91 960                                        | 11.8                                          |
| **Asia**                           | **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** |
| Bangladesh, 2010***                | 309 367                                       | 8.7                                           |
| Cambodia, 2010****                 | 32 504                                        | 9.1                                           |
| Myanmar, 2009*                     | 38 763                                        | 2.9                                           |
| Pakistan, 2012** **                | 622 564                                       | 14.6                                          |
| Philippines, 2000*                 | 78 901                                        | 4.5                                           |
| Sri Lanka, 2010**                  | 30 892                                        | 6.4                                           |
| **Latin America**                  | **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** |
| Argentina, 2010**                  | 39 970                                        | 4.4                                           |
| Brazil, 2012**                     | 113 164                                       | 2.4                                           |
| Chile, 2011**                      | 18 264                                        | 4.6                                           |
| Colombia, 2008*                    | 93 336                                        | 9.1                                           |
| Costa Rica, 2012**                 | 3970                                          | 3.4                                           |
| Dominican                          | 24 882                                        | 10.3                                          |
| Republic, 2012**                   | 21 625                                        | 8.6                                           |
| Guatemala, 2003*                   | 219 430                                       | 8.1                                           |
| Mexico, 2009****                   | 28 652                                        | 3.9                                           |
| Peru, 2013**                       | 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.

**Estimate from published study;** estimate 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
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; 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.
assumptions affect the final estimates only slightly; some countries for which we lack data. The majority of these 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) | 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, Guiana, 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%). 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. 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 toward better access to health services; 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 Caribbean increased from 87% in 2008 to 91% in 2012.)

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. 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. 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.

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.

References

1 Say L, Chou D, Gemmill A, Tuncalp O, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Global Health 2014;2:323–33.
2 Kasebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014;384:890–1004.
3 United Nations Population Fund, United Nations Children’s Fund, World Health Organization. The World Bank. Trends in Maternal Mortality: 1990–2010. Geneva: World Health Organization, 2012.
4 World Health Organization. Unsafe Abortion Incidence and Mortality: Global and Regional Levels in 2008 and Trends During 1990–2008. Geneva: World Health Organization, 2011.
5 Singh S. Global consequences of unsafe abortion. Women’s Health (Lond Engl) 2010;6:849–60.
6 World Health Organization. The Prevention and Management of Unsafe Abortion: Report of a Technical Working Group in Geneva, 12–15 April 1992. Geneva: World Health Organization, 1993.
7 Singh S. Hospital admissions resulting from unsafe abortion: estimates from 13 developing countries. Lancet 2006;368:188–92.
8 Faundes A, Fiala C, Tang OS, Velasco A. Misoprostol for the termination of pregnancy up to 12 completed weeks of pregnancy. Int J Gynecol Obstet 2007;99(Suppl 2):S172–7.
9 Harper CC, Blanchard K, Grossman D, Henderson JT, Darney PD. Reducing maternal mortality due to elective abortion: potential impact of misoprostol in low-resource settings. Int J Gynecol Obstet 2007;98:66–9.
10 Juarez F, Singh S, Garcia SG, Olavrieta CD. Estimates of induced abortion in Mexico: what’s changed between 1990 and 2006? Int Perspect Sexual Reprod Health 2008;34:158–68.
11 Winkoff B, Sheldon W. Use of medicines changing the face of abortion. Int Perspect Sexual Reprod Health 2012;38:164–6.
12 Prada E, Singh S, Remez L, Villareal C. Unintended Pregnancy and Induced Abortions in Colombia: Causes and Consequences. New York: Guttmacher Institute, 2011.
13 Zamberlin N, Raifer S. Revision del Conocimiento Disponible Sobre Experiencia de las Mujeres con el Uso del Misoprostol en América Latina. Lima, Peru, Buenos Aires, Argentina: Consorcio Latinoamericano Contra el Aborto Inseguro; Centro de Estudios de Estado y Sociedad, 2010.
14 Huda FA, Ngo TD, Ahmed A, Alam A, Reichenbach L. Availability and provision of misoprostol and other medicines for menstrual regulation among pharmacies in Bangladesh via mystery client survey. Int J Gynecol Obstet 2014;124:164–8.
15 Lara D, García SG, Wilson KS, Paz F. How often and under which circumstances do Mexican pharmacy vendors recommend misoprostol to induce an abortion? Int Perspect Sexual Reprod Health 2011;37:75–83.
16 Bankole A, Adevolle I, Hussain R, Owolule O, Singh S, Akinyemi JO. The incidence of abortion in Nigeria. Int Perspect Sexual Reprod Health 2015; (in press).
17 Basinga P, Moore AM, Singh S, Carlin E, Birungi F, Ngabo F. Abortion incidence and postabortion care in Rwanda. Stud Fam Plann 2012;43:11–20.
18 Izugbara C, Kimani E, Mutua M, Mohamed S, Ziraba A, Egesa C, et al. Incidence and Complications of Unsafe Abortion in Kenya: Key Findings of a National Study. Nairobi, Kenya: African Population and Health Research Center, Ministry of Health, Kenya, Ipas, and Guttmacher Institute, 2013.
19 Juarez F, Singh S. Incidence of induced abortion by age and state, Mexico, 2009: new estimates using a modified methodology. Int Perspect Sexual Reprod Health 2012;38:58–67.
20 Levandowski BA, Mhango C, Kachingale E, Lunguji J, Katengeza H, Gebreassellassi H, et al. The incidence of induced abortion in Malawi. Int Perspect Sexual Reprod Health 2013;39:88–96.
21 Sathar ZA, Singh S, Rashida G, Shah Z, Niazi R. Induced abortions and unintended pregnancies in Pakistan. Stud Fam Plann 2014;45:471–91.
22 Sedgh G, Rossier C, Kabore I, Bankole A, Mikulich M. Estimating abortion incidence in Burkina Faso using two methodologies. Stud Fam Plann 2011;42:147–54.
23 Sedgh G, Sylla AH, Philbin J, Keogh S, Ndiaye S. Estimates of the incidence of induced abortion and consequences of unsafe abortion in Senegal. Int Perspect Sexual Reprod Health 2015; 41:11–19.
24 Singh S, Juarez F, Cabigon J, Ball H, Hussain R, Nadeau J. Unintended Pregnancy and Induced Abortions in the Philippines: Causes and Consequences. New York: Guttmacher Institute, 2006.
25 Singh S, Prada E, Kestler E. Induced abortion and unintended pregnancy in Guatemala. Int Family Plann Perspect 2006;32:36–45.
26 Singh S, Fetters T, Gebreassellassie H, Abdella A, Gebrehiwot Y, Kumbi S, et al. The estimated incidence of induced abortion in Ethiopia. Int Perspect Sexual Reprod Health 2010;36:16–25.
Singh, Maddow-Zimet

27 Singh S, Hossain A, Maddow-Zimet I, Bhuiyan HU, Vlassoff M, Hussain R. The incidence of menstrual regulation procedures and abortion in Bangladesh. Int Perspect Sexual Reprod Health 2012;38:122–32.

28 Keogh S, Kimaro G, Muganyizi P, Philbin J, Bankole A. Abortion incidence and postabortion care in Tanzania. PLoS One 2015 (in press).

29 Guttmacher Institute and Internation Union for the Scientific Study of Population. Methodologies for Estimating Abortion Incidence and Abortion-Related Morbidity: A Review. New York and Paris: Guttmacher Institute and Internation Union for the Scientific Study of Population, 2010.

30 Harlap S, Shiono PH, Ramcharan S. A Life Table of Spontaneous Abortions and the Effects of Age, Parity and Other Variables. New York: Academic Press, 1980.

31 Bongaarts J, Porter I. Fertility, Biology and Behavior: An Analysis of the Proximate Determinants. New York: Academic Press, 1983.

32 CCSS system data. Egresos Hospitalarios según diagnóstico principal. 2013 [http://ccss.csdapp3.ccss.sa.cr/bin/rr/PortEngine.exe/Portal]. Accessed 19 February 2015.

33 Ministerio de Salud del Peru (MINSA). Principales causas de morbilidad hospitalizacion por sexo: Peru, 2013. 2015, [www.minsa.gob.pe/estadisticas/estadisticas/Morbilidad/HSMacros.asp?700]. Accessed 1 May 2015.

34 Department of Health Planning. Myanmar Annual Hospital Statistical Report 2009. Nay Pyi Taw, Myanmar: Ministry of Health, 2011.

35 Departamento de Estadísticas e Información de Salud (DEIS). Egresos Hospitalarios de mujeres, según previsión y causas. Chile, 2011. 2015, [http://intradesis.minsal.cl/EgresosHospitalarios/menu_publica_nueva/menu_publica_nueva.htm]. Accessed 1 March 2015.

36 Dirección de Estadísticas e Información de Salud (DEIS). Egresos de Establecimientos Oficiales por Diagnóstico – Ano 2010. Buenos Aires, República Argentina: DEIS, 2012. Report No.: 11.

37 Medical Statistics Unit. Indoor Morbidity and Mortality Report 2010. Colombo, Sri Lanka: Ministry of Health, 2012. [http://203.94.76.60/health/eng/publications/AHRR/MMR/%20REPORTS.zip]. Accessed 20 October 2013.

38 Ministerio del Poder Popular para la Salud. Anuario de Morbilidad 2011. Caracas, Venezuela: Ministerio del Poder Popular para la Salud, 2011.

39 Ministerio da Saúde. Sistema de Informações Hospitalares do SUS—SIH/SUS, 2013.

40 Ministry of Health and Quality of Life. Health Statistics Report 2012. Mauritius: Ministry of Health and Quality of Life, 2013. [http://health.govmu.org/EnglishStatistics/Health/Mauritius/Pages/default.aspx]. Accessed 14 October 2013.

41 Oficina Nacional de Estadística (ONE). Dominicana en Cifras 2014. Santo Domingo, Dominican Republic: ONE, 2014.

42 World Health Organization. International Statistical Classification of Diseases and Related Health Problems. Geneva: World Health Institute, 2014. [http://apps.who.int/classifications/icd10/browse/2015/en]. Accessed 15 December 2014.

43 Singh S, Monteiro MF, Levin J. Trends in hospitalization for abortion-related complications in Brazil, 1992-2009: why the decline in numbers and severity? Int J Gynecol Obstet 2012;118(Suppl 2):S99–106.

44 Departamento de Planificacion, MINSAL. Cuadros de Egresos Hospitalarios. Chile: MINSAL, 1992.

45 United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2012 Revision, CD-ROM Edition. 2013.

46 Instituto Nacional de Estadística e Informática (INE). Encuesta Demográfica y de Salud Familiar, 2013. Lima, Peru: INEI, 2014.

47 Department of Census and Statistics (DCS), Ministry of Healthcare and Nutrition (MOH). Sri Lanka Demographic and Health Survey 2006–07. Colombo, Sri Lanka: DCM and MOH, 2009.

48 Centro de Estudios y Demográficos (CESDEM), ICF International. Encuesta Demográfica y de Salud 2013. Santo Domingo, República Dominicana: CESDEM and ICF International, 2014.

49 Union of Myanmar, Ministry of Immigration and Population, Department of Population. Country Report on 2007 Fertility and Reproductive Health Survey. Naypyidaw: Ministry of Immigration and Population, 2009.

50 Ministerio de Salud, Dirección de Estadísticas e Información de Salud. Estadísticas Vitales: Información Básica—Año 2010. Buenos Aires, Argentina. Ministerio de Salud, 2011. Report No.: 5.

51 World Health Organization. World Health Statistics 2012. Geneva: World Health Organization, 2012.

52 Singh S, Darroch JE, Ashford LS. Adding It Up: The Costs and Benefits of Investing in Sexual and Reproductive Health 2014. New York: Guttmacher Institute, 2014.

53 Pantelides EA, Maario S. Estimating induced abortion in Argentina. 2007 Nov 7; Paris, France 2007.

54 Center for Reproductive Rights. The world’s abortion laws. 2014 [http://reproductiverights.org/sites/crr.civicactions.net/files/documents/AbortionMap2014.PDF]. Accessed 12 December 2014.

55 Duggal R, Ramachandran V. The Abortion Assessment Project—India: key findings and recommendations. Reprod Health Matters 2004;12(Suppl 24):122–9.

56 Stillman S, Frost J, Singh S, Moore A, Kalyanwala S. Abortion in India: A Literature Review. New York: Guttmacher Institute, 2014.

57 Vlassoff M, Hossain A, Maddow-Zimet I, Singh S, Bhuiyan HU. Menstrual Regulation and Postabortion Care in Bangladesh: Factors Associated With Access to and Quality of Services. New York: Guttmacher Institute, 2012.

58 Singh S, Wulf D, Hussain R, Bankole A, Sedgh G. Abortion Worldwide: A Decade of Uneven Progress. New York: Guttmacher Institute, 2009.

59 Sundaram A, Vlassoff M, Mugisha F, Bankole A, Singh S, Amanya L, et al. Documenting the individual- and household-level cost of unsafe abortion in Uganda. Int Perspect Sexual Reprod Health 2013;39:174–84.