

# THE COST TO THE HEALTH SYSTEM OF POST-ABORTION CARE IN RWANDA

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## **Abstract**

Based on research conducted in 2012, we estimate the cost to the Rwandan health-care system of providing post-abortion care (PAC) due to unsafe abortions, a subject of policy importance not before studied at the national level. Thirty-nine public and private health facilities representing three levels of health care were randomly selected for data collection from key care providers and administrators for all five regions. Using an ingredients approach to costing, data were gathered on drugs, supplies, material, personnel time, and hospitalization. Additionally, direct non-medical costs such as overhead and capital costs were also measured. We found that the average annual PAC cost per client, across five types of abortion complications, was \$93. The total cost of PAC nationally was estimated to be \$1.7 million per year, 49% of which was expended on direct non-medical costs. Satisfying all demand for PAC would raise the national cost to \$2.5 million per year. Post-abortion care comprises a significant share of total expenditure in reproductive health in Rwanda. Investing more resources in provision of contraceptive services to prevent unwanted or mistimed pregnancies would likely reduce health systems costs.

## **I. Introduction**

Nineteen years after the 1994 genocide that destroyed health infrastructure and led to the loss of almost a million lives, Rwanda has made impressive progress in gradually rebuilding its health system and improving access to health services, including reproductive health services (Rusa *et al.* 2009; Basinga *et al.* 2011). Improvements in reproductive health care include better

availability and quality of maternal health services and the inclusion of post-abortion care in the services offered at public health facilities (Basinga *et al.* 2012). Over the past ten years, the maternal mortality ratio in Rwanda declined considerably, but still remains high at 476 deaths per 100,000 live births (NISR 2012). In 2010, the maternal deaths surveillance and response system reported severe bleeding and infection as the leading causes of maternal deaths, while unsafe abortion practices were also recognized as contributing to high maternal mortality. The World Health Organization (WHO) estimated a ratio of 100 deaths per 100,000 live births in Eastern Africa in 2010 due to unsafe abortion (WHO 2011). In Rwanda, mortality due to unsafe abortion is unknown.

Until recently abortion was legally permitted in Rwanda only when two physicians certified that it was necessary to save a pregnant woman's life or protect her physical health. The May 2012 revision of the law extended the grounds for which abortion is authorized to include fetal abnormalities, rape, incest and forced marriage; legal abortions are still subject to court review and recommendations from at least two doctors (Republic of Rwanda, 2012c). A 2009 study on abortion in Rwanda showed that the abortion rate (25 abortions per 1,000 women aged 15-44) was lower than the rate for Eastern Africa (36) and similar to the rate of 28 for all Africa (Basinga *et al.* 2012; Sedgh *et al.* 2012).

Complications of unsafe abortion often require expensive treatment in terms of skilled personnel, surgical procedures, expensive drugs and supplies, and prolonged hospital stays (Henshaw *et al.* 2008, Johnston *et al.* 2007, Vlassoff *et al.* 2008, Vlassoff *et al.* 2009a). A review

of the literature, however, reveals that very little research has been conducted on the direct economic costs to women and households, or to national health systems in sub-Saharan Africa (Woog *et al.* 2007). Such estimates are not available for Rwanda. To partially address this knowledge gap the present paper estimates the cost of post-abortion care (PAC) to the national health-care system disaggregated by health-care level, region, severity of complication and cost component.

## **II. Data and Methods**

This study is based on data collected from 39 health facilities in April-May 2012. The sample of facilities was randomly selected from a sample frame of 166 facilities providing PAC that was constructed in the 2009 study estimating abortion incidence care in Rwanda (Basinga *et al.* 2012). Our sample frame consisted of facilities providing different levels of care and ownership structures (public, faith-based and private). At the tertiary level of care, we selected all three referral hospitals that provide reproductive health care. Hospitals and health centers at the district level were grouped by region (Kigali city, North, West, East and South)<sup>1</sup> and ownership. Within each region and ownership type, we randomly selected one district hospital and two health centers giving a total of 10 district hospitals and 20 health centers. Private facilities with an annual caseload of less than 12 post-abortion patients treated were excluded. We then

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<sup>1</sup> Although our sample was based on Rwanda's five regions, four regions (North, East, South and West) are largely rural in character whereas the fifth region, Kigali, is largely urban. Since findings from the four rural regions were very similar, in the analysis of the data we opted to contrast Kigali with the other four regions taken together.

grouped the remaining private facilities by type (hospital, polyclinics and clinics) and randomly selected one hospital, one polyclinic and four clinics. (See Annex Table 1 for more detail.)

Prior to commencing the research, the study obtained clearance letters from the National Ethic Committee, the National Institute of Statistics and the Ministry of Health. All potential participants were read an informed consent form before survey administration began. During the pretest of survey instruments, the research team explored the possibility of collecting costing data on PAC directly from facility records. One elite hospital in Kigali did seem to have a record-keeping system whose data base could be tapped to yield the necessary information. However, an investigation of several more typical facilities showed that the data collection effort required to extract useful data would have been far too onerous and costly.

The methodology used in this study to estimate costs was developed by the Guttmacher Institute and is known as the *Post-Abortion Care Costing Methodology* (PACCM). PACCM adopts the “ingredients approach” (Johns *et al.* 2003) and began as an adaption of the WHO’s *Mother-Baby Package* costing spreadsheet (Weissman *et al.* 1999). The method was first used in Nigeria (Bankole *et al.* 2007) and has subsequently been employed in costing studies in Ethiopia (Vlassoff *et al.* 2012a) and Uganda (Vlassoff *et al.* 2012b). The data-collection instruments and the overall methodology of the present study are similar to those of the Uganda study.

PACCM is a low-cost approach designed to yield cost estimates useful for policy analysis. Its perspective is that of the health-care system. Two questionnaires, one collecting data on drugs,

supplies and materials, the other on all other inputs<sup>2</sup>, gather information from key informants such as senior health care providers knowledgeable about PAC and facility administrators. Direct-cost data<sup>3</sup> are gathered separately for all five main types of abortion complications— incomplete abortion, sepsis, shock, cervical/vaginal laceration, and uterine laceration/perforation,<sup>4</sup> following the WHO’s classification (WHO 1999).

Respondents were queried on the time required to treat each type of abortion complication, time spent in non-treatment activities, the length of the work year and salaries and benefits, for nine categories of health worker directly involved in PAC.<sup>5</sup> Some benefits, such as professional allowances (duty fees, performance allowances), were omitted from the study to save effort. Our personnel cost estimates would thus somewhat underestimate the true cost of labor. Data on the cost of hospitalization were also collected. These included the proportion of cases hospitalized, the average length of stay and the estimated lodging and food costs per day. Although costing studies of PAC have generally omitted direct non-medical costs (Vlassoff *et al.* 2008), they are a significant component of total costs. The United Nations document on global

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<sup>2</sup> “Input” means anything that is consumed in the providing a particular treatment. Ibuprophen tablets, units of blood, sterile gloves, time spent by health workers and hemoglobin tests are all considered to be inputs.

<sup>3</sup> We use the term “direct medical costs” to refer to inputs directly related to the provision of medical care and “direct non-medical costs” to refer to health-system costs not related to actual treatment such as overhead and capital costs. (“Indirect costs” would then apply to costs that accrue to households or society, not to the health system.) This terminology was adopted in a previous sister study in Uganda. We acknowledge, however, that there is no universally accepted set of terms to cover the different components and dimensions of costs.

<sup>4</sup> The category “uterine perforation” includes cases of other lower abdominal perforations as well as hysterectomies.

<sup>5</sup> The nine health-worker categories are: gynecologist/obstetrician, anesthetist, general practitioner (doctor), nurse, midwife, lab technician, pharmacist, assistant pharmacist and social worker. In fact, 18 sub-categories were used since several cadres had formal sub-cadres with specific ranges of salaries. For example, the cadre of nurses comprises four distinct sub-cadres.

reproductive health costs reported that direct non-medical costs in 2008 were about twice as large as direct medical costs in Sub-Saharan Africa (United Nations 2009). Vlassoff *et al.* 2008 found that between one quarter and one third of total PAC costs were non-medical in the African and Latin American regions. A recent study of PAC costs in Uganda (Vlassoff *et al.* 2012b), the first thoroughgoing attempt to measure the direct non-medical PAC costs at the national level,<sup>6</sup> found that 68% of direct costs were non-medical.

In this study respondents were queried on both capital and overhead costs. For capital costs, data were collected on infrastructure and equipment<sup>7</sup> replacement costs and their useful lifetimes. Finally, data on overhead costs were gathered through the facility-based interviews in three areas: the numbers and salaries of 26 categories of non-medical support staff; eleven specific overhead expenses such as plant maintenance and utility charges; and specifics of outsourced contracts for security and cleaning. Overhead costs per case, as well as capital costs per case, were arrived at by using the proportion of PAC cases (due to induced abortions) to all cases, under the assumption that all types of treatments shared overhead and capital expenses equally.

The calculation of the annual capital cost for post-abortion care, disaggregated by type of facility, used the following formula:

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<sup>6</sup> A thorough study of all cost components of four facilities in Mexico City (Levin *et al.* 2009) found comparably high direct non-medical costs.

<sup>7</sup> Capital costs included both the cost of construction and durable equipment such as furniture, vehicles, x-ray machines, laboratory equipment, etc.

$$K_i = A_i \times P_i \times N_i \div C_i$$

Where

$K_i$  is the annual capital cost attributable to treating one PAC case,

$A_i$  is the annual amortized cost<sup>8</sup> of capital per year of useful life,

$P_i$  is the proportion of all cases that are PAC cases,

$N_i$  is the number of facilities in Rwanda,

$C_i$  is the number of PAC cases, and

$i$  is the *ith* type of facility.

Data on the drugs, supplies and materials used in PAC were collected on over 100 inputs, but more than 400 data items were obtained to cover the dimensions of inpatient/outpatient status and type of complication. The list of drugs, supplies and lab tests was taken from previous studies in other countries and from WHO's *Mother-Baby Package* (WHO 1999). The prices of drugs and supplies were obtained both from the medical procurement and distribution division of the Rwanda Biomedical Center and, when local price data were lacking, from several international sources (DrugBank 2012, IDA Foundation 2012, Management Sciences for Health 2012, Pharma Professional Services 2012, UNICEF 2012 and UNFPA 2010). When required, prices were adjusted to 2012 by using World Bank GDP deflators (World Bank

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<sup>8</sup> Amortization was calculated as follows. If a constant rate of inflation is assumed, then the annual write off or depreciation of capital should take this into account. The annual depreciation amount should be adjusted upwards so that the present value of all such amounts is equal the amount of the original investment. Here, we assume an annual rate of inflation of 3%. "Useful" lifetime means the number of years a facility is actually in use for the purpose for which it was intended until it needs to be replaced.



2012). Other factors influencing final cost, either positively or negatively, such as spoilage, stock-outs, transportation costs and bulk-order discounts were not measured.<sup>9</sup> The prices of laboratory tests were obtained from a small survey of private laboratories in Kigali. The cost of blood was obtained from the Rwanda blood costing model used by the national center for blood transfusion of the Rwanda Biomedical Center. The responses from the experts interviewed are assumed, on average, to provide a reasonable approximation of the true values of the various rates and amounts of specific inputs.

Quantities of inputs reflected the amounts normally used in treating specific complications. Using these data yielded estimates of *costs per treatment*. Since one case may involve multiple treatments an adjustment, employing the relative shares of complication types, was necessary to calculate *costs per case*. A sensitivity analysis was performed in order to assess the relative effects of measurement errors on cost estimates. All variables—numbering close to 2,000 in all—were tested using maximum and minimum values for each variable to compute a range of possible total cost estimates.<sup>10</sup>

#### Estimating the number of PAC cases

The number of PAC cases in Rwanda in 2012 was estimated from the 2009 incidence of abortion study (Basinga *et al.* 2012). We obtained the number of PAC cases for 2012 by adjusting the 2009 estimate using the population growth rate (United Nations Population

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<sup>9</sup> Free procurement of drugs and supplies by foreign donors was not an issue since this paper is concerned with how much PAC costs, not with who pays for it.

<sup>10</sup> For all variables, the minimum was set at 75% of the mean value and the maximum at 125% of the mean.

Division 2012) as a proxy for the growth rate in the number of PAC cases. As seen in the second panel of Table 1, three-quarters of PAC patients were treated for incomplete abortion, 13% for sepsis and 9% for shock. In general, serious complications such as lacerations and perforations were more common at higher level facilities than lower level ones. Across all 39 facilities, we found that, on average, each PAC patient was treated for just over one complication, although this ratio varied by facility type and region.

Table 1 also shows the numbers of cases of rare, but very serious complications. These include morbidities such as peritonitis, renal failure, septicemia and heart failure, which are rare but life-threatening complications. As shown in Table 1, very few such cases were reported in our study, amounting to about 1% of admissions at referral hospitals and only 0.1% of all admissions. The cost of treating these rare conditions is omitted in this study, but as each case may be very expensive, the overall cost estimates will be somewhat under-estimated by this omission. In Rwanda, over four fifths of most PAC cases were treated as inpatients in 2012. While 81% of women suffering from incomplete abortions were admitted as inpatients, 97% with uterine perforations were treated as inpatients. While around 95% of all PAC cases presenting at health centers were treated as inpatients, only 82%, presenting at referral hospitals were hospitalized.

Overall, we estimated that 1.17% of all patients presenting at health facilities in Rwanda in 2012 were treated for post-abortion complications (induced or spontaneous). The number of PAC cases due to induced abortion for Rwanda in 2012 was estimated to total 18,300 (bottom

panel), one quarter in Kigali region and three quarters in the other four regions. Even though each health center, on average, treats few PAC cases—about three per month—in total these facilities treated around 54% of all PAC cases. Many women suffering complications after unsafe abortions never reach a health facility for treatment. Using estimates from the abortion incidence study (Basinga *et al.* 2012), we estimated that in Rwanda in 2012, the number of women with *untreated* abortion complications was 9,150.

### Limitations of the study

Even though our sample of health facilities was selected randomly, the small number of observations (N = 39) argued against the use of statistical probability analysis. Confidence intervals (not reported here) computed for the main cost components were quite wide due to the small sample. However, the sensitivity analysis does provide a range for our estimates of the total cost of treating the complications of unsafe abortion.

The data gathered through the PACCM approach are estimates made by PAC providers and facility administrators. Although the respondents have long experience in post-abortion treatments, the information they provided may suffer from unknown response biases. For instance, there may be a tendency to inflate the amount of time health workers spend with patients. The PACCM aims to keep research costs low while still generating reliable cost estimates suitable for informing policy decisions, but not managerial ones. It trades off some precision in order to minimize the time and effort in data collection.

Difficulties in measuring specific treatment inputs posed further constraints on our study. Determining the amounts of drugs and supplies used in PAC was complicated by a wide variation in nomenclature, presentation and packaging. We minimized this problem by opting for recording amounts in a few common units such as the milligram. Selecting the future rate of inflation, an important driver of capital costs, also added to imprecision. In this case we followed the usual practice of assuming a constant rate of 3% per year. Determining the cost of labor similarly had measurement issues. Although the time spent by health workers in treatment was likely reported accurately, the proportion of total work time actually spent treating patients as opposed to time spent in non-medical activities is harder to gauge. This imprecision tended to underestimate the true cost of labor, but perhaps was compensated for by respondents inflating their estimates of the time spent in treatment.

### **III. Results**

#### **Direct Medical Costs**

##### **Costs of drugs, supplies, materials and laboratory tests**

We estimated that the cost per PAC case attributable to unsafe abortion of drugs, supplies and other physical inputs amounted, on average, to \$26 in 2012 (Table 2).<sup>11</sup> Although this cost

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<sup>11</sup> All costs in this study are given in 2012 United States Dollars (USD).

varied slightly between Kigali (\$32) and other regions (\$25), there were notable differences by facility type. Expenditure at district hospitals was only a little over half that at referral hospitals and health centers spent about one quarter as much. Across all facility types, the cost of drugs and supplies was found to be considerably lower for out-patients than for in-patients (not shown).

Costs of drugs and supplies by complication are shown in the bottom panel of Table 2. Shock, estimated at \$53 per treatment, was the most costly complication, whereas cervical and vaginal lacerations were the least expensive (\$12). The high cost of blood transfusions and the abundance of laboratory tests were the main contributors to the cost of treating shock. The main cost drivers in treating sepsis and incomplete abortions were found to be the number and frequency of laboratory tests performed such as ultrasound and blood tests. In treating uterine perforations, on the other hand, operating room supplies were the major drivers of cost.

Medicines, supplies and lab tests accounted for 56% of direct treatment costs overall. These costs represented 72% of direct medical costs in health centers, compared to around 60% in referral and district hospitals. On the other hand, they comprised only 24% of direct medical costs in private clinics, but this was largely due to the relative preponderance of less severe PAC cases in private facilities.

#### *Costs of medical personnel*

The percentages of PAC cases seen by the various cadres of health workers, the total time each type of worker spent in the treatment of patients and the salary and benefits received by the workers are the three main components of direct labor costs.<sup>12</sup> The proportion of patients seen by specific medical cadres (not shown) varied considerably. For example, gynecologists or obstetricians attended 100% of patients suffering from incomplete abortion at referral hospitals, but only 53% of such patients at district hospitals (looking only at hospitals having gynecologists or obstetricians on staff). Around 20% of incomplete abortion cases received counseling from social workers at referral and district hospitals while 54% did at health centers.

Our study found that the time spent attending patients varied by category of worker and facility, by type of complication and by region. The most notable differences were seen in private clinics where we found that health workers spent significantly more time with patients. For instance, private clinic midwives spent a total of 14 hours with patients in cases of shock, whereas midwives in district hospitals spent only three hours (not shown). In cases of uterine perforation, private nurses spent almost four hours tending patients but nurses at district hospitals spent only 48 minutes on average. Within the public system, time spent generally varied by the severity of the complication. For example, in cases of retained products of abortion we found that on average nurses spent 50 minutes with patients at referral hospitals, 96 minutes at district hospitals and 127 minutes at health centers. Gynecologists/obstetricians spent 73 minutes with sepsis patients at referral hospitals, but only 38 minutes at district hospitals having these specialists on staff.

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<sup>12</sup> The labor cost of non-medical health personnel are treated below under overhead costs.

These data, together with information on non-treatment time and salaries and benefits, allowed us we compute average costs of labor per case (Table 2, top panel). Overall, the cost of labor per PAC case was estimated to be \$17 with wide variations by type of health facility, costing as much as \$53 at private clinics. The higher cost in the private sector reflects greater time spent attending patients, not higher salaries, which were comparable to public-sector remuneration. Within the public sector, the cost of labor for PAC was related directly to level of care, as expected, severe cases being referred to higher level facilities. Thus, labor cost \$28 at referral hospitals but only \$5 at health centers. Regionally, PAC labor costs were found to vary widely: on average \$40 in Kigali compared to only \$10 in the four rural regions. The cost of labor varied by complication (Table 2, bottom panel), but not in the way that would necessarily be expected *a priori*. While the average labor cost for repairing perforated uteruses was around \$20, the cost of labor for treating shock was about twice as high (\$39).

### Hospitalization costs

As seen in Table 2, hospitalization (lodging and meals only) comprised only 8% of total direct medical costs overall.<sup>13</sup> Hospitalization was more expensive at private clinics (around \$18) than in public facilities (\$1 to \$10). Treatment of sepsis incurred the highest cost (\$9) while lacerations required only \$1.40 in hospitalization costs, both because relatively few laceration

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<sup>13</sup> As in other studies using the PACCM methodology, respondents were queried about special fees that patients might have to pay in order to receive service. In Rwanda, however, no such fees were reported at all.

cases needed hospitalization and because their average length of stay was shorter than other types of complication.

The average length of stay (not shown) varied by both type of facility and by complication. PAC patients on average spent 3.5 days in referral hospitals but only 2.2 days in health centers and 0.9 days in private clinics. In referral hospitals, patients being treated for incomplete abortion stayed, on average, for 1.7 days, 8.0 days for sepsis, 9.3 days for shock and 10.0 days for perforations.

## **Direct Non-medical Costs**

### Overhead costs

Our study collected overhead costs in three categories: the cost of non-medical workers, maintenance/ operational expenses and outsourcing costs for security and cleaning services.<sup>14</sup>

In 2012, the total annual wage bill for non-medical workers per facility ranged from \$366,000 for referral hospitals to \$39,000 for health centers (Table 3). Referral hospitals employed an average of 62 non-medical workers, district hospitals 35 workers, health centers 15 workers and private clinics 11 for ancillary, non-treatment activities. The annual cost per facility for

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<sup>14</sup> The United Nations document on global reproductive health costs reports that direct non-medical costs in 2008 were about twice as large as direct medical costs in Sub-Saharan Africa (United Nations 2009). Indirect costs, called “program and system costs,” included the costs of program management, supervision, health education, monitoring and evaluation, advocacy, human resources training, information systems, commodity supply systems, and capital costs for maintaining and expanding the physical capacity of health facilities.



maintenance expenses ranged from \$1.9 million for referral hospitals to \$43,000 for health centers. These expenses were almost three times higher for facilities in the Kigali region than in the other four regions. Outsourced contracts for cleaning and/or security cost referral hospitals \$367,000 on average, but only \$87,000 at district hospitals. Adding up these three components of overhead, the total average overhead cost per facility amounted to \$163,000 per annum. The portion attributable to PAC (due to induced abortion) averaged \$1,300 per facility—\$20,700 for referral hospitals, \$3,800 for district hospitals, \$800 for health centers and \$1,300 for private facilities. Overhead per PAC case amounted to \$28 at district hospitals, \$63 at referral hospitals and \$33 health centers.

### Capital costs

Capital costs were estimated from survey data on the costs of the facilities' infrastructure and equipment as well as data on the useful lifetimes of the facilities. Referral hospitals, as expected, were the most expensive, costing \$66.6 million on average to construct and equip, while health centers were the least costly at \$1.5 million per facility. Regionally, capital spending per facility in the Kigali region was more than seven times that in the rest of the country. The estimated useful lifetimes of facilities varied little among public and faith-based facilities (40-42 years), while private facilities had an estimated lifetime of 50 years. Overall amortization costs for PAC due to unsafe abortion were found to be \$2,300 per facility, ranging from \$23,800 for referral hospitals to \$400-500 for other types of facilities. The cost of capital was greatest for referral hospitals at \$73 per PAC case and least at district hospitals at \$3 per

PAC case. The cost of capital per PAC case in Kigali was estimated to be more than 2.5 times higher than in the four surrounding regions.

#### Total direct costs per case

Table 4 displays the total direct costs of all inputs per PAC case, both medical and non-medical, by facility type and by region, aggregated across all complication types. The average cost per PAC case due to unsafe abortion was estimated to be \$93 and was directly related to the level of care: treatment of post-abortion cases at referral hospitals was the most costly (\$239 on average); per-case PAC treatment at district hospitals cost \$93, while \$72 was spent per case at health centers.

We found that non-medical expenditures on capital and overhead, necessary for the functioning of the health system although not directly tied to the provision of care, were 51% of total cost per case. This non-medical component ranged from 67% of total cost at health centers to 33% at district hospitals.

## **IV. Discussion**

### National cost of PAC due to unsafe abortion

Our results on cost per case and cost per treatment of post-abortion care were extended to compute the full monetary impact of unsafe abortion on the national health system. From our data and from the findings of the 2009 abortion incidence study (Basinga *et al.* 2012), we were able to disaggregate the estimated 18,300 PAC cases in 2012 caused by induced abortions by type of complication, facility type and region. Applying these numbers to the relevant costs per case yielded national cost totals (Table 5). The bottom panel of Table 5 displays the total costs to the Rwanda health system for treating PAC in 2012 by facility type and region. Including direct medical and non-medical costs, the grand total for Rwanda was estimated to be \$1.7 million. A little under half of this amount, or \$837,000, went to non-medical costs (overhead and infrastructure) while the remainder (\$861,000) was spent on direct medical inputs (drugs, supplies, labor and hospitalization). Hospitalization accounted for only 4% of total expenditure, drugs and supplies for 28% and the wages of medical personnel for 18%.

Treating incomplete abortion accounted for the largest share of total expenditure on PAC: 52% of labor costs, 80% of the cost of drugs and supplies and 66% of hospitalization costs were spent in treating this complication (not shown). Treatment of sepsis and shock accounted for most of the remainder of direct medical costs, while lacerations and perforations together consumed only around 2-4% of direct medical inputs. Most PAC expenditure occurred in health centers (\$705,000) followed by district hospitals (\$519,000). Referral hospitals accounted for \$235,000 or only 14% of total expenditure on PAC caused by unsafe abortion.

### Sensitivity analysis

As the small size of our sample precluded the use of statistical inference to obtain confidence intervals, we undertook a sensitivity analysis to gain an understanding of the extent to which imprecisely measured inputs would affect cost estimates. Data on several hundred inputs were collected in the study.<sup>15</sup> We attempted to test the sensitivity of a large portion of these variables, focusing on their impact on total national cost.

Some results of this analysis are shown in Table 6. The top panel displays the ten inputs (not related to drugs or supplies) that had the largest impacts. We found that cost estimates were most sensitive to variations in capital and overhead data as well as some labor inputs. The three inputs determining capital costs were ranked first, third and fifth in terms of sensitivity. For example, raising the data values for the variable “infrastructure and equipment cost” by 25% raised the total national cost estimate by 4.02%. In terms of sensitivity to overhead inputs, transportation, utilities, building maintenance and outsourced service contracts were the biggest drivers of total PAC cost. Three labor-related inputs also ranked among the top ten most sensitive variables: the numbers of hours in a work year for nurses/midwives and doctors, and the salaries of midwives. As can be seen, the tenth most significant input had an impact of only 0.74% on total cost in the sensitivity test. Of 219 non-drug/supply inputs tested, 157 had an impact of less than 0.05% on the total cost of PAC.

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<sup>15</sup> Around 250 variables on labor, overhead, hospitalization and capital costs were collected; and more than 1,600 variables on the costs of drugs and supplies were collected in the study.

The lower panel of Table 6 shows the ten inputs of drugs, supplies and materials—including lab tests—whose variation influenced total cost the most. Six inputs in this top-ten list were either laboratory tests or the abdominal ultrasound procedure. The test for syphilis, for example, caused a 0.54% change in total cost when its data values were either raised or lowered by 25%. Of the 521 physical inputs tested, only 22 changed total cost by 0.1% or more and 411 inputs had a negligible effect (0.01% or less).

### *Rwanda and Uganda: Contrasting PAC Costs of Two Neighbors*

As mentioned, the current study closely mirrors a 2010 costing study in Uganda, both in methodology and in proximity in time, making it interesting to explore the similarities and differences between the responses of these neighboring countries' health systems to the challenges thrown up by unsafe abortion.

Table 7 lists several indicators used for this comparison. We note, first of all, that income levels and overall spending on health were broadly similar in the two countries. The cost of treating post-abortion complications from unsafe abortion was similar in the two countries: \$93 per case in Rwanda and \$138 in Uganda. Breaking down the total cost figure into its major components (Table 7, second panel) we see further similarities: drugs/supplies, labor and hospitalization costs were roughly comparable between countries. On the other hand, the overhead component in Rwanda (\$32) was 60% higher than in Uganda (\$20), while capital costs in Rwanda were only one fifth as large as Uganda's. Medical salaries were substantially higher in Rwanda than in Uganda (lower panel). The amount of time medical cadres spent with PAC

patients was also higher in Rwanda than Uganda, further adding to the gap in per-case costs.

Table 7 also shows two examples of material inputs: blood sacs for transfusions and hemoglobin tests. In both cases, Rwandan prices were above Ugandan ones.

The distribution of patients by level of health care was quite similar in the two countries.

However, the distribution of PAC cases by type of complication showed that Uganda had a somewhat heavier burden of serious cases. This likely indicates that access to safe—though still clandestine—abortions was probably greater in Rwanda than in Uganda.

## **V. Conclusion and Implications**

We estimate the cost of treating the consequences of unsafe abortion to the Rwanda health system in 2012 at \$1.7 million, non-medical costs (overhead and infrastructure) comprising 49% of this total. Improving “accessibility to quality, and demand for, maternal and child health services” is one of the strategic objectives of the Rwanda health sector strategic plan (Republic of Rwanda, 2012b). This increased government prioritization towards reproductive health services is reflected by the 116% increase in reproductive health total expenditures in 2009-2010 compared to 2006, with an increase of the publicly funded share of reproductive health expenditures from 14% to 38% (Republic of Rwanda, 2012b). Total expenditure on health in Rwanda in 2009-2010 was estimated at \$420.3 million and, of this amount around 10%—\$41.4 million— were allocated to reproductive health services (Republic of Rwanda, 2012a). Thus our estimates show that the cost of treating post-abortion complications from unsafe procedures

was 4.1% of projected spending on reproductive health and 10.6% of total public spending on reproductive health. The cost of unsafe abortion to the health system is therefore a considerable one.

According to Basinga *et al.* (2012), almost one-third of women who experienced post-abortion complications did not receive treatment. If all women with complications had been able to access health care services, the total cost of PAC would have increased to \$2.5 million in 2012. However, we should note that our estimates are based on expert opinion, not population-based data, and also that women not attending health facilities may have less severe symptoms on average than those who do attend. Despite this uncertainty, there is no doubt that treating all women who have an unmet demand for PAC would represent a sizable additional financial burden on scarce health resources, should this need be met.

Unsafe abortion generates unnecessary costs to society on a variety of levels (Vlassoff *et al.* 2008). This study focuses on only one component of the cost of unsafe abortion—the cost to the health-care system of treating post-abortion complications. There are many other substantial costs involved (Vlassoff *et al.* 2008) including the treatment of longer-term morbidities that result from unsafe abortion—especially the high cost of infertility treatment—as well as the economic cost to Rwandan households and society of productive time lost through abortion-related morbidity and mortality. The total financial burden of unsafe abortion would therefore be much higher than the costs we are able to report from our study.

Preventing the root causes of unsafe abortion is essential. Basinga *et al.* (2012) estimated that 47 percent of all pregnancies (about 275,000 in all) were unintended. The substantial cost estimates from our study reinforce the importance of reducing unsafe abortion by increasing contraceptive coverage and PAC in a country where abortion is restricted. A better health policy would address this root cause of unsafe abortion by addressing the large unmet need for contraception which still stood at around 19% in 2010, having declined from 38% in 2005 (NISR 2009; NISR 2012). Cost-benefit comparisons in Nigeria (Bankole *et al.* 2007), Ethiopia (Vlassoff *et al.* 2012a) and Uganda (Vlassoff *et al.* 2012b) demonstrated that more spending on family planning would achieve substantial savings from reduced expenditure in PAC. Although no recent data are available on the cost of family planning services in Rwanda, if we use costs of contraceptive services found in neighboring countries (around \$30 per user)<sup>16</sup> as a proxy, we can make a similar comparison for Rwanda. Comparing this cost to the per-case cost of PAC (\$93) it is clear that there exists a strong economic rationale for preventing unwanted pregnancies in Rwanda through family planning. The marginal benefit-cost ratio of this strategy would be more than 3:1; that is, every franc spent in family planning would save the health system more than three francs in PAC treatments averted.

Rwanda has achieved remarkable health gains over the last decade; the cost estimates from this study provide evidence to further improve health policies and programs to continue the positive trend towards increasing contraceptive use and access to post-abortion care.

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<sup>16</sup> The average annual costs of family planning per user are as follows: Ethiopia \$32.21 (Sundaram *et al.* 2010), Uganda \$22.24 (Vlassoff *et al.* 2009b) and Burkina Faso \$34.75 (Vlassoff *et al.* 2011).



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## VI. Tables

**TABLE 1. AVERAGE NUMBER OF PAC CASES PER YEAR AND DISTRIBUTION OF ABORTION COMPLICATIONS BY FACILITY TYPE AND REGION, RWANDA, 2012**

	Referral Hospitals	District Hospitals	Health Centers	Private Clinics	Kigali	Other Regions	All Facilities/ All Regions
<b><i>Average number of PAC cases per year per facility</i></b>							
From incidence study (2009)*	484	200	37	75	100	44	<b>57</b>
<b><i>Percent of PAC cases with specific complications</i></b>							
Incomplete abortion	73.2%	70.8%	78.1%	78.9%	70.3%	79.1%	<b>76.0%</b>
Sepsis	6.1%	12.5%	12.8%	18.0%	17.6%	10.4%	<b>13.0%</b>
Shock	5.2%	14.9%	8.1%	2.5%	7.2%	9.7%	<b>8.8%</b>
Lacerations	4.9%	1.5%	0.0%	0.0%	1.7%	0.2%	<b>0.8%</b>
Perforations	10.7%	0.3%	1.0%	0.6%	3.2%	0.6%	<b>1.5%</b>
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
<b><i>Number of PAC cases with rare complications**</i></b>							
Number per 1000	9.3	2.5	0.1	0.0	3.0	3.0	<b>1.4</b>
<b><i>Percent of PAC patients treated as <u>inpatients</u></i></b>							
Incomplete abortion	76.7%	90.0%	95.2%	21.7%	51.7%	97.6%	<b>81.1%</b>
Sepsis	100.0%	97.8%	98.1%	55.0%	80.6%	97.6%	<b>91.5%</b>
Shock	100.0%	100.0%	84.0%	99.5%	92.6%	91.2%	<b>91.7%</b>
Lacerations	73.3%	100.0%	100.0%	83.3%	87.1%	100.0%	<b>95.4%</b>
Perforations	100.0%	100.0%	100.0%	83.3%	92.9%	100.0%	<b>97.4%</b>
<b>All Complications</b>	<b>81.6%</b>	<b>92.6%</b>	<b>94.7%</b>	<b>30.0%</b>	<b>63.5%</b>	<b>97.1%</b>	<b>83.8%</b>

<b>Percent of all admissions that are PAC cases***</b>							
Percent of all cases	1.24%	2.76%	0.87%	0.77%	0.88%	1.32%	<b>1.17%</b>
<b>Estimated number of PAC cases annually (2012) <u>due to induced abortion</u></b>							
Incomplete abortion	700	4,000	7,700	1,500	3,000	11,000	<b>13,900</b>
Sepsis	100	700	1,200	300	900	1,400	<b>2,300</b>
Shock	100	800	800	0	500	1,200	<b>1,700</b>
Lacerations	0	100	0	0	100	0	<b>100</b>
Perforations	100	0	100	0	100	100	<b>200</b>
<b>All complications</b>	<b>1,000</b>	<b>5,600</b>	<b>9,800</b>	<b>1,900</b>	<b>4,600</b>	<b>13,700</b>	<b>18,300</b>

\* Source: Basinga *et al.* 2012

\*\* Rare complications include peritonitis, renal failure, organ failure, septicemia, poisoning, heart failure, etc.

\*\*\* "All admissions" means all patients that present at health facilities, both male and female.



**TABLE 2. COST PER CASE FOR POST-ABORTION CARE BY FACILITY TYPE AND REGION AND  
COST PER TREATMENT BY TYPE OF COMPLICATION, RWANDA, 2012 (USD 2012)**

Cost per Case (USD)	Referral Hospitals	District Hospitals	Health Centers	Private Clinics	Kigali	Other Regions	All Facilities/ All Regions
Inputs of drugs, supplies and materials	65.38	36.55	17.25	22.34	31.82	24.58	<b>26.26</b>
Inputs of labor	28.01	23.22	5.39	53.40	39.85	10.22	<b>17.07</b>
Hospitalization	9.69	2.28	1.22	17.65	10.12	1.79	<b>3.72</b>
<b>Total direct costs</b>	<b>103.08</b>	<b>62.04</b>	<b>23.87</b>	<b>93.39</b>	<b>81.80</b>	<b>36.59</b>	<b>47.05</b>
<b><u>Percentage Distribution of Costs</u></b>							
Inputs of drugs, supplies and materials	63%	59%	72%	24%	39%	67%	<b>56%</b>
Inputs of labor	27%	37%	23%	57%	49%	28%	<b>36%</b>
Hospitalization	9%	4%	5%	19%	12%	5%	<b>8%</b>
<b>Total direct costs</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
Components of Cost per Treatment (USD)	Type of Complication						
	Incomplete Abortion	Sepsis	Shock	Lacerations	Perforations		
Inputs of drugs, supplies and materials	38.80	29.15	53.20	12.13	30.64		
Inputs of labor	15.31	30.65	38.55	15.79	19.56		
Hospitalization	3.59	8.66	5.96	1.41	5.40		

**TABLE 3. OVERHEAD AND CAPITAL COMPONENTS OF PAC COST PER CASE BY FACILITY TYPE  
AND BY REGION, RWANDA, 2012 (USD 2012)**

	Referral Hospitals	District Hospitals	Health Centers	Private Clinics	Kigali	Other Regions	All Facilities/ All Regions
<b>Overhead Costs</b>							
Annual wage bill for non-medical workers per facility*	366,000	219,000	39,000	126,000	125,000	54,000	64,000
Annual maintenance and other operational expenses per facility**	1,931,000	323,000	43,000	109,000	199,000	67,000	85,000
Annual cost of outsourced contracts per facility***	367,000	87,000	4,000	0	50,000	8,000	14,000
<b>Total annual overhead expenditure per facility</b>	<b>2,664,000</b>	<b>629,000</b>	<b>86,000</b>	<b>235,000</b>	<b>374,000</b>	<b>129,000</b>	<b>163,000</b>
Total annual overhead cost <u>to supply PAC due to induced abortion</u> per facility	20,700	3,800	800	1,300	3,600	900	1,300
<b>Overhead cost per PAC case (due to induced abortion)</b>	<b>63.14</b>	<b>27.66</b>	<b>33.03</b>	<b>25.13</b>	<b>54.06</b>	<b>25.60</b>	<b>32.18</b>
<b>Capital Costs</b>							
<i>Infrastructure and equipment costs per facility</i>							
Amount per facility	66,560,000	3,570,000	1,490,000	1,710,000	15,890,000	2,120,000	7,060,000
<i>Useful lifetime</i>							
Number of years	40	40	42	50	46	40	42

<i>Amortized annual infrastructure and equipment costs <u>to supply PAC due to induced abortion</u>****</i>								
Amount per facility	23,800	500	500	400	5,500	400	2,300	
<b>Capital cost per PAC case (due to induced abortion)</b>	<b>72.55</b>	<b>3.16</b>	<b>14.92</b>	<b>6.67</b>	<b>25.61</b>	<b>9.95</b>	<b>13.57</b>	

- \* Data were collected on 26 categories of non-medical workers such as: guard, cleaner, receptionist, record keeper, supply clerk, etc.
- \*\* Data were collected on eleven operational expenses such as: building maintenance, utilities, vehicle maintenance, travel expenses, audio/visual materials, education/reference materials, etc.
- \*\*\* Cleaning and security.
- \*\*\*\* The future annual rate of inflation was assumed to be 3%.

**TABLE 4. COST PER CASE FOR POST-ABORTION CARE DUE TO INDUCED ABORTION BY FACILITY TYPE AND REGION, RWANDA, 2012  
(USD 2010)**

<b>Components of Cost</b>	<b>Referral Hospitals</b>	<b>District Hospitals</b>	<b>Health Centers</b>	<b>Private Clinics</b>	<b>Kigali</b>	<b>Other Regions</b>	<b>All Facilities/ All Regions</b>
<b><i>Direct Medical Costs*</i></b>	<b>103.08</b>	<b>62.04</b>	<b>23.87</b>	<b>93.39</b>	<b>81.80</b>	<b>36.59</b>	<b>47.05</b>
<b><i>Direct Non-medical Costs**</i></b>							
Overhead	63.14	27.66	33.03	25.13	54.06	25.60	32.18
Capital	72.55	3.16	14.92	6.67	25.61	9.95	13.57
<b><i>Total Direct Non-medical Costs</i></b>	<b>135.69</b>	<b>30.82</b>	<b>47.95</b>	<b>31.80</b>	<b>79.67</b>	<b>35.55</b>	<b>45.76</b>
<b><i>Total Cost per PAC Case</i></b>	<b>238.77</b>	<b>92.86</b>	<b>71.81</b>	<b>125.19</b>	<b>161.47</b>	<b>72.14</b>	<b>92.81</b>
<b><i>Percentage Distribution</i></b>							
Direct costs	43.2%	66.8%	33.2%	74.6%	50.7%	50.7%	50.7%
Indirect costs	56.8%	33.2%	66.8%	25.4%	49.3%	49.3%	49.3%
<b><i>Total Cost per PAC Case</i></b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

\* From Table 2.

\*\* From Table 3.

**TABLE 5. ESTIMATES OF TOTAL ANNUAL COSTS AT THE NATIONAL LEVEL OF POST-ABORTION CARE (DUE TO INDUCED ABORTION)  
BY FACILITY LEVEL, REGION AND TYPE OF COMPLICATION, RWANDA, 2012 (USD 2012)**

Cost Components	Referral Hospitals	District Hospitals	Health Centers	Private Clinics	Kigali	Other Regions	All Facilities/ All Regions
<b><i>National cost of labor for PAC (USD)</i></b>							
<b><i>All Complications</i></b>	28,000	130,000	53,000	102,000	169,000	144,000	312,000
<b><i>National cost of drugs, supplies and materials for PAC (USD)</i></b>							
<b><i>All Complications</i></b>	64,000	204,000	169,000	43,000	135,000	346,000	481,000
<b><i>National cost of hospitalization for PAC (USD)</i></b>							
<b><i>All Complications</i></b>	10,000	13,000	12,000	34,000	43,000	25,000	68,000
<b><i>National infrastructure and equipment cost to supply PAC (USD)</i></b>							
Capital cost to system to supply PAC	71,000	18,000	147,000	13,000	108,000	140,000	248,000
<b><i>National overhead cost to supply PAC (USD)</i></b>							
Overhead cost to system to supply PAC	62,000	154,000	324,000	48,000	229,000	360,000	589,000
<b><i>TOTAL NATIONAL COST OF PAC (USD)</i></b>	235,000	519,000	705,000	240,000	684,000	1,015,000	1,698,000
<b><i>Total Direct Cost of PAC</i></b>	102,000	347,000	234,000	179,000	347,000	515,000	861,000
<b><i>Total Indirect Cost of PAC</i></b>	133,000	172,000	471,000	61,000	337,000	500,000	837,000

**TABLE 6. RESULTS OF SENSITIVITY ANALYSIS:  
THE VARIABLES TO WHICH NATIONAL TOTAL PAC COST IS MOST SENSITIVE, RWANDA, 2012**

<b>Cost Input</b>	<b>Cost Component Contributed to</b>	<b>Absolute Difference between Minimum and Maximum (USD)</b>	<b>Percent Change in National Total Cost</b>
<b><i>Labor, Hospitalization, Overhead, Capital</i></b>			
Infrastructure and equipment cost	Capital	124,200	4.02%
Number of hours in work year (nurses/midwives)	Labor	73,500	2.38%
Average lifetime of facility	Capital	68,100	2.21%
Number of hours in work year (doctors)	Labor	59,700	1.94%
Future rate of inflation	Capital	59,700	1.93%
Transport*	Overhead	31,000	1.00%
Salary of midwives	Labor	30,000	0.97%
Cost of outsources service contracts	Overhead	28,800	0.93%
Maintenance and operational costs	Overhead	25,800	0.84%
Utilities**	Overhead	22,700	0.74%
<b><i>Drugs, Supplies, Lab Tests</i></b>			
Amoxicillin	Drugs/Supplies	19,600	0.58%
Test for syphilis	Drugs/Supplies	18,300	0.54%
Test for HIV	Drugs/Supplies	18,000	0.53%

Test: complete blood count (NFS)***	Drugs/Supplies	17,500	0.52%
Metronidazole by injection	Drugs/Supplies	16,600	0.49%
Ultrasound	Drugs/Supplies	13,700	0.40%
Ringer Lactate (Hartmann's solution)	Drugs/Supplies	13,600	0.40%
Urine cyto-bacteriological test (ECBU)****	Drugs/Supplies	10,800	0.32%
Blood for transfusion (500ml bag)	Drugs/Supplies	9,600	0.28%
Pregnancy test	Drugs/Supplies	8,600	0.25%

\* Fuel, repairs, maintenance, lodging, etc.

\*\* Water, gas, electricity, telephone, waste collection, etc.

\*\*\* In French: Numeration formule sanguine (NFS)

\*\*\*\* In French: Examen Cyto-Bacteriologique des Urines (ECBU)

**TABLE 7: COMPARING THE COST OF POST-ABORTION CARE IN RWANDA AND UGANDA, 2012**

	Uganda	Rwanda
<b><u>General Indicators</u></b>		
Total population	36,269,000	11,460,000
Number of women aged 15-44	7,351,000	2,589,000
Number of PAC cases*	113,000	18,300
Number of PAC cases per 1000 woman aged 15-44	15.37	7.07
Gross domestic product per capita**	\$1,345	\$1,282
Health expenditure per capita (USD, 2010)	\$46.72	\$55.51
Reproductive health expenditure per capita (USD)***	\$9.65	\$3.61
PAC expenditure per capita (USD)	\$0.38	\$0.15
Cost per case of PAC (USD)	\$138.17	\$92.81
<b><u>Components of Cost of PAC</u></b>		
Cost of labor per PAC case (USD)	\$11.75	\$17.07
Cost of drugs/supplies per PAC case (USD)	\$25.46	\$26.26
Cost of hospitalization per PAC case (USD)	\$5.90	\$3.72
Cost of capital per PAC case (USD)	\$74.66	\$13.57
Cost of overhead per PAC case (USD)	\$19.89	\$32.18
<b><u>Specific Cost-related Indicators</u></b>		
<b>Percent of PAC cases treated at:</b>		
Primary level	64%	60%
Secondary level	28%	34%
Tertiary level	7%	6%
<b>Percent of PAC cases treated for:</b>		



Incomplete abortion	62%	76%
Shock	21%	13%
Sepsis	9%	9%
Lacerations or perforations	9%	2%
<b>Average monthly salary (USD):</b>		
Obstetrician/gynecologist	\$592	\$946
Nurse-midwife	\$219	\$401
Pharmacist	\$349	\$434
Average time spent, doctor, sepsis (minutes)	71	53
Average time spent, nurse, sepsis (minutes)	88	131
Average time spent, doctor, incomplete abortion (min.)	49	46
Average time spent, nurse, incomplete abortion (min.)	88	128
Cost of one unit of blood (USD)	\$7.79	\$48.60
Cost of hemoglobin test (USD)	\$0.85	\$1.32

\* PAC cases due to induced abortions

\*\* PPP, current international dollars, 2011

\*\*\* For Uganda, annual expenditure for maternal and newborn health, 2010

Note: Unless otherwise stated, Ugandan costs inflated by U.S. inflation rate for period 2010-2012.

Sources: World Bank, UN Population Division, U.S. Bureau of Labor, Vlassoff et al. 2012b,  
data from this study.

## Annex Tables

**Annex Table 1.** The study sample selection, by type of health facility and ownership, 2012

Type of health facility	Sample frame	Health facilities excluded	Number selected	Percent sampled	Response rate
Referral hospital	3	-	3	100	100
District hospital	40	-	10	25	100
Health center	86	-	20	23	100
Private hospital, polyclinic, clinic	37	22	6	46	100
<b>Total</b>	166	22	39	27	100