OVERVIEW OF THE COST OF UNSAFE ABORTION IN AFRICA

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Synopsis: Unsafe abortion imposes significant costs on the health systems of Africa as well as burdens on the economies of the region. Estimates of the cost of post-abortion care, for which some empirical data are available, are presented in this paper. Tentative estimates for other, less researched societal costs are also reported on.

1. Introduction

Unsafe abortion-related morbidity and mortality (UARMM) impact welfare at the individual, household, community and national levels. Out of an estimated 46 million induced abortions that take place every year in the world, around 21.6 million are unsafe abortions[1]. About 6.2 million of these unsafe abortions occur in Africa—5.5 million of them in sub-Saharan Africa, where an estimated 31 out of 1,000 women of reproductive age undergo an unsafe abortion each year. More than 1.7 million of these abortions result in serious medical complications that require hospital-based treatment[2]. Many women suffer long-term effects, including an estimated 600,000 women who annually suffer secondary infertility and a further 1.5 million women who experience chronic reproductive tract infections.

The cost that these figures imply is a matter of importance for public policy. Despite this, little research has gone into estimating UARMM costs or developing an overall framework and costing methodology to arrive at comprehensive cost estimates. The objectives of this paper are to survey the empirical information available on costing unsafe abortion in Africa, to describe the methodological approaches available, given the constraints of the subject matter, and finally to estimate cost ranges within the limitations of data on unsafe abortion for the African region.

The many complications from unsafe abortion have been listed elsewhere, for instance by Bernstein and Rosenfield and the World Health Organization[3,4]. When we look at existing costing studies, however, we will find that in practice only a few of the major complications have been taken into consideration.

Economic Impact of Unsafe Abortion – Framework for Analysis

Unsafe abortion generates unnecessary costs to society at a variety of levels (Figure 1). Where abortion is illegal, households will generally finance the costs of the abortion procedure from their own resources. Even where abortions are legal, many women will still have recourse to unsafe procedures for a variety of reasons: the stigma attached to abortion, the desire of the woman to maintain secrecy, or the inadequacy of the health system vis-à-vis abortion procedures. A proportion of women who have an unsafe abortion will experience complications; some of these women will seek care within the formal health system, while many will seek care outside of the formal health system or not at all.[a] Where women obtain

[a] The framework in Figure 1 is taken from Vlassoff *et al*. (2008).

care determines who bears the direct medical costs.[b] In public facilities, the costs may be shared between households and government if fees are charged. The process of seeking care will incur potentially significant non-medical costs, such as the cost of transportation[5,6].

Women suffering from complications face three possible outcomes: survival with no long-term consequences, survival with long-term consequences such as infertility, or death. The probability of each outcome is a function of whether, where and how soon treatment is sought for post-abortion complications. Each outcome generates indirect costs in the form of lost productivity, which are borne by the affected households and broadly by society. In economies with large pools of unemployed, these societal costs will be more easily offset. Even at the household level, some proportion of short-term lost productivity would most likely be made up by the household members themselves, or by their friends and family. Long-term productivity losses, however, cannot be offset at the micro level in the same way they can be at the societal level. Finally, children from households experiencing a maternal death may also suffer in terms of their future health and education potential[7], with further economic implications for the household and society.

The emphasis in this framework is on costs that can be measured in monetary terms, although how to evaluate the indirect costs of lost productivity is a question that remains open to discussion. The social and psychological costs to women who experience complications from unsafe abortion are impossible to monetize, but such costs are nonetheless real. The stigmatization suffered by women who are known to have had an abortion is a very real cost in many societies.

While recognizing the multi-dimensional nature and range of potential economic impacts, the focus of this paper is on estimating one component—the health-system cost of treating the consequences of unsafe abortion. For other costs, where data availability is more limited (or nonexistent), the paper discusses methodological issues and presents some preliminary estimates for selected cost categories.

2. Review of Costing Literature

Published costing studies in the area of abortion have recently been reviewed[8,9]. In both of these reviews, nine studies comprising 25 sub-samples analyze data from sub-Saharan African

[b] Direct costs refer to those costs that are directly linked to providing/receiving PAC, including costs of supplies, patient travel, and staff time, whereas indirect costs represent overhead and capital costs as well as the value of lost productivity due to illness or disability.

countries. The present paper is based extensively on these two papers, as well as on a monograph[10]. Important considerations regarding the quality and validity of the data available from the literature include the following:

Study background and context

Characteristics of a study's population, the legal status of induced abortion, geographical location, and a description of the level and type of care provided at study hospitals were taken into account in assessing data validity.

Resource inputs

Differences in resource inputs can lead to large variations in cost estimates. Resource inputs include the type and nature of the intervention, as well as the "ingredients" that comprise the interventions and their individual costs, such as personnel, drugs, supplies and overhead. Whether capital resources are included is another important consideration. The severity of the complications also affects cost calculations.

Costing methods

The methods used to collect and analyze data ultimately influence the resulting unit cost estimations, as well as the internal validity of the study. Empirical collection of cost data requires a detailed assessment of individual inputs and their quantity, and is sometimes substituted by modelled estimates, which can be less accurate. Empirical costing can be done using a top-down or bottom-up approach, and these methodologies may influence study results, as can the study sample size. It is also important to discern whether a study considers only financial costs, or all economic costs, and whether incremental or full costs of an intervention are presented.

Health and economic outcomes

The cost of abortion care is often presented as a *per case* or *per treatment* outcome. While it is most correct to differentiate between the two (a treatment is a single event whereas a case may include follow-up treatments for the primary complaint), abortion cases often only consist of one treatment, and so the two outcomes are used interchangeably in much of the literature.

PAC Interventions

Post-abortion complications cover a very wide range of medical problems. The following is a summary of the medical procedures and treatments reported on in this literature:

<u>Operative Procedures</u>

- Colpopuncture
- Colpotomy [c]
- Dilation and curettage
- Hysterectomy
- Intestinal resection
- Laparotomy [d]
- Manual vacuum aspiration
- Resuscitation, intensive care unit
- Surgery (unspecified)

Other Procedures

- Blood transfusions
- General anaesthesia
- Intravenous antibiotics
- Intravenous fluids
- Local anaesthesia
- Sedation

Medicine Administered

- Abortifacients
- Analgesics
- Antibiotics
- Antimalarial drugs
- Flagyl
- Haematinics [e]
- Tetanus vaccination
- Vitamins

This list is incomplete. For instance, treatment for poisoning, renal failure, psychosis, and infertility*, inter alia*, would require interventions not listed here.

Data Considerations

Reported PAC costs vary greatly from one study to another, the range being from $2.34 to $389[10 f]. There are many possible explanations for these differences. Personnel time costs may

[c] Colpotomy: an incision made into the wall of the vagina. This was formerly used to confirm the diagnosis of ectopic pregnancy.

[d] Laparotomy: a surgical incision into the abdominal cavity, for diagnosis or in preparation for major surgery.

[e] Haematinic: an agent that tends to stimulate blood cell formation or to increase the haemoglobin in the blood.

be estimated according to the actual patient-provider contact time in one study but by dividing the salary cost of personnel by the number of patients attended in another study. Indirect costs such as overhead costs, capital depreciation costs, administrative costs, etc., may be included in one study but excluded in another. The inclusion or exclusion of subsidized treatment costs is another significant source of variation between studies. To arrive at reasonable regional cost-per-patient estimates, therefore, it was necessary to make some assumptions about the inclusion of certain components.

To get a better appreciation of cost measurement issues, we examine an important component of PAC costs, namely, hospitalization. Table 1 presents all costing studies in sub-Saharan Africa that have specific findings regarding hospitalization of patients as part of PAC. The simple average length of stay (ALOS) across these studies is 5.2 days. Again, there is a very wide variation in hospitalization, from 0.5 days in an Egyptian study to over 26 days in a Nigerian study[11].[g] Sample designs differ across these studies: some studies covered only the most severely complicated cases or took place in settings where the overall safety of abortion procedures was extremely low, while other studies covered settings where abortion methods tended to be less dangerous.

This possibility is reinforced when we divide the available studies into those reporting on operations research, that is, the replacing D&C with MVA as the preferred technique for evacuating the uterus. In order to hold other factors constant while comparing the two procedures, such studies typically select women with first trimester procedures and no complication aside from incomplete abortion. Because of the relatively low severity of abortion complications in these studies' samples, their estimates of treatment costs of unsafe abortion tend to be low.

Severity of Complications

A useful categorization of the severity of post-abortion complications has been developed by Rees[12]. In Table 2, post-abortion cases are ranked by severity and assigned to one of the three categories. However, data on abortion-related complications by severity are limited. One study

[f] In general, the published material available do not allow distinctions to be made as to which cost components were included or excluded, nor as to differences in the populations sampled of cases of post-abortion complications. Both these sources of variation can be expected to contribute to cost-per-case variability.

[g] The Nigerian study in question (Konje *et al.*, 1992) reported an average length of stay far longer than any other study. The study's sample included only patients with post-abortion complications where sepsis was also present. This probably explains the lengthy hospitalizations.

in South Africa has used this categorization to estimate PAC costs according to severity of complication[13]. Another study in Kenya has also used this framework although it did not measure costs[14]. Data on the pattern of severity from these studies will be used below in estimating regional costs.

3. Cost to the Health System of PAC: Regional Estimates

A number of empirical studies have examined PAC costs in several sub-Saharan African countries (Table 3). These studies typically collect data from a specific region of the country or from specific health facilities. Most of the studies estimate costs on a per-case basis. This is most often an overall cost, but one study in South Africa has estimated per-case costs broken down by severity of complication and level of facility[13]. In addition to health system costs, the full direct cost of treatment includes out-of-pocket expenses paid by the patient (or her household) such as transportation and, depending on the health system, co-payments and fees. Generally, however, costs to patients have not been reported. The direct costs estimated in this section, therefore, refer only to those borne by the health system.

The review of literature suggests two approaches to estimating global and regional costs. One approach is to use estimates of average cost per patient of post-abortion care (PAC) based on available literature. A second approach is to adapt an existing costing framework, incorporating into the model empirical data on the cost of specific components of PAC. This approach models health interventions from the perspective of all the detailed inputs (drugs, supplies, personnel time, overheads, etc.) needed to supply one complete treatment to one patient. If all inputs that make up a particular treatment are known and costs assigned to each of them, total cost of a particular complication from an unsafe abortion can be estimated in this way, from the "bottom up." Each approach is described in detail below.

3(a) Cost per Case Estimates—Study-Averages Method

The average cost per case of PAC calculated from available empirical studies was the basis for the first costing approach. As mentioned, a systematic literature review identified 25 African studies in which estimates of the cost per case of PAC were provided. The findings from these studies are summarized in Table 3. Seven countries and three (out of five) United Nations sub-regions of Africa are represented in the table.

The average cost estimates varies greatly between countries. Even within the same country, there were large variations in cost estimates, e.g., Uganda and Kenya. The studies identified often did not specify which resources were included, measured and valued, nor did they explicitly state which populations of PAC cases were being sampled. While most or all of the low cost estimates likely omitted some important categories, it was generally not possible from the information provided to determine where this was the case.

When deriving an estimate of average cost from the studies, we tried out a variety of approaches. Given the lack of information on costing methods used by each study, the preferred approach was to take a simple average of all the studies. Studies were also classified by their sample characteristics. To compensate for the fact that the sample average includes studies analyzing only low severity cases, we considered the effect of only including those studies which sampled all women reporting to a hospital, regardless of trimester and severity, indicated as "all levels of severity" in Table 3. As two further exercises, we examined the effect of excluding studies which did not report length of stay in hospital and older studies based on surveys conducted prior to 1995, in the belief that the remaining studies would better reflect contemporary information and good practice in costing methods. These latter two approaches, however, did not produce average costs very different from the overall average and so were not pursued further.

Faced with these data-quality issues, we finally opted to use three distinct methods for calculating regional costs, yielding a cost range rather than a point estimate. As mentioned, a number of the empirical cost studies restricted their samples to women who presented at a hospital with incomplete abortions, but who otherwise had no serious symptoms. Our first estimation method, then, is to use the average costs per patient of such studies as the basis for regional estimates. These estimates represent the *lower boundary* of the cost range since they omit the more expensive high-severity cases. Since severe cases were omitted, it is very likely that the true cost to health systems in African countries of treating post-abortion complications are greater than these estimates.

A second calculation method utilizes work done on classifying abortion complications into three levels of severity, described in the preceding section[12,13]. In this approach, we treat the lower-boundary cost-per-patient estimates as representing low-severity cases. We then use the severity patterns reported in the literature to estimate medium and high-severity costs. We refer to the estimates derived from this method as the *central cost estimates* since they take all types of complication into account.

Finally, existing empirical cost studies have generally been found to omit certain cost components, in particular overhead and capital costs. We can use the results of applications of the MBP costing model to estimate the relative size of these missing components and assume that the empirically derived cost-per-patient averages measure only the direct components of drugs, supplies and personnel costs. Estimates using this third method represent the *upper boundary* of the cost range.

As mentioned above, the uncertain quality of the data on costs per patient makes it advisable to present a range of cost estimates by varying underlying assumptions. Table 3 lists a number of cost-per-patient estimates based on the nine studies (and 25 sub-studies) in sub-Saharan African countries which yielded usable data. Several articles reported results from multiple samples of women attending health facilities for PAC, while others reported bottom-up facility surveys, such as MBP applications. Several of the studies investigated the costs and benefits of introducing the manual vacuum aspiration technique for evacuating incomplete abortions instead of other techniques such as dilation and curettage. These studies typically had at least two samples, one a pre-test and the other a post-test.

The first row of the table shows simple averages taking into account all 25 cost estimates available. In terms of US dollars (2011), the average cost per patient is $78.33. Of the 25 samples, eight can be categorized as low-severity samples, meaning that the women sampled would be classified as having "low" severity complications using the Kay-Rees severity framework. The other 17 samples included women of all severity categories.[h] Simple averages of these two groups of samples are shown in Table 4. The average cost per patient for treating low-severity complications is $7.86, while the average cost for samples of women with medium or high-severity complication is $111.50.

The first alternate method of estimating cost per cases (Table 4, row 4) gives the lower boundary estimates of costs since it assumes that low-severity cost per patient can be applied to all women seeking PAC, and as such will undoubtedly underestimate total expenditures. As can be seen, row 4 is identical to row 2 of the table.

Row 5 shows the costs per patient using the second calculation method, where information about the incidence and cost of treatment by severity level is used. The average cost is calculated to be $64.58 per patient. Two studies provide information on severity patterns in

[h] We loosely use the word "sample" since a number of bottom-up studies are not based on client samples but rather are facility based, such as the MBP applications, which refer to women with all post-abortion complications. Also, one study (Konje 1992) sampled only women with sepsis, which likely corresponds to women with medium or high severity levels.

South Africa and Kenya[13,14]. Combining the two studies, we assume that low-severity cases are 63.6 per cent, mid-severity cases 15.9 per cent, and high-severity cases 20.5 per cent of the total number of PAC cases. Using these percentages as weights together with the estimated costs by severity of the South African study, we arrive at an average cost across all levels of severity. Of course, this approach is a crude one as it extrapolates the experiences of two countries to the whole region. Nonetheless, because it takes into account available data on the severity pattern of post-abortion complications, this method is useful in generating crude estimates of the cost of unsafe abortion across all categories of severity.

Finally, in row 6, average cost using the third calculation method is shown. This method assumes that most studies have underestimated the true cost of treatment by omitting certain, hard-to-measure cost components, in particular, overhead and capital. Using information from the five studies which applied the MBP costing model, rough estimates of the shares of overhead and capital costs in total treatment costs were made. Based on these five studies, direct costs are estimated to be 72 per cent, overhead 16 per cent and capital 12 per cent of total costs.[i] Observed costs are then inflated by a factor of 1.38 (1.00 / 0.72 = 1.38) to take into account overhead and capital. The estimated cost using this method ($89.12) is higher than those from any of the other three methods and so may be considered to form the upper boundary of the cost range.

Table 5 shows the estimated total expenditure on PAC in 2011 by the health systems of countries in Africa using the costs per case presented in Table 4. We estimate that the total cost of PAC due to unsafe abortion lies in the range $131 to $224 million *per annum*, with a central estimate of $189 million.

3(b) Cost per Case Estimates—Bottom-up Method

The "bottom up" approach to health-system costing (or ingredients approach) makes use of an "off the shelf" costing model developed by the WHO, namely, the WHO Mother-Baby Package (MBP) costing spreadsheet[15]. The spreadsheet tool estimates the costs of twelve interventions

[i] The breakdown of costs by component varied between studies. In some, this breakdown was available only for all MBP interventions taken together: in others, the breakdown was available for abortion complications separately. Studies also generally had results for both "current", meaning actual, and "standard" practice, meaning WHO standard MBP protocols for treatment. First, an overall direct-cost average was calculated. (An inflation factor of 1.24 was used to increase direct costs for data relating to all interventions combined. The factor was estimating by comparing all-intervention costs with abortion-complication costs, whose treatments seem to have fewer indirect costs.) Second, the overhead and capital average costs were calculated and inflated until the total of the three cost components equalled 100 per cent.

that comprise the Mother-Baby Package. The underlying strategy of the MBP aims to reduce the number of high-risk and unwanted pregnancies; the number of obstetric complications; and the case fatality rate in women with complications. Since its development, several countries, including Ghana and Uganda, have used the model to estimate the cost of components of maternal and child health services[16-19]. The model has also been used to estimate PAC costs in Nigeria[20].

One of the interventions contained in the MBP is post-abortion care, which the MBP defines as treatments for the following five complications: shock/loss of fluid, sepsis, incomplete abortion, cervical/vaginal lacerations and uterine lacerations (and perforations). Using the MBP model to estimate the health-system cost of unsafe abortion is advantageous because it allows the researcher to tap into a well-developed model in which all costs are systematically incorporated, including default values for all inputs. This feature allows us to design cost-effective studies where the amount of data collection can be traded off against the degree of precision required for the cost estimates. The MBP model's default values are based on international prices for certain inputs, which can sometimes be preferable to using locally-derived estimates.

Although the MBP model is easy and inexpensive to use, it does have some draw backs. The model also uses a three-tier health system which does not fit the health structure in many country applications. The majority of defaults are based on values estimated by a panel of WHO experts. In country applications, however, some defaults may be difficult to replace with actual data. Lastly, the MBP spreadsheet assumes that the distribution of abortion-related complications in the model is fixed across patient samples.

To apply the MBP model at the country level, each type of PAC treatment is broken down into the quantities and unit costs of its constituent inputs (drugs, materials, equipment, personnel, overheads and infrastructure). The existing studies using the MBP are summarized in Table 6 which shows the cost-per-case results of the three empirical studies which took place in African countries. The overall costs per patient (in 2011 US dollars) show a lot of variability, from about $11 to $126, under current practice, and from $35 to $57, under "standard" practice. Also, except for the Ghana study, "standard" costs are substantially higher than current costs, perhaps reflecting that current treatment regimes may be utilizing insufficient resources per case.

Table 7 shows a range of estimates of the total cost to health systems in Africa of PAC from MBP "bottom up" studies. For the region as a whole, we estimate that about $128 million is currently being expended on treating the almost 1.2 million hospitalizations due to unsafe

abortion. If standard WHO-recommended protocols were being followed, however, an estimated $158 million would be expended. Note that these estimates do not include the millions of women who have serious complications but never reach a health facility.

The total cost estimates for Africa from the MBP studies tend to be lower than the estimates using the study-averages method (previous section). Overall, estimates from the two methods point in the same direction: total annual regional PAC costs in the range of $160-$190 million. It should be noted that the two sets of estimates are not completely independent of one another since in the 25 cost-per-patient studies are included the three MBP-application studies.

4. Other Costs: Review of Evidence, Methods and Assumptions

Within the rubric of direct health costs, the following four costs of treatment from post-abortion complications may be distinguished:

- Direct costs resulting from women hospitalized for post-abortion complications (dealt with in preceding section)
- Direct costs that would result if women who need hospital-based treatment but do not receive it were to have this need met
- Direct costs to women from receiving treatment from less severe complications at the primary health care level
- Direct costs that would result if women experiencing infertility due to unsafe abortion were to receive treatment.

We now look at the latter three categories of direct health costs and then at other economic costs that result from morbidity and mortality related to unsafe abortion.

4(a) Treating Unmet Need for PAC

A major gap in abortion research is the almost complete lack of information about the prevalence of women with serious complications who fail to receive medical attention from a formal health facility. Some informed estimates put this proportion at between one third and one half of those who experience complications in countries where access to abortion is highly restricted[21,22]. Using the estimate of Singh[2], namely that around 15-25 per cent of women undergoing unsafe abortions suffer untreated complications, we estimate that in sub-Saharan

Africa at least 825,000 women have an unmet need for PAC, in addition to the 1.2 million hospitalisations that occur annually.[j]

Some of these women may receive no treatment at all, while others may be treated in non-formal or traditional medical systems. Much of the abortion-related mortality takes place in this group of anonymous women. It is also likely that the inadequacies of formal health systems in sub-Saharan Africa explain a large part of why such a significant proportion of women do not seek post-abortion care or are unable to access it. For Africa, the additional total cost to give care to these women lies in the range $92 to $153 million (USD 2011), depending on the assumptions chosen. If all the unmet demand for PAC were met by the health systems, then the direct health-system costs would be much higher than the estimates computed in the previous section.

4 (b) Women with Minor Complications

Besides the costs to health systems for treatment of the estimated 1.2 million women with unsafe abortions receiving care in a hospital setting, there are many other women who suffer from minor complications that can be treated at the primary health care level. Very little is known about how many of the 6.2 million women in Africa experiencing unsafe abortion each year fall into this category. One study estimated their number at one million women (globally), based on their survey of several small-scale country studies[22]. The number of such women in SSA could be 250,000 or more. Pain management, treatment for anaemia and counselling are typical treatments that could be delivered at this level of care.

Unfortunately, no empirical study was found that had cost data on minor complications. In lieu of better data, we can hazard a first approximation of the cost of treating minor post-abortion morbidities by assuming that a visit to a primary health care post by a woman with a minor post-abortion complication might cost about the same as the average of the other health interventions of the Mother-Baby Package. For sub-Saharan Africa the average facility visit costs $8.51 actually and would cost $16.34 if WHO standard protocols were followed. Using the Benson-Crane estimate of 250,000 cases of minor post-abortion complications annually, the total cost of treating minor complications in Africa would be in the $2.1 to $4.1 million range.

[j] Benson and Crane estimate that only around 75 per cent of women needing hospital care after unsafe abortions actually present themselves at hospitals. Kay, however, quoting an older study from Chile, reports that perhaps only "10-50 % of women who have had unsafe abortions actually receive medical attention." In this study, the 15-25 per cent range reported by Singh has been used.

4(c) The Cost of Infertility

One of the most important long-term disabilities associated with unsafe abortion is secondary infertility resulting from acute infections or uterine perforations, among other severe complications. The incidence of post-abortion secondary infertility is not well documented, but recent work at WHO has estimated the proportion of women suffering from infertility as a result of unsafe abortion to be around 12 per cent in Africa[23]. From these data, it is possible to obtain rough estimates of the numbers of women suffering from post-abortion infertility.

We can safely assume that very few women in developing countries are able to seek infertility treatment, given the high cost of techniques such as in vitro fertilization which can easily cost several thousands of dollars in developed countries. In developing countries, infertility treatment within public health systems is virtually unknown. We can conclude with certainty that almost all women who suffer from infertility as a consequence of unsafe abortions belong to the group of women with an unmet need for infertility treatment. However, it has been suggested that in some societies and in certain circumstances—e.g., in cases of powerlessness to use contraception—some women may resort to unsafe abortion as a form of contraception, calculating that the procedure may lead to infertility, an outcome that these women desire[24]. Thus, even if we know how many women suffer infertility as a long-term sequelae of unsafe abortion, we do not necessarily know the proportion of these women who would desire treatment were it available to them.

No studies have been carried out on the cost of infertility treatment in a developing setting. In fact, even in developed countries such studies are rare; only one source was found describing costs in a developed country (Finland) of successful in vitro fertilization for infertile couples[25]. In the study, the estimated cost for a successful IVF treatment was 3,291 *Euros* (2003). This cost was reduced to 3,181 *Euros* by excluding the cost of a three-day sick leave, and then converted into US dollars (2011). The resulting cost was $4,346 per treatment. Note that this cost does not include the cost of any unsuccessful IVF treatments. Thus, this average cost under-estimates the real cost since it assumes, unrealistically, that all women become pregnant from their first treatment.

From the estimate of infertility morbidity given by Ahman, there may be 660,000 African women annually who become infertile after unsafe abortions. If treatment costs around $4,000 for each of these women, then the potential cost of the unmet need for infertility treatment could amount to $2.6 billion each year.[k] This estimate would decrease if we could factor in the

[k] The 660,000 women who suffer secondary infertility in a given year will not all seek infertility treatment (if it were available) in the same year. Some would never seek it at all and the treatments of those who do would be spread

proportion of infertile women who would not want to be treated; on the other hand, it would increase if we were to estimate the average number of IVF treatments needed before a successful pregnancy occurs.

Even though infertility treatment has almost never been part of the reproductive health services provided by public health systems in the developing world—meaning that only the wealthiest strata can afford treatment—it is nevertheless important to highlight the magnitude of the cost that would be incurred if every case of post-abortion infertility were to receive adequate treatment. Although lack of data prevents precise estimation of this cost, there is no doubt that the amount is substantial.

4(d) Out-of-Pocket Expenses

In the calculations of health-system costs presented in previous sections of this paper we made no attempt to separate costs borne by the public health system from those borne by the patient or her household. Regarding treatment costs, in some cases health systems have a well-defined schedule of co-payments which patients must pay as part of the service. In other, less well-organized systems, many of the costs that are formally contributed by the public system are in fact often borne by the patients themselves. For example, supplies and medicines may be habitually out-of-stock in public hospitals, so individuals must purchase these items on their own prior to or during treatment. Thus, some double-counting may occur if patients' out-of-pocket expenses are added to estimated total treatment costs. It is interesting, nonetheless, to examine out-of-pocket expenses on their own since they may be an onerous cost from the woman's viewpoint, particularly if her household income is low to begin with.

The out-of-pocket expenses of women seeking PAC are not confined to incidental (or not so incidental) expenses associated with the treatment itself. They also include such expenses as transportation costs to and from the health facility, food and lodging while awaiting treatment, income foregone while seeking treatment, during treatment and after treatment during the recuperation period, as well as any income foregone by other household members while caring for women with post-abortion complications. To date, very little data have been collected on such costs. The studies that do provide some partial data on out-of-pocket costs were described in Vlassoff *et al*., which cites eight studies that provide data on out-of-pocket expenses associated with PAC in Africa. The data suggest that in Africa total out-of-pocket expenses for

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out over a number of subsequent years. However, if we can assume that this pattern remains roughly constant over several years, we can validly make the simplifying assumption that all 660,000 cases sought treatment in the same year. Nonetheless, the problem of not knowing how many women would never seek treatment, even if treatment were available, remains, as does the problem of multiple treatments before successful pregnancies.

PAC treatment may amount to just under $200 million. This must be considered an under-estimate because no studies have collected data on other costs borne by the women themselves such as productive days lost before treatment, transportation, food and lodging costs, or on productive days lost by the woman and other household members during the convalescence period.

4(e) Other Costs to Individuals or Households

The costs of UARMM to public health systems are not the only costs occasioned by post-abortion complications. Certain other costs are borne by the affected women themselves or by the household in which they live. One such economic cost of abortion-related mortality is the *cost of orphanhood*. Several studies of orphanhood costs after AIDS-related deaths of parents are available, which could serve as models for costing this aspect of UARMM. Another indirect cost is the negative effect on *children's future prospects*, mainly through losing out on educational opportunities, but also via the negative effects of chronic poor health and nutrition. In all these cases, the causal chain would run from either crippling household costs from treatment, or from the death of the mother or from her long-term disability, to reduced expenditure on education, health or food. Finally, there are *psychological costs* as well. Secondary infertility in many settings is extremely damaging psychologically and stigmatizing to the woman. Chronic PID, teratogenicity[l] and dyspareunia[m] can also cause marital stress and lead to psychological trauma.

Another indirect cost is an intergenerational effect, namely, the lower productivity of children – and hence a lower future income stream – as a result of less education and/or poorer nutrition and health occasioned by UARMM of mothers. At this point, however, no empirical studies linking UARMM with changes in schooling or nutrition of children have been done. If a quantitative linkage could be documented, estimation of this impact on future income would be possible and worthwhile.

4(f) Impact of Unsafe Abortion on the Economy

Death and disability affect a country's economy chiefly by lowering labour productivity and by lessening savings and investment. Bloom explains that:

[l] Teratogenicity: the presence of an agent or factor that causes malformation of an embryo.

[m] Dyspareunia: difficult or painful sexual intercourse.

> …healthier workers have better attendance rates and are more energetic and mentally robust. Workers in healthy communities, moreover, need to take less time off to care for sick relatives. Body size, which is greatly influenced by one's health during childhood, has been found to have large impacts on long-term productivity.[26]

Furthermore, they calculate that "a one-year increase in life expectancy improves labour productivity by 4 per cent"[26].[n]

Health also impacts the economy through its effect on savings and investment:

> Healthier people expect to live longer, so they have a greater incentive to save for retirement. They are also able to work productively for longer, giving them more time to save. Workers and entrepreneurs therefore have a larger capital base to draw on for investment, leading to greater job creation and higher incomes. The savings booms in the East Asian "tiger" economies in the last quarter of the 20th century were largely driven by rising life expectancy and greater savings for retirement.
>
> (Bloom 2005, p. 32).

In this report we follow the approach of Bloom in evaluating the gains to the economy through the mechanisms just described. Building on prior work by Weil, Bloom calculated the gains accruing to better survival through better health: "… each extra surviving adult in a group of 1,000 boosts income per capita by 0.119 per cent"[26,27].

Economic Impact of Abortion-Related Mortality

We first look at the impact that abortion-related mortality has on the economy or, conversely, the added economic benefits that would accrue in the absence of abortion-related deaths. Around 29,000 such deaths occur each year in Africa. In order to make use Bloom's estimate of gain in per capita income from a reduction in mortality, we must estimate the number of additional women who would survive to age 60 if all abortion-related deaths were eliminated.

As an example, if a woman who dies from an unsafe abortion at age 28 instead does not die, then her future productivity will incrementally add to per capita income. However, not all such women would survive to age 60 (the terminal year that Bloom uses in his calculations). In fact, the number of such women who will live to at least age 60 would be reduced due to the pattern of normal mortality, which can be found in life tables. Once we calculate the number of women

[n] Another approach to valuation is described in Hutubessy (1999).

who would live to age 60 we can estimate the positive impact on per capita income using the relationship suggested by Bloom[26].

Thus, the first step in measuring the impact of mortality is to make the simplifying assumption that all abortion-related deaths occur at the observed average age of unsafe abortion. Using data on age patterns from Shah[28] and assuming that the age pattern of abortion-related deaths mirrors the age pattern of unsafe abortion, we calculate how many of those women, *if they had not died from abortion complications*, would survive to age 60. Once we know the number of additional surviving women, it is a simple matter to apply the Bloom analysis. The impact on income[o], from Vlassoff *et al*.[10], is small. Adjusting their estimates for more recent WHO estimates of deaths due to unsafe abortion and inflation, this methodology yields an estimate of $2.9 million lost income for all of Africa.

Economic Impact of Abortion-Related Morbidity

The long-term health consequences of abortion complications have not been well studied. Among those noted in the literature are secondary infertility, hysterectomy, severe anaemia, and pelvic inflammatory disease (PID). Empirical data on the incidence of these long-term morbidities, however, are almost non-existent. The only source of quantitative information on post-abortion morbidities comes from the World Health Organization. A WHO report gives global estimates for both secondary infertility and PID[23].[p] According to this report, between 15 and 30 per cent of women having unsafe abortions develop reproductive tract infections (RTI) which can lead to secondary infertility as well as PID. The study also estimates the incidence of infertility at 12 per cent of women in Africa.[q]

Using these sparse empirical estimates as a starting point, it is possible to approximate the effect that unsafe abortions have in lowering the productivity of women who subsequently suffer long-term morbidities. To estimate the indirect cost of decreased functioning, we assume that the disability weights given by the GBD are reasonable proxies of the reduced productivity of women suffering from those disabilities. For example, a woman suffering infertility sequelae has a GBD disability weight of 0.18[29]. In a setting where the woman's average income is, say, $1,000 per annum, the value of lost income due to her disability would be estimated at $180 per year.

[o] In this analysis GDP is used as a proxy for income.

[p] Aahman (2005) estimated that 16.5 per cent of women with unsafe abortions develop chronic PID.

[q] The WHO/World Bank Global Burden of Disease disability weight for infertility is 0.180, meaning that on average a women suffering from infertility is physically disabled for 18 per cent of her life *post facto*. The disability weight for chronic RTI is 0.067[29].

Since the empirical evidence on morbidity incidence is weak, we calculate central estimates of the numbers of women suffering long-term disability effects using WHO's suggested rates, as well as lower-bound and upper-bound estimates to form ranges within which we can be more confident that the true incidence numbers lie. In the case of secondary infertility, WHO assigns incidence rate of 12 per cent of unsafe abortion cases to WHO African regions. For the lower bounds, we use 8.4 per cent (a drop of 30 per cent). For the upper bound of infertility incidence, we arbitrarily use 12 per cent (no change).

There is even less certainty in the case of the WHO estimates of RTI incidence among women having unsafe abortions, which WHO gives as between 15 and 30 per cent[23]. We use this range as the lower and upper boundaries of RTI incidence.

Table 8 shows estimates of the impact of lower productivity on economic output.[r] Out of 5.5 million African women experiencing unsafe abortions annually, around 1.5 million are estimated to suffer from long-term PID and a further 600,000 from secondary infertility (central estimates). For infertility morbidity, we estimate that the range that likely includes the true incidence figure goes from 430,000 to 620,000 women. For RTI/PID incidence, the range is from 840,000 to 1.7 million women. We apply GBD disability weights to the incidence numbers and multiply by per capita income (using GDP per capita as a proxy).[s] We estimate that infertility morbidity costs the Africa region between $78 and $111 million over a one-year period, the central estimate being $109 million. For RTI long-term morbidity, the estimated range is $56-$113 million and the central estimate is $101 million. Combining the two long-term morbidities, disability caused by unsafe abortions may cost from $134 to $224 million in lost income and production measured over one year. However, since we have no data on the extent to which these two disabilities might overlap, adding together the estimated costs of the two quite likely over-estimates the total cost.

In this estimation of costs, we account for only one annual cohort of women undergoing unsafe abortions and evaluate the economic cost over a period of only one year. But each year about 21.7 million women suffer the same fate. To the extent that long-term disabilities persist for longer than one year—which is very likely—there would be a multiplier effect of women from previous years whose productivity was still adversely affected by lingering disability.

[r] In this exercise, GDP per capita was used as a proxy for income (see endnote 26).

[s] Note that the infertility disability weight, 0.180, has not changed from the original GBD estimates for 1990 to the latest ones. The disability weight for RTI, however, was originally estimated to be 0.169 but has been lowered to 0.067 in the latest GBD edition[29].

Without better data on how these disabilities persist over time, however, it is not possible at present to include a multiplier in these cost estimates. It is safe to say, however, that the cost estimates presented in Table 8 are substantial under-estimates of the true cumulative economic costs.

5. Conclusions

The purpose of this paper was to estimate the costs, in monetary terms, of unsafe abortion-related morbidity and mortality in sub-Saharan Africa. Using a framework for the analysis of costs related to unsafe abortion we were able to examine a number of specific costs by marshalling the available empirical evidence, scanty though it is in many areas. In the face of empirical data limited both quantitatively and qualitatively, it is nonetheless important to be able to make reasonable, if imprecise cost estimates since they may be of use in developing health policy to confront the problem of unsafe abortion.

Most emphasis was placed on estimating costs to health systems of treating the complications arising from unsafe abortion, both because more data exist in this area than in other costing areas and because such estimates are of immediate policy relevance. An important limitation in the empirical studies available is the very wide range of costs reported. Our analysis revealed several probable causes for this variation and the methodology we employed was designed to take these limitations into account. Future research should be more careful to specify clearly which cost components are being measured and which are not. It would also be very useful to collect cost data by each main type of abortion complication.

With appropriate caveats for data limitations, estimations for the Africa region were arrived at for several different aspects of the total economic cost of unsafe abortion. Considering only central estimates, these include:

- $189 million – health-system costs for PAC (study-averages approach)
- $128 million – health-system costs for PAC (MBP costing model approach)
- $123 million – central estimate of notional health-system cost to provide hospital-based care to women with unmet need for PAC
- $3 million – central estimate of cost to treat minor complications of unsafe abortion

- $2.6 billion – notional cost to treat all post-abortion infertility cases

- $200 million – out-of-pocket expenses in sub-Saharan Africa for PAC treatment

- $2.9 million – economic cost, in lower productivity, from mortality due to unsafe abortion

- $210 million – economic cost, in lost income, from long-term disability due to infertility and/or RTI caused by unsafe abortion

With respect to minor complications costs, very little hard data are available to estimate these costs, either in terms of the prevalence of such complications or in terms of the cost per case of treatment. We compiled all available data and used results from MBP costing applications to make rough approximations of costs in this area. Despite the dearth of data in this costing area, it seems that this cost component is not of major importance from a policy perspective.

With respect to infertility treatment costs, infertility treatment is not given high priority in Africa because treatment is very expensive and because the advanced technology required is often unavailable. The incidence of secondary infertility after unsafe abortion has not been measured with much precision and for treatment costs one has to rely on evidence coming from developed countries. Despite these limitations, it seems clear that addressing this reproductive health issue would be very costly, perhaps even costing more than hospital-based treatment of immediate complications.[t]

Besides direct treatment costs, the paper also examined indirect costs to national economies and/or to the incomes of households in the region. The total estimated cost of foregone income as well as out-of-pocket expenses are quite large. However, the data underpinning the estimates are largely inadequate, except for data on length of hospital stay. The whole issue of valuating women's work, especially in developing settings where so much of it is "non-market" employment, is complex and not yet satisfactorily solved.

In the area of economic impact of mortality, we have relied on general health-economics studies, assuming that abortion-related deaths affect the economy in the same way as deaths

[t] As mentioned earlier, not all such women will want infertility treatment making the total cost an over-estimate. On the other hand, neither can it be assumed that a woman seeking to terminate a pregnancy at a particular moment in her life will never want to have children in the future.

from other illnesses. Our tentative conclusion is that abortion-related deaths do not seem to have a significant impact on the economy through productivity losses.

The lack of data and the assumptions necessitated in this area make the estimated costs of morbidity liable to rather large confidence intervals. They rely in large part on the disability weights of the Global Burden of Disease project. A further assumption, made due to lack of data, was that disabilities last for only one year. This clearly leads to under-estimating costs in this area but is the only viable assumption possible until studies on the long-term impact of abortion-related disabilities on productivity become available. Despite the limitations of the available data, we can safely say that costs of abortion-related morbidity are large and should play a significant role in policy discussions.

These sums are considerable and impose an added burden on already over-stretched health resources in African countries. Results from a United Nations estimate of maternal and newborn health expenditures can be used to place the cost of unsafe abortion in context.[46] For instance, the model estimates that obstetric complications cost health systems in Africa around $490 million annually. Treating the consequences of unsafe abortion thus adds a financial burden almost half of what is currently spent on obstetric emergencies.

The cost estimates presented here add a strong and new dimension to existing arguments about the need to eliminate unsafe abortion. This information should be communicated to governments, and compared to much less costly alternatives for preventing unintended pregnancy and unsafe abortion, namely provision of contraceptive services and safe abortion. In addition, more resources should be directed towards studying the other costs of unsafe abortion which, in total, likely dwarf the costs of PAC. In particular, data needs to be collected on the size and characteristics of the large group of women who suffer serious complications but who do not receive post-abortion care through the health system. The economic consequence of morbidity resulting from unsafe abortion is another area where investigative work is urgently needed including studies of productivity losses.

TABLES

Table 1. PAC Studies in Africa Reporting Hospitalization			
Country	**ALOS (days)**	**Year**	**Reference**
Ethiopia	1.2	1996	Jeppsson *et al*., 1999
Kenya	1.5	1991	Johnson et al., 1993
Kenya	1.7	1996	Ominde et al., 1997
Kenya	1.0	nd	Kizza and Rogo, 1990
Tanzania	0.6	1992	Magotti et al., 1995
Tanzania	2.4	nd	Mpangile et al., 1999
Egypt	0.5	1994	Nawar et al., 1999
Burkina Faso	1.1	1997	Population Council, 2000a
Nigeria	10.5	1977	Figa-Talamanca et al., 1986
Nigeria	10.6	1977	Omu et al., 1981
Nigeria	26.4	1984	Konje et al., 1992
Nigeria	8.0	1985	Adewole, 1992
Nigeria	11.8	1988	Okonofua et al., 1992
Nigeria	2.9	2002	Guttmacher, 2005
Senegal	2.1	1997	Population Council, 2000b
Senegal	0.9	2001	Dabash et al., 2003
Simple Average:	**5.2**		

Notes: (1) ALOS = Average length of stay in hospital/health center
(2) Year = Year of data collection (nd = no date)

Table 2. Severity of Abortion Complications		
Severity Category	**Symptoms**	
Low	Temp. ≤ 37.2°C	and
	No clinical signs of infection	and
	No system or organ failure	and
	No suspicious findings on evacuation	
Moderate	Temp. 37.3 – 37.9°C	or
	Offensive products	or
	Localized peritonitis	
Severe	Temp. ≥ 38°C	or
	Organ failure	or
	Peritonitis	or
	Pulse ≥ 120	or
	Death	or
	Foreign body/mechanical injury on evacuation	
Source: Rees *et al.*, 1997, p. 433		

Table 3. Empirical Studies Estimating Costs per Patient of Treating Abortion Complications					
Country	**Year of study**	**Complication Severity of Sample**	**Sample size**	**Cost per Patient**	
				Study year, US$	**US$, 2011**
Ghana	2003	All levels of severity	NA (modeled)	$45.88	$56.07
Ghana	1998	All levels of severity	NA	$66.46	$89.51
Ghana	1998	All levels of severity	NA	$63.88	$86.04
Kenya	1991	Low severity	10	$3.09	$4.75
Kenya	1991	Low severity	11	$5.24	$8.06
Kenya	1991	Low severity	11	$2.94	$4.52
Kenya	1991	Low severity	45	$4.37	$6.72
Kenya	1991	Low severity	17	$3.99	$6.14
Kenya	1991	Low severity	5	$15.25	$23.46
Malawi	1998	All levels of severity	NA	$41.77	$56.26
Malawi	1998	All levels of severity	NA	$29.95	$40.34
Nigeria	2002	All levels of severity	NA (modeled)	$103.00	$125.87
Nigeria	1984	Medium and high levels of severity	230	$223.11	$396.13
South Africa	1994	All levels of severity	NA	$303.10	$436.37
South Africa	1994	All levels of severity	NA	$85.35	$122.88
South Africa	1994	All levels of severity	NA	$137.18	$197.50
Tanzania	1992	Low severity	92	$4.36	$6.56

Table 3. Empirical Studies Estimating Costs per Patient of Treating Abortion Complications					
Country	**Year of study**	**Complication Severity of Sample**	**Sample size**	**Cost per Patient**	
				Study year, US$	**US$, 2011**
Tanzania	1992	Low severity	107	$1.75	$2.63
Uganda	2006	All levels of severity	NA (modeled)	$44.87	$62.12
Uganda	2006	All levels of severity	NA (modeled)	$33.61	$46.53
Uganda	2006	All levels of severity	NA (modeled)	$6.41	$8.87
Uganda	2006	All levels of severity	NA (modeled)	$24.72	$34.22
Uganda	1998	All levels of severity	NA	$35.43	$47.72
Uganda	1998	All levels of severity	NA	$57.60	$77.58
Uganda	1996	All levels of severity	NA (modeled)	$8.24	$11.41
Notes: SC = sharp curettage; MAV = manual vacuum aspiration; D&C = dilation and curettage					

Table 4. Average Costs per Patient from Existing Studies on the Cost of Post-Abortion Care (PAC)			
	Number of Sub-samples	**Cost per Case**	
		USD (Study Year)	**USD (2011)**
Simple Averages of All Studies			
All Severity Samples	25	$54.06	$78.33
Low Severity Samples	17	$5.12	$7.86
Medium and/or High Severity Samples	8	$77.09	$111.50
Other Methods of Estimating Costs			
Method 1: Lower Bound	25	$4.43	$6.77
Method 2: Severity Patterns	25	$44.86	$64.58
Method 3: Adding Overhead, Capital Costs	25	$61.90	$89.12

Table 5. Total Cost of PAC in Africa: Study-Averages Methods (USD 2011)				
Number of PAC Cases Treated	**Method 1: Low Boundary**	**Method 2: Severity Levels**	**Method 3: Overhead, Capital**	**Central Estimate**
1,731,000	131,400,000	223,500,000	222,400,000	188,700,000

Table 6. Applications of the MBP Costing Spreadsheet: Cost per PAC Case (USD 2011)										
Study Area	**Health Centers (current USD)**		**Hospitals (current US$)**		**All Facilities (current USD)**		**All Facilities (USD 2011)**		**Year of Study**	**Article**
	Curr.	**Stand.**	**Curr.**	**Stand.**	**Curr.**	**Stand.**	**Curr.**	**Stand.**		
Uganda	1.92	10.98	13.66	38.76	9.25	28.35	11.41	35.09	1996	Weissman *et al*. 1998
Ghana	41.44	40.53	61.60	63.34	51.53	51.94	56.07	56.53	2003	Asante *et al*. 2004
Nigeria	83.11	--	148.25	--	115.68	--	125.88	--	2005	Bankole *et al*. 2008

Note: (1) Ghana: Study does not give shares of cases treated in health centers and in hospitals. 50% : 50% shares assumed.
(2) Two right-most columns show costs converted to US 2011 dollars. All other costs refer to year of study.

Table 7. Total Cost of PAC in Africa: Application of the MBP Costing Spreadsheet						
Number of PAC Cases Treated	**Total Cost of PAC (Central Estimates)**		**Sensitivity Analysis**			
			Minimum Estimated Total Cost		**Maximum Estimated Total Cost**	
	Current	*Standard*	*Current*	*Standard*	*Current*	*Standard*
1,731,000	128,000,000	158,400,000	111,200,000	125,800,000	143,800,000	192,100,000

Table 8. Economic Impact of Abortion-Related Morbidity in Africa: Estimates of Lost Income (One Year)			
	Central estimate	**Lower-bound estimate**	**Upper-bound estimate**
Women with secondary infertility	**$65,618,000**	**$33,618,000**	**$68,487,000**
Number of women	602,000	431,000	617,000
One-year income loss (USD 2011, millions)	$109	$78	$111
Women with long-term RTI	**$151,500,000**	**$47,040,000**	**$189,840,000**
Number of women	1,500,000	840,000	1,680,000
One-year income loss (USD 2011, millions)	$101	$56	$113
Note: RTI = reproductive tract infections			

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FIGURE 1.

Framework for estimating the economic costs of unsafe abortion

(see Vlassoff *et al*. 2008)