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ECONOMIC CONSEQUENCES

Public hospital costs of treatment of abortion complications in Nigeria

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ABSTRACT

Unsafe abortion is a significant contributor to maternal mortality in Nigeria, and treatment of postabortion complications drains public healthcare resources. Provider estimates of medications, supplies, and staff time spent in 17 public hospitals were used to estimate the per-case and annual costs of postabortion care (PAC) provision in Ogun and Lagos states and the Federal Capital Territory. PAC with treatment of moderate complications (US $112) cost 60% more per case than simple PAC (US $70). In cases needing simple PAC, treatment with dilation and curettage (D&C, US $80) cost 18% more per case than manual vacuum aspiration (US $68). Annually, all public hospitals in these 3 states spend US $807 442 on PAC. This cost could be reduced by shifting service provision to an outpatient basis, allowing service provision by midwives, and abandoning the use of D&C. Availability of safe, legal abortion would further decrease cost and reduce preventable deaths from unsafe abortion.

1. Background

Globally, 47 000 women are estimated to die each year from complications of poorly performed induced abortions, 29 000 of them in Africa [1]. Many more women suffer from short- and long-term disabilities. These consequences result from a confluence of factors, including low use of modern contraceptive methods, restrictive abortion laws, lack of safe abortion services, and gender discrimination. An estimated 1.18 million women annually obtain care in health facilities in Sub-Saharan Africa for treatment of unsafe abortion complications such as incomplete abortion, hemorrhage, septicemia, and uterine perforation [2]. The health system costs of such treatment in the region are estimated to range from US $68 million to US $76 million per year [3].

1.1. Abortion in Nigeria

Nigeria represents a particularly acute situation, with low contraceptive use, high rates of unwanted pregnancy, and high rates of unsafe abortion. Recent estimates show a maternal mortality ratio of 608 per 100 000 live births with 36 700 women dying annually from pregnancy-related causes, the second largest number in the world [4]. The national fertility rate is 5.7 births per woman, although wide differences exist across geographic zones [5]. Contraceptive prevalence is quite low, with just 9.7% of currently married women using a modern contraceptive method in 2008, and has not increased markedly since 2003 when it was 8.2% [5].

Although abortion is legal only to save the life of the woman, 1 in 10 Nigerian women has had an abortion in their lifetime. Abortion is most common among women who were younger than 25 years, unmarried, and childless at the time [6]. The only national estimate of abortion incidence in Nigeria was conducted in 1996, with a rate of 25 abortions per 1000 women aged 15–44 years, although rates were much higher in the southern part of the country. Two of the states in this study, Ogun and Lagos, are located in the Southwest zone, where abortion rates are high at 46 per 1000 [7]. Factoring in population growth since the 1996 study, researchers estimate that 760 000 abortions occurred in Nigeria in 2006 [6].

The practice of abortion is also often unsafe in Nigeria. According to a 2002–2003 household survey of women of reproductive age, almost half of women reporting an abortion had a surgical procedure, manual vacuum aspiration (MVA) or dilation and curettage (D&C), which was performed in a clinic, hospital, or private office of a physician [6]. However, despite this common use of technologies with normally low complication rates, 1 in 4 women interviewed in the household survey who reported a surgical abortion had serious complications [6]. Based on mortality data from a 2002–2003 hospital survey, researchers estimate that about 3000 women die each year in Nigeria from abortion complications, a likely underestimate [8].

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1.2. Costs of treating abortion complications in Nigeria

An array of studies using different methodologies has been conducted in Nigeria to estimate the costs of induced abortion and the costs of treatment of complications from unsafely performed abortion. Using the 1996 estimates of induced abortion and abortion complications and survey findings from 150 health facilities in 2 states, Adewole et al. [9] estimated that the cost of treating 141 000 cases of abortion complications per year was £9.4 million. The methodology used to calculate the per-case and total costs is not detailed, however, and it is not clear if the "cost" of treatment refers to the full cost of care or the portion paid by patients to the facility for treatment.

In a 2002–2003 public and private hospital survey of patients seeking treatment of postabortion care (PAC) for complications of unsafely induced abortion, induced abortion, or treatment of spontaneous abortion, and the main clinical provider for each patient, Henshaw et al. [8] obtained the amount women paid for care outside the hospital and the amount paid for treatment in the hospital. The average per-case amount paid by women presenting at facilities for serious complications resulting from induced abortions obtained elsewhere was 10 971 Naira (US $91). In contrast, the average per-case amount paid for treatment of a spontaneous abortion was 5114 Naira (US $43).

To estimate the annual costs of PAC to the Nigerian health system, Bankole et al. [10] calculated that the annual health system cost for treating women with complications of unsafely induced abortions was US $7.6 million. An additional US $11.4 million would have been required to treat women who needed but did not obtain clinical care for complications. The estimated per-case cost for hospital-based care was US $132, including costs absorbed by both women and the health system. Estimated costs of treating complications from unsafely performed abortions represent 3.5% of the 2005 total expenditure of public health care [10].

To provide evidence on the implications of shifting away from unsafe abortion, researchers modeled rates of morbidity and mortality and cost data from the literature to determine the most cost-effective strategies for offering safe abortion in Nigeria [11]. All safe abortion approaches (hospital-based D&C; hospital-based MVA; clinic-based MVA; and medical abortion using misoprostol) yielded gains in life expectancy and cost savings compared with unsafe abortion. MVA provided in a clinic setting was the most cost-effective of all safe abortion strategies in Nigeria, and converting all unsafe procedures to clinic-based MVA was estimated to save more than US $2.5 million per 100 000 procedures.

The present study was conducted to add more recent cost estimates of PAC in Nigeria to the existing body of literature. The aim was to provide a more comprehensive level of detail of how PAC provision is organized and clinically managed in public hospitals by obtaining data on different uterine evacuation technologies, inpatient and outpatient care, as well as severity of presenting complications. To this end, the objectives of the study were to: (1) describe current PAC caseloads and treatment regimens in selected study public hospitals; (2) calculate estimates of the per-case costs of treatment of abortion complications; and (3) calculate estimates of annual costs of treatment of abortion complications in all public hospitals in the 3 study states. These data will be used as an aid to improve management of care and law reform efforts in Nigeria.

2. Methods

2.1. Sampling

The study sample was drawn from a list of all 79 PAC-providing public hospitals in the study states provided by the Nigerian Ministry of Health. Estimated monthly caseloads for each of these sites were also obtained through a combination of Ipas site-monitoring visits and Ministry of Health data. A total of 21 facilities (5 tertiary and 16 secondary hospitals) were purposively selected from this list for the study. Facilities were included from Abia, Ogun, and Lagos states as well as the Federal Capital Territory (FCT, also called Abuja), representing 3 of the 6 geopolitical zones of Nigeria. Each selected facility reported a minimum of 5 PAC cases per month and was located in an urban, semi-urban, or rural setting. The purposive sample was developed to represent, as well as possible, public sector hospitals that provide PAC, since resources did not allow for a full random sample.

Data were obtained from 19 facilities; 2 tertiary-level facilities were not able to complete and submit data collection forms because of physicians' strikes underway in those sites. Facilities in Abia state were not included in the analysis because of insufficient data. The analysis ultimately included 17 facilities representing 22% of all 79 PAC-providing public hospitals and 34% of the estimated annual PAC caseload in public hospitals in the 3 states. Because of low caseloads and difficulties in obtaining caseload information from a number of facilities originally considered, 11 of the 17 included hospitals had taken part in Ipas-sponsored clinical training of their current or former providers, had participated in service delivery upgrades, and/or had received MVA instrument donations.

2.2. Data collection

The study utilized *Savings*, an Excel-based tool designed by Ipas based on cost inputs and types of abortion complications found in the World Health Organization's (WHO) Mother-Baby package [12]. The cost estimates generated by the *Savings* tool incorporate the various clinical practice regimens currently in use for PAC and compares these with alternative treatment strategies for safe abortion.

A data collection tool to be completed by providers working in the study facilities was developed. The tool reflects PAC caseloads, clinical treatment regimens, amounts used and costs of drugs and supplies, and time and costs of health personnel to care for women presenting with abortion complications at each health facility. Treatment methods for uterine evacuation of incomplete abortion included D&C, MVA, electric vacuum aspiration (EVA), misoprostol alone (MPAC), and dilation and evacuation (D&E). Data were also collected on cases treated with expectant management, to capture PAC cases where a uterine evacuation method was not necessary. The tool was pretested by physicians from the Lagos state study hospitals and subsequently modified.

Data collectors were primarily nurse-midwives, obstetrician-gynecologists, and general practitioners with experience providing clinical PAC services in their individual facilities. The study team visited facilities to familiarize participating providers with the tool, and subsequently revisited or called each facility several times to answer questions, troubleshoot, and remind participants of the deadline for completion. The forms for each facility were collected in person and reviewed for any missing, incomplete, or questionable data. Follow-up contact with the facilities occurred to resolve outstanding issues, and additional data were collected in 8 facilities to clarify the inputs required for complicated PAC cases. Data were collected from June to September 2010.

2.3. Facility-level data collection

The number of women treated for postabortion complications in each facility between January and March 2010 was retrieved from the facility logbook by the respondents. In 5 facilities that did not have logbook data, the study coordinator and study respondent used the case notes of PAC patients to report caseload. The data were reported by the severity of complications with which patients

presented, the type of treatment received, and the amount of time spent in the facility.

Providers also reported on the name, quantity, and cost of medications and supplies typically used for each treatment procedure. The time spent per uterine evacuation procedure type per patient for each cadre of staff participating in the treatment process as well as salary information were also collected.

No names, record numbers, or other information that could be used to identify individual patients was collected. Data on contraceptive acceptance rates and referral rates were collected but were insufficient for analysis. Overhead costs, treatment fees, or external supplies provided by women, the cost of contraceptives, the cost of referral, transportation costs, and social or economic costs were not collected. The study methodology did not permit distinguishing between PAC cases seen for treatment of spontaneous abortion and those seen for treatment of complications of induced abortion performed outside the health facility.

2.4. State-level data collection

Some information was also collected from the relevant state-level Ministries of Health. Staff salary and benefit information was collected from the federal Ministry of Health and from the Ogun state Ministry of Health. Comparable information was not available for Lagos state and FCT. These data were merged with the provider-reported salary data to compute the average salary for each staff cadre.

2.5. Study approvals

Administrative approvals to conduct the study were obtained from all 4 states' Ministries of Health. The Nigerian Navy Reference Hospital in Lagos provided ethical approval that covered all participating facilities. The National Hospital in Abuja also gave ethical clearance for the study to be conducted in that facility.

2.6. Data entry and analysis

The 17 facilities reported 873 cases treated for PAC over the 3-month period. Eight cases had incomplete data and were excluded. Descriptive statistics of cases by severity of presenting complications were computed for the remaining 865 cases, but 5 cases with severe complications were included only in estimations of per-case cost, and were excluded from subsequent estimations of annual total cost because of questionable data quality. Complete per-case and annual cost analysis was conducted for 860 cases from 4 tertiary hospitals and 13 secondary hospitals. Data from each facility were entered into the *Savings* tool.

Data on staff time, supplies, and medications used for a typical PAC procedure were entered for each procedure type and for each complication severity level performed at a facility. Averages of the costs of supplies and the salaries of staff reported by each facility and through state-level data collection were used to generate unit cost constants across all facilities.

2.7. Average per-case costs

To determine the cost that each item contributed to a PAC case by procedure type, the unit cost of each item was multiplied by the amount of that item that was used. The costs of each item's contribution were then summed to calculate the overall cost of supplies and medications used for a typical PAC case. The same calculations were performed for staff time and the overall cost of staff time was added to the overall cost of supplies to arrive at an estimate of the average per-case cost by procedure type.

Three categories of PAC cases were defined based on the severity of complications: simple cases; cases with moderate complications; and cases with severe complications. Simple PAC cases were defined as those that did not require treatment of sepsis, a blood transfusion, or any surgical repair. PAC cases with moderate complications were defined as those that required treatment of sepsis, a blood transfusion, or both. Costs beyond those for a simple PAC case to treat sepsis and provide a blood transfusion were obtained from the 8 facilities involved in additional data collection.

The additional overall cost for treating moderate complications (inclusive of both sepsis and blood transfusions) was calculated by averaging the additional cost of a blood transfusion and the additional cost of treatment of sepsis. For each procedure type, this additional cost was added to the per-case cost of simple PAC to arrive at the cost of treating a woman who needed PAC with treatment for moderate complications. The average additional cost of moderate complications was considered a constant and was applied across all facilities that reported cases with moderate complications.

PAC cases with severe complications were not included in the overall average per-case cost calculations because only 1 out of the 5 reported cases that required surgical repair had sufficient data for costing purposes. The cost of these cases would have had a negligible effect on the overall per-case cost since it comprised less than 1% of the PAC cases originally collected.

2.8. Cost of current PAC treatment at study hospitals

To calculate the cost of current PAC treatment, the per-case costs of each procedure type were averaged across all facilities. Within each procedure type, per-case costs were calculated for simple PAC and PAC with moderate complications, and stratified by inpatient care and outpatient care.

The total annual cost of current PAC treatment for all facilities was calculated by applying the overall per-case cost of simple PAC and PAC with moderate complications to their respective proportion of annual caseload. The proportion of annual cases with moderate complications was assumed to be the same as the proportion reported during the data collection period (see Table 1). It was also assumed that the proportion of PAC cases treated with expectant management (PAC without need for a uterine evacuation) remained the same (10% among simple PAC cases; 5% among PAC cases with moderate complications). Annual caseload was calculated by quadrupling the reported 3-month caseload from the 17 study facilities.

2.9. Estimates of current PAC costs in hospitals in the 3 states

The analysis applied the per-case costs of PAC with uterine evacuation to non-study hospitals in the 3 states by calculating the average of the per-case costs of D&C/D&E, MVA/EVA, and MPAC, by complication severity. For expectant management cases, the per-case costs generated from the study were used. The annual total cost of non-study facilities was then generated by multiplying their annualized caseloads by these per-case costs, by severity of complications for PAC with uterine evacuation and expectant management cases.

Data from the Ministry of Health and from routine monitoring interviews with Ipas intervention sites were used to calculate the average annual caseload for PAC-providing public hospitals (108 cases per year). It was assumed that non-study hospitals had the same distribution of complication severity as study hospitals. It was also assumed that the proportion of cases treated with expectant management was the same in non-study hospitals as in study hospitals.

All costs were calculated in Nigerian Naira and reported at an exchange rate of ₦152.6 = US $1.

Table 1
Caseload distribution by state and procedure type

Care and procedure	FCT/Abuja No. (%)	Lagos No. (%)	Ogun No. (%)	Overall No. (%)
Severity of complications (n = 865)				
Simple PAC [a]	280 (83)	303 (75)	88 (72)	671 (78)
PAC with moderate complications [b]	55 (16)	100 (25)	34 (28)	189 (22)
PAC with severe complications [c]	2 (1)	3 (<1)	0 (0)	5 (<1)
PAC procedure technology (n = 860)				
MVA/EVA	263 (79)	322 (80)	46 (38)	631 (73)
MPAC	5 (1)	48 (12)	43 (35)	96 (11)
D&C/D&E	28 (8)	9 (2)	19 (16)	56 (7)
Expectant management [d]	39 (12)	24 (6)	14 (11)	77 (9)
All procedures [e]	335 (100)	403 (100)	122 (100)	860 (100)

Abbreviations: D&C, dilation and curettage; D&E, dilation and evacuation; EVA, electric vacuum aspiration; FCT, Federal Capital Territory; MPAC, misoprostol alone for PAC; MVA, manual vacuum aspiration; PAC, postabortion care.
[a] PAC with uterine evacuation or expectant management.
[b] PAC with uterine evacuation or expectant management and treatment of sepsis and/or a blood transfusion.
[c] PAC with uterine evacuation and surgical repair of cervical/vaginal lacerations, laparotomy, or hysterectomy.
[d] PAC that does not require evacuation of uterine contents.
[e] Excludes 5 cases with severe complications.

3. Results

3.1. Distribution of PAC cases

All study facilities reported at least 1 PAC case during the data collection period, and almost all cases received a uterine evacuation. Nineteen percent of the cases included in the analysis were treated at tertiary hospitals. The largest proportion of cases (47%) was treated in Lagos state, while only 14% were treated in Ogun state. However, FCT had the highest average number of cases per month (n = 23) – more than double the average cases per month in Ogun.

3.2. Per-case costs of PAC

Out of all 860 PAC cases, 78% required only simple PAC (Table 1). There were 180 cases with treatment for sepsis and 52 blood transfusions. Fifteen facilities treated at least 1 case with additional complications, ranging from 5% to 100% of cases reported within a facility.

PAC treatment with moderate complications cost an average of US $112 per case, 60% more than a simple PAC case (US $70, Table 2). Treating a PAC case with severe complications was more than 3.5 times the cost of treating a simple PAC case (US $258 versus US $70, Table 2). Treatment of a simple PAC case ranged from US $67 for those treated with expectant management to US $84 for those treated with MPAC (Table 2).

The estimated per-case costs of each procedure type varied widely across facilities: MVA/EVA (US $43 to US $141); D&C/D&E (US $44 to US $114); MPAC (US $48 to US $129); and expectant management (US $32 to US $104). The average per-case cost of using D&C/D&E was 18% more than the cost of using MVA/EVA. Procedure types with a higher proportion of caseload receiving treatment for either sepsis or blood transfusion had higher average per-case costs.

Eighty-four percent of all PAC cases were treated with WHO-recommended methods. All but 1 facility reported using MVA/EVA for at least 1 case; 15 facilities reported using MVA/EVA for 50% or more of facility caseload. Three of the 4 tertiary hospitals reported the highest frequency of using MVA (97%–100%). Only 8 facilities reported using D&C/D&E with a range of 3% to 42% of facility caseload.

Fifty-eight percent of cases were treated on an outpatient basis (i.e. the woman was admitted for a hospital stay of less than 24 hours). Eighty-nine percent of outpatient cases were performed with either MVA/EVA or MPAC with an average length of stay of 5 and 6 hours, respectively. MVA/EVA was used for 61% of inpatient uterine evacuations with an average length of stay of 55 hours – 9 hours less than inpatient D&C/D&E. Eighteen percent of all inpatient uterine evacuations were performed with MPAC (average length of stay of 55 hours) compared with only 7% of outpatient uterine evacuations (average length of stay of 6 hours). Thirteen percent of all inpatient PAC cases were treated only with expectant management with the longest average length of stay of 70 hours.

Uterine evacuation procedure types with a higher proportion of inpatient caseload had higher average per-case costs. The overall average per-case cost of inpatient PAC treatment (US $95) was 38% more expensive than outpatient treatment (US $69 per case, Table 2). Fifty-eight percent of all inpatient PAC cases required only simple PAC treatment; simple PAC cases treated on an outpatient basis were 16% less expensive than those treated on an inpatient basis (Table 2).

Table 2
Average per-case costs by inpatient versus outpatient status and procedure type (n = 865 cases)

Care and procedure	Per-case cost, mean, US$		
	Inpatient (≥24 h stay) (n = 365)	Outpatient (<24 h stay) (n = 500)	Overall (n = 865)
Simple PAC [a]			
MVA/EVA	75	66	68
MPAC	86	81	84
D&C/D&E	86	75	80
Expectant management [b]	74	58	67
All simple PAC procedures	78	67	70
PAC with moderate complications [c]			
MVA/EVA	122	88	114
MPAC [b]	114	89	113
D&C/D&E	113	85	105
Expectant management [b]	96	–	96
All moderate complications procedures	118	87	112
PAC with severe complications [d]	258	–	258
All procedure types [e]	95	69	79

Abbreviations: D&C, dilation and curettage; D&E, dilation and evacuation; EVA, electric vacuum aspiration; MPAC, misoprostol alone for PAC; MVA, manual vacuum aspiration; PAC, postabortion care.
[a] PAC with uterine evacuation or expectant management.
[b] PAC that does not require evacuation of uterine contents.
[c] PAC with uterine evacuation or expectant management and treatment of sepsis and/or a blood transfusion.
[d] PAC with uterine evacuation and surgical repair of cervical/vaginal lacerations, laparotomy, or hysterectomy; the cost reported here describes the per-case cost of laparotomy only.
[e] Excludes 5 cases with severe complications.

Table 3
Current estimated annual total cost of PAC in 3 study states in Nigeria

Measure	Total annual cost, US$		
	Simple PAC [a]	PAC with moderate complications [b]	All PAC cases [c]
Average per-case cost	70	112	79
Annual total cost for 17 study hospitals	189255	84760	274015
Annual total cost for all 79 public hospitals in 3 study states [d]	557482	249960	807442

Abbreviation: PAC, postabortion care.
[a] PAC with uterine evacuation or expectant management.
[b] PAC with uterine evacuation or expectant management and treatment of sepsis and/or a blood transfusion.
[c] Excludes cases with severe complications.
[d] Inclusive of the 17 study facilities.

Almost all facilities (n = 16) reported PAC cases with uterine evacuations that were performed by a doctor, usually with the involvement of a nurse. Only 1 hospital reported the involvement of a midwife along with a doctor. Three hospitals reported the involvement of a consultant obstetrician-gynecologist for at least 1 procedure type.

3.3. Annual total costs of PAC

The total annual cost for the 17 facilities included in the study under current treatment conditions is US $274 015 (Table 3). Using the assumptions outlined previously, it is estimated that together, all 79 PAC-providing public hospitals in the 3 included Nigeria states currently spend US $807 442 on PAC provision annually (Table 3). Thirty-one percent of that cost (US $249 960) is spent on the treatment of women with moderate complications.

4. Discussion

More than three-quarters of PAC cases were classified as low severity, although almost all facilities reported treating at least one case of moderate complications. MVA or MPAC, both WHO-recommended methods, were used for a large majority of cases; this finding is not surprising given that 11 of the 17 facilities had participated in Ipas provider training and other interventions to improve PAC services. PAC with MVA is always part of Ipas trainings; however, some providers may have been exposed to the use of misoprostol at these trainings as well.

Moderate complications were a small percentage of overall cases but were much more costly to treat – 60% more so per case – than simple cases. Although the 5 severe cases were not included in the overall calculations, the per-case cost (US $258, more than 3.5 times higher than that for a simple case) is illustrative of the negative impact such cases have on resource-poor health facilities.

In addition to the severity of presenting complications, other factors influencing costs were the type of uterine evacuation technique used, the patient's length of stay in the facility, and provider cadre. For simple PAC, per-case cost of D&C/D&E was 18% higher than with MVA/EVA. One unexpected finding was the slightly higher cost of MVA/EVA compared with D&C/D&E for inpatient cases with moderate complications. Because of the relatively rare use of D&C/D&E (7% of cases spread among 8 facilities), only 1 facility was able to report the additional cost of care required to treat these cases. This facility's data were used as the constant additional cost of moderate complications for all D&C/D&E cases, despite the fact that it was lower than the marginal cost of moderate complications with MVA/EVA and is likely an underestimate of the cost of care.

The per-case overall cost of MPAC was surprisingly high, and not markedly different from that of D&C/D&E cases. This finding could reflect the fact that MPAC made up a surprisingly large share of inpatient cases, with an average length of stay of more than 2 days and related higher costs. MPAC patients could have received the drug and been required to remain in the facility until the evacuation was complete. Standard practice for uncomplicated PAC cases is outpatient administration of misoprostol in the facility, with discharge of the patient to complete the abortion at home and instructions to return with any unexpected complications [13,14]. Even for simple outpatient MPAC cases, however, the per-case cost seems unexpectedly high, and indicates a need for further inquiry into current clinical practices and possible provider updates on appropriate use of the method. In June 2010, misoprostol for PAC was approved by the National Reproductive Health Working Group of Nigeria, a policy body of the federal Ministry of Health, opening the door to more widespread use of this option.

A slight majority (58%) of cases were treated on an outpatient basis, most of these with MVA/EVA or misoprostol. The overall per-case cost of inpatient, simple PAC was 16% more than outpatient care, irrespective of the method use. The findings are consistent with those of other studies in Africa and Latin America that report that MVA for PAC on an outpatient basis is less costly than inpatient D&C [15,16].

A reliance on physician providers contributed to overall higher costs. Apart from specialist physicians (anesthesiologists, obstetrician-gynecologists), general physicians are the highest-paid personnel on the salary list of 23 staff cadres that was obtained from facility providers and the Ministry of Health. In contrast, midwives are paid much less, ranking ninth in salaries. Trained midwives are safely able to provide abortion services, using either MVA or medical abortion [17,18], and many midwives have been trained to provide PAC in Nigeria. Trained midwives often encounter administrative barriers that limit their ability to provide routine PAC in hospital settings, despite the cost and other advantages of doing so. A policy shift that allows trained midwives to perform uterine evacuations for simple postabortion care would allow physicians to concentrate on more complicated obstetrics and gynecology cases.

The findings suggest that providers in the study facilities have largely moved to recommended uterine evacuation methods but that several challenges remain, including: (1) improvements in clinical management of using misoprostol; (2) a full shift to outpatient care for appropriate patients; (3) service provision of PAC by midwives; and (4) abandonment of D&C owing to its higher complication rates compared with MVA or medical abortion. These improvements would reduce overall PAC costs to the health system.

The World Bank (2009) calculates a per capita health expenditure cost of US $69, with more than one-third of total health expenditures borne by the public sector in Nigeria [19,20]. Just 1 PAC case over the 3 states consumes an estimated US $79, which is illustrative of the stress that current practices place on public health system budgets and the hidden effect on competing obstetric and gynecologic needs that may go unmet.

Limitations of the study include the use of provider estimates of staff time and supplies and medications to calculate per-case costs for different PAC procedures. This approach is subject to recall bias. Although results from a time-motion study would have been more

reliable, such a study requires significantly more time and financial resources than were available.

An additional limitation is the small and purposive sample of public health facilities included in the study. Although facilities were chosen to represent as well as possible the range of size and urbanity of public hospitals in the 3 states, the representativeness of the data to private facilities or to other states of Nigeria is limited. These findings pertain only to the public sector and to PAC that is in conformity with the law. Although a greater percentage of national PAC cases may occur in the private sector, the resource costs to private facilities are not paid for by government funds. The aim of this study was to produce data that could be used to advocate to the Nigerian government for policy change, that is, illustrating the financial burden that a restrictive abortion law places on the public sector to treat women with abortion complications who have no legal avenue for pregnancy termination.

The costs reported in this study are limited to recurrent costs for directly providing PAC. Capital, fixed, indirect, or start-up costs were not included. Recurrent costs tend to contribute most of the cost and are more likely affected by changes in clinical practice. Some costs of care may have been covered by PAC patients who purchased supplies or medications outside the hospital; the hospitals may have also recouped some costs of care through patient fees not included in the estimates. Furthermore, changes in clinical care and organization of services are unlikely to yield direct, "in-pocket" savings to health systems. However, a shift in the current clinical protocol for the management of PAC cases would make more resources available for other critical obstetric-gynecologic needs, improve service quality, and enable facilities to better meet demands for care.

The per-case estimate of US $79 includes both costs of treatment of induced abortion complications and spontaneous abortion. It is not markedly different from the per-case estimate of US $91 for serious induced abortion complications in an earlier hospital study in Nigeria that included both private and public facilities [8]. Although the authors of the present study are confident that the per-case cost estimates are reasonable, it is possible that the annual costs are an underrepresentation of the true cost of PAC to public health facilities. The caseload data that were used to calculate annual costs were reported from facility logbooks that could have been missing entries; for example, 2 sites reported that women sometimes receive PAC in the emergency department and as a result are not recorded in the logbooks. However, 11 of the 17 study sites were Ipas-supported sites that have focused on maintaining complete logbooks throughout the years of support. Additionally, PAC caseloads for 5 study sites were extrapolated from the review of patient case notes and can be considered complete as it is unlikely that a woman will have been seen or treated without a case note record. Furthermore, the majority of study facilities had implemented interventions that reduced PAC costs through use of MVA, provision of outpatient services and others. Non-study facilities may have been less likely to implement such interventions, and therefore, the 3-state estimate of annual PAC costs may be an underestimate.

Although severe complications were not included in the aggregate annual costs estimated here, the importance of these cases should not be neglected. Severe complications are far more likely to result in maternal mortality, and the per-case cost of treating such cases is many times the cost of providing a safe abortion. The study population had few cases with severe complications, but when these cases do occur, they result in substantial costs to hospitals, women, and families far beyond those that are financial. The needless death of women from abortion complications is more than a financial problem for governments; it is a serious public health and human rights issue.

The estimates reported here reflect the current restrictive abortion law and high rates of abortion in Nigeria, much of it clandestine and unsafely performed. For many poor women, the public sector plays an essential, life-saving role when they experience abortion complications. A less costly and more humane option would be widespread availability of safe, legal abortion [12,21]. This scenario would require reform of state abortion laws to allow safe abortion on request and implementation of safe, legal services in public and private health facilities. Safe abortion prevents almost all abortion complications and their related treatment costs. Combined with improved access to contraceptive services, safe, legal abortion is an obvious route to help reduce Nigeria's high maternal death rate.

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Conflict of interest

All authors are current or former employees of Ipas.

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